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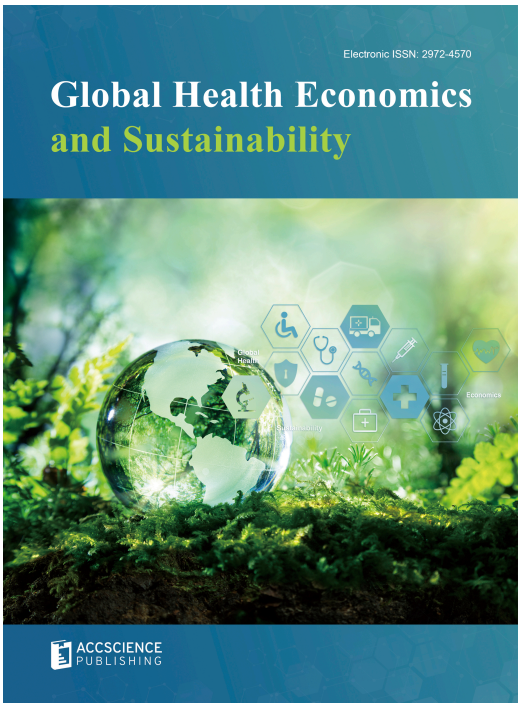

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AccScience Publishing
8 Burn Road, #15-03 Trivex, Singapore 369977.

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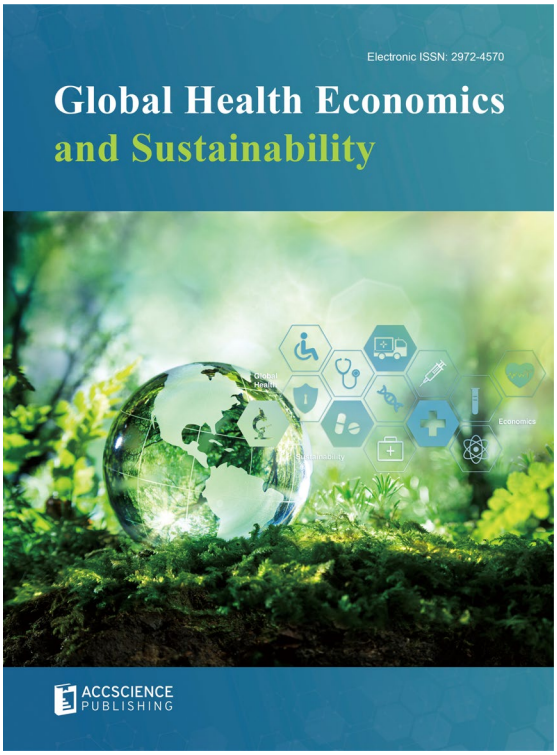

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REVIEW ARTICLE

Preparing for disease X: A look at the psychological impact of COVID-19 on frontline healthcare workers and responses to reduce their burden

Jarryd S. Ludski*

Department of Emergency Medicine, University of Notre Dame Australia, School of Medicine Sydney, Sydney, New South Wales, Australia

Abstract

The coronavirus 2019 (COVID-19) pandemic placed enormous strain on healthcare workers (HCWs) and systems. With over 766 million cases, a high risk of workplace-acquired infection, and a constantly evolving disease trajectory, COVID-19 placed an incredible burden on frontline HCWs. Studies on previous pandemics have highlighted the presence of significant psychological distress in HCWs; yet, mental health remained a secondary consideration in many hospitals' pandemic responses. This review explores the psychological impact of COVID-19 on frontline HCWs during the early stages of the pandemic and describes responses implemented by health services to reduce it. In addition, it aims to provide a structure for the implementation and evaluation of future evidence-based programs that support the well-being of frontline HCWs helping to prepare for disease X. A narrative review with a systematic approach was completed using the MEDLINE, Cumulative Index to Nursing and Allied Health Literature, and Cochrane databases. Twenty publications were included in the study. Symptoms of psychological distress were reported in up to 70% of frontline HCWs, with as many as 50% suffering depression, 62% reporting anxiety, and 45% of those who required quarantine experiencing insomnia. Mindfulness training, safe rest areas, mental health practitioners, and pandemic rostering are responses that were implemented across health services during the pandemic. While the impact of COVID-19 has been enormous, its final toll remains unknown. High rates of psychological distress among frontline HCWs mean that the impact will extend far beyond the virus itself. Health services must implement evidence-based resilience strategies to ensure the safety of their frontline staff now and in the future.

Keywords: Coronavirus 2019; Frontline healthcare workers; Psychological impact; Psychological distress; Responses; Disease X

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***Corresponding author:**
Jarryd Ludski
(jarryd.ludski1@my.nd.edu.au)

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1. Introduction

In late 2019, the novel coronavirus (COVID-19) was first recognized, and on January 30, 2020, it was declared a public health emergency of international concern by the World Health Organization (WHO, 2020). Ten months later, on October 27, 2020, global case numbers exceeded 43 million, with over 1.1 million deaths (BBC, 2020) including

many healthcare workers (HCWs). By May 2023, there had been over 766 million cases globally, with almost 7 million deaths (WHO, 2023). The threat of COVID-19 posed a great challenge to hospital systems, leading to staff shortages, a scarcity of medical supplies, and an increased risk of workplace-acquired infections (Master *et al*., 2020). In September 2020, the WHO announced that despite HCWs accounting for only 3% of the population, they had accounted for 14% of COVID-19 cases in many countries, with this figure being as high as 35% (WHO, 2020). COVID-19 was a worldwide health crisis, yet it was not the first pandemic that the modern world has faced nor will it be the last. The Spanish flu, severe acute respiratory syndrome, Middle East respiratory syndrome, Ebola, and swine flu have all emerged over the last century (Gupta & Sahoo, 2020). The WHO identifies "Disease X" as a priority for global investment, research, and development; it denotes a currently unknown pathogen with the potential to cause a serious international epidemic (WHO, 2022). Disease X is a placeholder concept that encourages scientists, HCWs, non-profit organizations, and the pharmaceutical industry to act proactively and not merely be wedded to responses to previous pandemics. Just as they have occurred in the past, pandemics will occur again; thus, preparation is crucial. Previous pandemics highlight that, apart from physical morbidity and mortality, these events cause a significant mental health burden among frontline HCWs, including anxiety, depression, burnout, insomnia, and post-traumatic stress disorder (PTSD; Gupta & Sahoo, 2020). Frontline HCWs are those in direct patient-facing roles, who are essential for providing care for COVID-19-positive patients in wards, the emergency department, the operating theater, and intensive care units (ICUs). Despite this knowledge and previous experience, the mental health of frontline HCWs often remains a secondary consideration behind the public's needs. The psychological, emotional, and physical demands placed on overstretched frontline HCWs may cause long-lasting and substantial negative impacts on their well-being (Roberts *et al*., 2020), stretching far beyond the COVID-19 pandemic. Gaining an understanding of these impacts, especially in the early stages of a pandemic, using COVID-19 as a case study, will provide greater insights into the impact on the health-care network and allow for improvements to bolster responses to future health threats or major psychologically distressing events.

1.1. Review objectives

The primary aims of this study were as follows:

a. To review and describe the available literature on the psychological symptoms, burden, and impact of the early stages of the COVID-19 pandemic on frontline HCWs
b. To highlight responses implemented by health services to mitigate the psychological symptoms, burden, and impact on frontline HCWs
c. To highlight previously initiated programs to support the well-being of frontline HCWs throughout the COVID-19 pandemic, thereby providing inspiration for individuals' health services to design, institute, and validate specific programs to reduce similar burdens from a potential disease X, major health threat, or psychologically distressing event; and
d. To provide the initial makings of a toolkit through an infographic and generalized assessment tool for health services to kick-start future well-being initiatives.

2. Methods

2.1. Study design

This narrative review following a systematic approach was designed based on informal discussions with senior emergency department physicians, nurses, and administration staff at three Victorian teaching hospitals, with a research question, study aims, and subsequent search strategy developed to attempt to gain a greater understanding of the broad impact of COVID-19 on frontline HCWs and, more specifically, in the emergency department. Given the vast inter-hospital and inter-unit variability worldwide, this design was adopted to limit the search strategy to emergency departments where senior clinicians felt that this vast heterogeneity would be somewhat reduced.

2.2. Search strategy

Published studies were found by searching the MEDLINE (OVID interface), Cumulative Index to Nursing and Allied Health Literature, and Cochrane Central Register of Controlled Trials (Cochrane Library) databases. Additional literature was identified through reference tracking. A bibliographic and gray literature search of the official WHO website was also conducted. The search strategy is highlighted in Table 1. The databases were searched for the following terms and included articles up to April 2024:

2.3. Types of studies

Primary empirical research studies were included, while editorials, protocols for planned studies, abstracts, and dissertations were excluded from the study.

2.4. Inclusion criteria

All relevant articles published or translated into English, with the full text available, were included in the review. While the search strategy limited the search to emergency departments, publications that also included findings on frontline HCWs in ICUs, or COVID wards were included in the study.

Table 1. Systematic search strategy used for the narrative review

SEARCH STRATEGY
"impact" OR "psychological impact"
AND
"COVID-19" OR "coronavirus" OR "2019-ncov" or "sars-cov-2" or "cov-19"
AND
"Emergency department" OR "emergency room" OR "accident and emergency" OR "accident & emergency" OR "a&e" OR "a & e"
AND
"staff" OR "healthcare workers" OR "nurses" OR "medical workers" OR "medical practitioners" OR "medical workforce" OR "healthcare professionals"

2.5. Screening procedure

A three-step screening process of the title, abstract, and full-text review was undertaken by the author. First, titles and abstracts were screened for relevance. Second, full texts were obtained for all potentially relevant publications and reviewed. Finally, all relevant publications were selected for inclusion in the review. This process is documented as a Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart in Figure 1.

2.6. Data extraction

The included studies were charted into a customized data extraction form to extract all relevant data from each one. Data extraction was performed by the author, extracting the following data:

- First author
- Year of publication
- Year of data collection
- Study design
- Country of data collection
- Study population and size
- Cohort occupation
- Outcome measures used (e.g., questionnaires and online surveys)
- Rates of psychological, physical, and emotional symptoms in frontline HCWs.

3. Results

A total of 58 publications were collected. Following the removal of duplicates, 50 publications underwent an abstract review, and 20 publications were deemed relevant for inclusion in the review, as outlined in Figure 1. All included publications were prospective questionnaires, cross-sectional surveys, or observational studies in nature and completed worldwide (in China, Singapore, India, Italy, the US, Australia, Taiwan, and the UK). The excluded

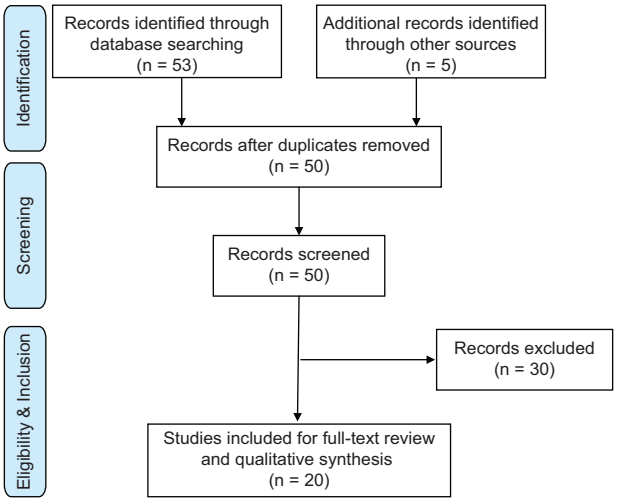

Figure 1. Search strategy flow diagram

publications reported the psychological impact on patients rather than frontline HCWs, implications of COVID-19 on patient care, or infection rates in frontline HCWs without assessing the psychological impact.

3.1. Mental health impacts of COVID-19 reported in frontline HCWs

COVID-19 posed a huge threat to public health and placed frontline HCWs at significant risk of psychological distress, with the literature highlighting a large proportion suffering ill effects from mental disorders. Up to 70% of frontline HCWs have reported symptoms of anxiety, depression, PTSD, sleep disturbances, cognitive decline, or burnout (Gupta & Sahoo, 2020; Que *et al.*, 2020). Similar impacts have been noted in the case of other psychological distress events, highlighted in those caring for Novichok-poisoned patients just before the pandemic, with high rates of stress in managers and those directly involved in the affected patients' care (Jenkins *et al.*, 2023).

3.1.1. Depression

Studies undertaken during the COVID-19 pandemic have found a high prevalence of depressive symptoms in frontline HCWs. Depression was reported in 44% of 1,103 frontline nurses (An, 2020), with 35% reporting moderate or severe symptoms. Furthermore, a study of 4,679 frontline HCWs across 348 Chinese hospitals highlighted a 35% prevalence of depressive symptoms (Presti *et al.*, 2020). Another study reported symptoms in 44% of frontline HCWs, including physicians, medical residents, nurses, technicians, and public health professionals (Que *et al.*, 2020). In addition, 37% of frontline HCWs in quarantine or who worked directly with COVID-19 patients reported suffering from depressive symptoms (Grover *et al.*, 2020). Finally, some

COVID-19 studies have reported depression in as many as 50% of frontline HCWs, which indicates that the impact is greater than that during the SARS pandemic (Gupta & Sahoo, 2020).

3.1.2. Anxiety

Global studies have reported symptoms of anxiety in 44 – 62% of frontline HCWs, with a quarter suffering moderate-to-severe anxiety (Gupta & Sahoo, 2020; Que *et al.*, 2020). A study in India highlighted that 60% of frontline HCWs in quarantine or working with COVID-19 patients experienced anxiety symptoms (Grover *et al.*, 2020). Moreover, a large proportion of respondents reported anticipatory anxiety (Horesh & Brown, 2020), with frontline HCWs expressing concerns regarding the future given the disease trajectory and virus transmission. In addition, 75 – 80% of frontline HCWs felt psychologically unsafe and held concerns about being a source of COVID-19 infection for their families, as well as failing to provide their usual standard of care to colleagues or friends (Felice *et al.*, 2020; Poonian *et al.*, 2020).

3.1.3. PTSD

While the risk of PTSD in frontline HCWs has long been established under standard working conditions, it is even greater during times of natural disasters, such as the COVID-19 pandemic, where stress and trauma are repeated daily (Presti *et al.*, 2020). Studies from the SARS pandemic have demonstrated symptomatic PTSD in up to 33% of nurses who worked in ICUs (Gupta & Sahoo, 2020) and greater symptomatology in those who experienced quarantine or worked in high-risk units compared with their colleagues in low-risk units (Gupta & Sahoo, 2020; Que *et al.*, 2020; Lee *et al.*, 2007). The response to the COVID-19 pandemic demonstrated many characteristics of mass trauma, with individuals moving into a state of hypervigilance, manifesting avoidance strategies, and experiencing negative moods, culminating in psychological distress (Grover *et al.*, 2020). Surveys from Chinese pediatric ICUs demonstrated rates of PTSD in 46% of frontline HCWs during the 1st months of the pandemic (Zhang *et al.*, 2022).

3.1.4. Insomnia

While evidence remains limited, a recent publication involving 150 frontline HCWs reported poor sleep in 60% of participants (Vadi *et al.*, 2022). This figure is higher than previously reported in 29% of frontline workers and in up to 45% of those required to quarantine or who worked directly with confirmed positive cases (Gupta & Sahoo, 2020, Que *et al.*, 2020, Grover *et al.*, 2020).

3.1.5. Burden of personal protective equipment (PPE)

Throughout the world, the mandatory use of PPE has been a mainstay in the fight to control COVID-19 infections in frontline HCWs. For these workers, it involves donning a close-fitting N95 face mask, protective eyewear, a gown, and surgical gloves. It is often cumbersome and uncomfortable and makes drinking water and breathing difficult (Ong *et al.*, 2020). This, in combination with fear over a limited supply of PPE and confusion about its effectiveness, heightens work intensity and increases feelings of fatigue, which then have detrimental effects on mental health (Master *et al.*, 2020, Gupta & Sahoo, 2020). Moreover, the use of PPE was associated with headaches that decreased work performance and productivity when used for more than 4 h/day (Ong *et al.*, 2020).

3.2. Measures implemented to assist frontline HCWs and reduce their burden

As outlined, frontline HCWs are at considerable risk of psychological distress, both throughout the COVID-19 pandemic and beyond. This psychological burden can lead to significant detrimental effects on their work, such as poor morale, staff conflicts, absenteeism, apathy, and lapses in care (An, 2020), which increase patient dissatisfaction and may result in poor patient outcomes. Staff wellbeing is an integral pillar of a hospital's pandemic response (Poonian *et al.*, 2020), with multiple strategies being suggested and implemented throughout the world in response to the pandemic.

3.2.1. Psychiatric support/support by mental health practitioners

Health-care services have utilized consultations with mental health experts, the distribution of health-promoting webinars, and stress management training as means of reducing the mental health burden faced by frontline HCWs (Gupta & Sahoo, 2020). With the majority of frontline HCWs reporting mild symptoms of psychological distress, interventions such as activity scheduling, behavioral activation, and relaxation techniques are beneficial (Grover *et al.*, 2020). Throughout Italy, access to a hotline with psychiatric support has been offered in major hospitals, along with the implementation of acceptance and commitment therapy (ACT). ACT is a mindfulness-based cognitive behavioral therapy aimed at improving psychological flexibility and was demonstrated to be effective in patients with PTSD (Prevedini *et al.*, 2011). An ACT-based psychoeducation booklet has also been designed for HCWs (Presti *et al.*, 2020). Finally, peer supporters trained in psychological first aid have been engaged in emergency departments to promote natural recovery from crisis and traumatic events, along with

wellbeing drop-in sessions providing additional avenues for vulnerable staff to seek support (Poonian *et al*., 2020).

3.2.2. Leadership and effective communication

Anticipatory anxiety, fear, misinformation, and a lack of confidence in PPE have been linked to significant psychological distress in frontline HCWs (Gupta & Sahoo, 2020). However, with clear, identifiable leadership and effective communication, anxiety can be minimized (Poonian *et al*., 2020). Moreover, through ensuring regular updates, providing opportunities to ask questions, and extending support beyond just hospital issues to areas such as family needs or finances, feelings of helplessness experienced by frontline HCWs can be reduced, thereby alleviating their stress and improving their mental wellbeing (Gupta & Sahoo, 2020, Poonian *et al*., 2020).

3.2.3. Rostering

COVID-19 posed a unique set of challenges to rostering in emergency departments. To ensure they remained staffed with appropriately skilled clinicians despite the possibility of staff being furloughed or isolated, many hospitals adapted their rosters. The pandemic strategy in Singapore's largest tertiary teaching hospital involved dividing staff into five equally balanced teams. They worked 12-h shifts with handovers, and staff overlaps were kept as brief as possible (Chua *et al*., 2020). The longer shifts had a built-in buffer capacity that provided additional rest days if no teams required quarantine, meaning that the average hours worked would only increase slightly if as many as three teams were required to isolate (Chua *et al*., 2020). In a large Melbourne metropolitan hospital, a roster was also implemented where full-time staff worked no more than four consecutive shifts followed by 3 days off, with staff rotating between areas of high and low stress (Poonian *et al*., 2020). This ensured an optimal recovery time for staff, protecting against chronic stress, and maintaining staff capacity to fulfill their roles (Poonian *et al*., 2020). Moreover, 4 hourly breaks were taken as encouraged by the Australian College of Emergency Medicine (ACEM), and the final 30 min of shifts were reserved for debriefing and reflective self-care (Poonian *et al*., 2020). Finally, some hospitals redeployed nurse practitioners and physician assistants to areas of critical need, providing support with low acuity diagnoses, discharging patients, and collaborating with telehealth physicians to reduce the burden on frontline HCWs (Proulx *et al*., 2020).

3.2.4. Safe rest areas

Research from China indicates the need for a "COVID-safe" rest area for frontline HCWs working in high-risk areas (Presti *et al*., 2020). At the Royal Melbourne Hospital, the emergency department has expanded non-clinical areas to provide these safe places for rest, mindfulness, yoga, and sustaining social connectedness (Poonian *et al*., 2020). In addition, safe areas provide easy access to water and educational materials for frontline HCWs to support their psychological well-being (Presti *et al*., 2020).

4. Discussion

This study highlights the enormous impact of the early stages of the COVID-19 pandemic on the psychological health of frontline HCWs globally, as well as the likely impact of a future pandemic or major event. Over 50% of frontline HCWs reported symptoms of psychological distress, such as anxiety, depression, insomnia, burnout, or acute stress reactions (Que *et al*., 2020). Thus, this pandemic had the potential to derail career paths, decrease job satisfaction, accelerate compassion fatigue, and cause significant detriment to patient outcomes. In addition, those who work in emergency departments, who work directly with COVID-19 patients, or who are forced to quarantine are at a significantly higher risk of distress, making the volume of affected frontline HCWs potentially huge (Master *et al*., 2020; Gupta & Sahoo, 2020; An, 2020; Que *et al*., 2020; Firew *et al*., 2020), reducing a health-care service's ability to function and placing their non-COVID patients at risk. Furthermore, psychological distress has been linked to medical errors, delayed recoveries, and poor patient satisfaction (Spinelli *et al*., 2019). Therefore, the implementation of evidence-based strategies to reduce psychological distress, not just in the context of COVID-19 but also for future psychologically distressing events, is crucial to ensure the health of frontline HCWs and improve patient care. In addition, these interventions will improve HCWs' work satisfaction and productivity; reduce absenteeism and employee turnover; and assist in the formation and maintenance of a supportive, safe, and effective work culture (Spinelli *et al*., 2019).

The establishment of evidence-based, preventive, and supportive measures to improve the mental health of frontline HCWs should be a priority for all health-care services in the early stages of a pandemic or psychologically distressing event. Many have already met this challenge by putting in place measures they believe will reduce the burden. While this is a positive step for frontline HCWs, the effectiveness of these programs has, unfortunately, only been demonstrated during non-pandemic times and has not yet been rigorously explored during a pandemic.

Resilience is defined as the maintenance or quick recovery of mental health during or after periods of stressful exposure (Kunzler *et al*., 2020). A Cochrane review of resilience training in health-care professionals highlighted

a reduction in symptoms of depression and stress levels when based on the principles of mindfulness, cognitive behavioral therapy, and ACT (Kunzler *et al*., 2020). In addition, yoga-based interventions were demonstrated to reduce emotional exhaustion, burnout, and anxiety while improving sleep and mental health (Spinelli *et al*., 2019). Moreover, mindfulness practices such as weekly 30-min sessions, structured programs, and the use of apps such as Smiling Mind have further demonstrated reductions in perceived stress, anxiety levels, and depressive symptoms (Spinelli *et al*., 2019; Smith *et al*., 2007; Flett, 2018; Braganza *et al*., 2018; Barattucci, 2019). These strategies have been recommended by the ACEM and the UK Intensive Care Society for improving staff well-being during and beyond COVID-19 (ACEM, 2020; Braganza and Popham, 2020).

There is limited evidence supporting the efficacy of other strategies that have been initiated, such as engaging mental health professionals; peer-support groups; and provision of effective, open communication (Serrano-Ripoll *et al*., 2020). However, a supportive supervisor and work culture, along with practical support, were demonstrated to protect staff mental health (Greenberg *et al*., 2020). Despite the lack of evidence, both the ACEM and ICS recommend these strategies, when endorsed by strong leadership, as feasible and sustainable measures to support staff well-being (Braganza *et al*., 2018, Braganza and Popham, 2020).

The implementation of policies and practices to improve the psychological health of frontline HCWs was shown to be positively associated with increased job satisfaction, improved workplace culture, and better patient outcomes (Braithwaite *et al*., 2017). Patient mortality rates, readmission rates, adverse events, and patient satisfaction – all improve with a positive workplace culture (Braithwaite *et al*., 2017). The adoption of health-promoting strategies is, therefore, a crucial tool in the arsenal of any health service to support staff through their careers, where they will face many significant challenges, including potential future pandemics or major events.

4.1. Future directions

Future research should focus on ensuring that all health services are aware of the high risks facing their frontline HCWs, as well as evidence-based interventions that can be implemented to support psychological well-being. This could be achieved through the distribution of informative flyers, such as the example provided in Appendix 1, followed by research that assesses psychological symptoms pre- and post-implementation and the creation of an evidence-based toolkit for other health services to replicate. Further research should also investigate the long-term prevalence of psychological distress in individual hospitals and its associated burden. With the large variation in the exposure and burden faced by each heterogeneous hospital, the quantitative evaluation of implemented measures is required to assess improvements in mental health and resilience. This could be achieved through the creation and confidential distribution of anonymous pre- and post-intervention questionnaires that address symptoms of psychological distress, such as the one presented in Appendix 2, with global studies to assess their validity and reliability in each diverse and heterogeneous population.

4.2. Limitations

This study was limited by heterogeneity in global study populations and variations in symptom evaluation tools. Furthermore, limiting the search strategy to emergency departments may reduce the findings' generalizability to other frontline HCWs.

5. Conclusion

The impact of the COVID-19 pandemic has been enormous, with its true toll unknown. Thus far, over 766 million cases have been recorded worldwide, with almost 7 million deaths. While the spread is now more contained, frontline HCWs are charged with continuing to ensure that the health needs of this patient population are met, recovering from the challenges posed by COVID-19, and preparing for the next pandemic or major event. The psychological burden placed on future frontline HCWs during the early stages of a pandemic is a crisis that must be anticipated and addressed in advance. With over 50% of frontline HCWs reporting symptoms of psychological distress, the impact of another pandemic will extend far beyond the problem caused by the virus itself.

Health institutions have implemented a multitude of strategies to assist in minimizing the burden placed on frontline workers. These resilience strategies may be costly; their use should be rigorously tested for efficacy as we move into an unknown and uncertain future. The use of validated strategies will provide a crucial tool for supporting the mental health of frontline staff, allowing them to continue their much-needed work and ensuring the safety of their entire communities now and in the future.

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Conflict of interest

The author declares that there are no competing interests.

Author contributions

This is a single-authored article.

Ethics approval and consent to participate

Ethical approval was deemed not to be required, as all data were retrieved from previously published studies, where approval was obtained by primary investigators.

Consent for publication

Not applicable.

Availability of data

The datasets used and/or analyzed during this study are available from the corresponding author on reasonable request.

Further disclosure

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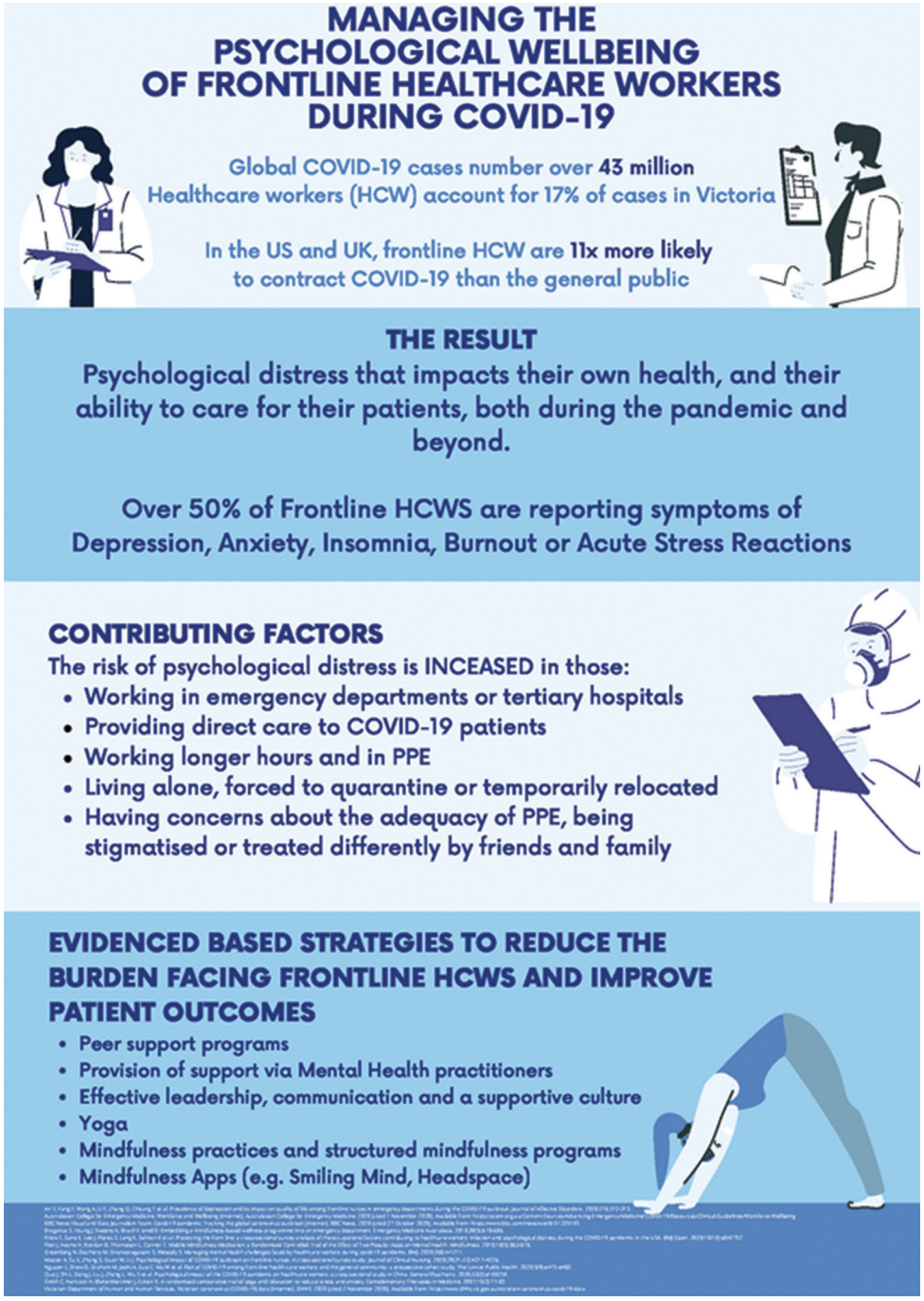
Appendix



Appendix 1. Example of an informative flyer to distribute to and among health-care services, using coronavirus 2019 as an example

Appendix 2. Example questionnaire for evaluating the baseline psychological health of frontline healthcare workers and the subsequent effectiveness of implemented interventions, using coronavirus 2019 as an example

Impact of COVID-19 on the psychological health of healthcare workers and the response of healthcare networks to reduce the burden. Questionnaire compiled by Dr. Jarryd Ludski				
Hospital				
Department				
Role				
Years of experience				
Exposure to COVID-19				
Has your hospital had COVID-19-positive or suspected-positive patients?	☐ Yes	☐ No		
Have you been responsible for the direct care of COVID-19-positive or suspected-positive patients?	☐ Yes	☐ No		
Have you had exposure to COVID-19-positive or suspected-positive patients?	☐ Yes	☐ No		
Has your role changed as a result of COVID-19?	☐ Yes	☐ No		
Have your working hours changed as a result of COVID-19?	☐ Yes	☐ No		
	☐ Increased	☐ Decreased	☐ N/A	
Psychological support				
Has your hospital provided any initiatives or programs to support staff mental health during the COVID-19 pandemic?	☐ Yes	☐ No		
Please describe (optional)….				
Have you used or taken part in any of these initiatives or programs?	☐ Yes	☐ No		
Did you find/feel that the initiatives or programs were helpful for your mental health?	☐ Very Unhelpful	☐ Unhelpful	☐ Neither helpful nor unhelpful	☐ Helpful ☐ Very helpful
Do you feel these initiatives/programs have had a lasting impact on your mental health?	☐ Yes	☐ No		
Please describe in what ways (optional)….				
Would you like the hospital to introduce additional support for healthcare staff?	☐ Yes	☐ No		
Please describe what support you would like…				

Symptom screen				
Depressive symptoms (patient health questionnaire – 9)				
Over the last 2 weeks, how often have you been bothered by any of the following symptoms?	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overreacting	0	1	2	3
6. Feeling bad about yourself, or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3

(Cont'd...)

Appendix 2. ***(Continued)***

Symptom screen				
Depressive symptoms (patient health questionnaire – 9)				
Over the last 2 weeks, how often have you been bothered by any of the following symptoms?	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
9. Having thoughts that you would be better off dead, or hurting yourself	0	1	2	3
Total =				
Interpretation	If at least four questions were answered in the shaded section, consider a depressive disorder. Add score to determine the severity: • If >5 in the shaded area, consider major depressive disorder • If 2 – 4 in the shaded area, consider another depressive disorder			

Severity	**Total score**	**Depression severity**
	1 – 4	Minimal depression
	5 – 9	Mild depression
	10 – 14	Moderate depression
	15 – 19	Moderately severe depression
	20 – 27	Severe depression

Anxiety symptoms (generalized anxiety disorder – 7)				
Over the last 2 weeks, how often have you been bothered by any of the following problems?	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3
Total =				

Interpretation	**Total score**	**Anxiety severity**
	0 – 4	Minimal anxiety
	5 – 9	Mild anxiety
	10 – 14	Moderate anxiety
	15 – 21	Severe anxiety

Insomnia symptoms (insomnia severity index)					
Over the last 2 weeks, please describe the severity of your insomnia.	**None**	**Mild**	**Moderate**	**Severe**	**Very severe**
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problems waking up too early	0	1	2	3	4
4. How satisfied/dissatisfied are you with your CURRENT sleep pattern?	Very satisfied 0	Satisfied 1	Moderately Satisfied 2	Dissatisfied 3	Very dissatisfied 4
5. How noticeable to others do you think your sleep problem is in terms of impairing the quality of your life?	Not at all noticeable 0	A little 1	Somewhat 2	Much 3	Very much noticeable 4
6. How worried/distressed are you about your current sleep problem?	Not at all worried 0	A little 1	Somewhat 2	Much 3	Very much worried 4

(Cont'd...)

Appendix 2. ***(Continued)***

Insomnia symptoms (insomnia severity index)					
Over the last 2 weeks, please describe the severity of your insomnia.	**None**	**Mild**	**Moderate**	**Severe**	**Very severe**
7. To what extent do you consider your sleep problem to CURRENTLY INTERFERE with your daily functioning (e.g., daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, or mood)	Not at all interfering 0	A little 1	Somewhat 2	Much 3	Very much interfering 4
Total =					

Interpretation	**Total Score**	**Severity**
	0 – 7	No clinically significant insomnia
	8 – 14	Subthreshold insomnia
	15 – 21	Clinical insomnia (moderate severity)
	22 – 28	Clinical insomnia (severe)

Stress (perceived stress scale - 10)					
During the last month, how often have you felt or thought a certain way	**Never**	**Almost never**	**Sometimes**	**Fairly often**	**Very often**
1. How often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. How often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. How often have you felt nervous and stressed?	0	1	2	3	4
4. How often have you felt confident about your ability to handle your personal problems?	4	3	2	1	0
5. How often have you felt that things were going your way?	4	3	2	1	0
6. How often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. How often have you been able to control irritations in your life?	4	3	2	1	0
8. How often have you felt you were on top of things?	4	3	2	1	0
9. How often have you been angered because of things that happened that were outside of your control?	0	1	2	3	4
10. How often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4
Total =					

Interpretation	**Total score**	**Stress severity**
	0 – 13	Low stress
	14 – 26	Moderate stress
	27 – 40	High perceived stress

ACCSCIENCE PUBLISHING

Global Health Economics and Sustainability

REVIEW ARTICLE

Trajectory and progress of opioid agonist therapy programs in the Kyrgyz Republic

Amanda R. Liberman[1]*, Ainura Kurmanalieva[2], Damira I. Biibosunova[3], Natalya Shumskaya[2], Roman Ivasiy[1], Daniel J. Bromberg[4,5,6], Lynn M. Madden[1,7], and Frederick L. Altice[1,4,7]

[1]Section of Infectious Diseases, School of Medicine, Yale University, New Haven, Connecticut, United States of America

[2]AIDS Foundation East-West in the Kyrgyz Republic, Bishkek, Kyrgyzstan Republic

[3]Division of Global HIV and TB, CDC, Bishkek, Kyrgyzstan Republic

[4]Department of Epidemiology of Microbial Diseases, School of Public Health, Yale University, New Haven, Connecticut, United States of America

[5]Heidelberg Institute of Global Health, Faculty of Medicine and University Hospital, Heidelberg University, Heidelberg, Germany

[6]Department of Psychiatry and Psychotherapy (Campus Charité Mitte), Charité—Universitätsmedizin Berlin, Berlin, Germany

[7]APT Foundation, New Haven, Connecticut, United States of America

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Mihajlo Jakovljevic M.D. Ph.D. MAE

***Corresponding author:**
Amanda Liberman
(amanda.liberman@yale.edu)

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Abstract

The incidence and mortality of human immunodeficiency viruses (HIVs) are rising in Eastern Europe and Central Asia (EECA), particularly among people who inject drugs. Opioid agonist therapies (OATs), such as methadone or buprenorphine, are the most effective treatments for opioid use disorder and serve as a key HIV-prevention strategy in EECA. OAT uptake across the region, however, has been limited. The Kyrgyz Republic was the first Central Asian country to initiate OAT and remains a pioneer in the region. To understand the progression of OAT scale-up, all legislations related to drug policies or methadone in the Kyrgyz Republic were analyzed from the country's founding to March 2023 and compared with policies in neighboring countries, particularly Kazakhstan and Tajikistan. Concurrently, local news coverage and policy reports were also assessed. OAT has been available in the Kyrgyz Republic since 2001, initially as a pilot project funded by international donors, and then with gradually increasing state support. Since its inception, the methadone program has evolved and influenced neighboring countries in Central Asia, despite numerous political challenges. The Kyrgyz Republic has expanded access to methadone, revised clinical protocols, and increased the number of distribution sites in communities and the carceral system to ensure broader access, aiming for program sustainability. While methadone policies and implementation in the Kyrgyz Republic have advanced earlier and more expansively than in neighboring countries, some challenges persist. Based on the findings, the suggestions provided may support the sustainable scale-up of methadone programs, enabling continued growth and improvement.

Keywords: Kyrgyz Republic; Methadone policy; Opioid use disorder; Opioid agonist therapy

1. Background

While the incidence and mortality of human immunodeficiency viruses (HIV) have declined in other regions over the past decade, in Eastern Europe and Central Asia (EECA), HIV-related incidence and mortality are increasing (Nachega *et al*., 2023; UNAIDS, 2022a). The epidemic is driven by the injection of opioids, for which maintenance with opioid agonist therapies (OATs), such as methadone or buprenorphine, is among the most effective strategies (Alistar *et al*., 2011; Degenhardt *et al*., 2019a; Tan *et al*., 2019; Ward *et al*., 2022). A systematic review found that OAT is associated with an average 54% reduction in HIV incidence among people who inject drugs (PWID; MacArthur *et al*., 2012), and it is now considered the global standard of care for opioid use treatment (Degenhardt *et al*., 2019b). To effectively decrease HIV incidence among PWID, OAT should cover at least 20% and preferably 40% of PWID (World Health Organization [WHO] *et al*., 2009). In EECA, however, OAT coverage has remained minimal at best – many EECA countries do not offer this life-saving intervention and those that do often only provide it as pilot programs. In particular, the Russian Federation, a major influencer in the region, legislatively bans any form of OAT and seeks to influence its neighbors.

In the Kyrgyz Republic, the HIV prevalence among PWID is 60 times higher than that among the general population (18% vs. 0.3%; Joint UN Programme on HIV/AIDS, 2023). The Kyrgyz Republic is one of the few Central Asian countries to provide methadone, although coverage remains low at approximately 4.4% (UNAIDS, 2022b). This is comparable with other countries in EECA offering methadone: 7.1% in Ukraine, 0.4% in Kazakhstan, and 2.7% in Tajikistan. The Kyrgyz Republic was the first country to initiate OAT in Central Asia and has the most experience with this intervention in the region. Moreover, it is the first and only country in Central Asia to provide take-home dosing and OAT in the criminal justice system, with both programs still in operation. This article reviews the history and policies related to methadone in the Kyrgyz Republic, as well as potential barriers and suggestions for sustainable methadone scale-up in the country.

2. Methods

All laws relating to methadone, OAT, drugs/narcotics, and drug policy were reviewed from 1991 (the country's founding) to March 2023 through the official legal databank of the Kyrgyz Republic (Ministry of Justice of the Kyrgyz Republic, n.d.). This analysis also included official reports from international funding organizations about the Kyrgyz methadone program. In addition, relevant laws governing methadone in the Kyrgyz Republic were compared with similar laws from the neighboring Kazakhstan and Tajikistan (Republic of Kazakhstan, n.d.; Republic of Tajikistan, n.d.). Notably, neither of the other two Central Asian countries (Uzbekistan and Turkmenistan) currently provide OAT, although methadone was briefly introduced and discontinued in Uzbekistan (Khachatrian, 2009). The Kyrgyz Republic, Kazakhstan, and Tajikistan all provide laws in Russian as well as in Kyrgyz, Kazakh, and Tajik, respectively; therefore, legal analyses were conducted in Russian by bilingual research team members (ARL, AK, RI, and DJB).

3. Results and discussion

Table 1 provides a history of key legislation and policy changes throughout the Kyrgyz Republic's methadone program. Key moments include the approval and launch of the first OAT site in the Kyrgyz Republic in 2001, the development of the first formalized methadone clinical protocol in 2010, the expansion of take-home dosing to all methadone program participants in 2020, and the introduction of buprenorphine as an OAT modality in 2020. Figure 1 presents a map indicating when the first non-penitentiary methadone site opened in each Kyrgyz city. Figure 2A presents a timeline of the OAT census by year, and Figure 2B shows the number of new HIV cases per year in the Kyrgyz Republic among all individuals and PWID. From 2010 to 2022, PWID has gone from representing nearly two-thirds of new HIV cases to representing only about 2% of new cases (Republican AIDS Center of the Ministry of Health of the Kyrgyz Republic, n.d.). PWID began representing less than half of new HIV cases in 2012, at the same time as the rapid expansion of the OAT census in the Kyrgyz Republic.

3.1. Introduction of OAT into the criminal justice system

In August 2008, a pilot OAT program was launched in Kyrgyz Republic's Colony No. 47, a penal institution, earning praise from the WHO for its organizational and clinical effectiveness, given the prevalence of within-prison drug injections (Azbel *et al*., 2018). This program led to reduced injection drug use among inmates, lowered risk of transmitting HIV, improved quality of life, and enhanced overall health (Subata *et al*., 2015). In 2009, two additional OAT sites were established, extending the program to the pretrial detention center in the Kyrgyz Republic. By June 2021, a total of 14 OAT sites were operational in prisons, serving nearly 400 patients (Republican Narcology Center, n.d.). The findings from the methadone program in Kyrgyz prisons showed early substantial scale-up and increased linkage to treatment after release, especially when patients

Table 1. Timeline for key legislative and policy related to methadone

Year	Policy change	Activities	OAT Census (Sites)	Source
1998	Order 66	Establishes regulation of narcotics. Methadone remains on the list of controlled narcotic substances as of 2019. Clarifies that addiction is a disease, framing people who use opioids as patients instead of criminals.	0 (0)	(About Narcotic Drugs, Psychotropic Substances and Precursors, 1998; On Amendments to the Resolution Government of the Kyrgyz Republic "On Narcotic Drugs, Psychotropic Substances, and Precursors Subject to Control in the Kyrgyz Republic" Dated 9 November 2007 No. 543, 2018)
1999	Order 60	Establishes citizens' right to quality mental health care, including treatment for substance use.	0 (0)	(On Psychiatric Care and Guarantees of Citizens' Rights in the Provision of Psychiatric Care, 1999)
2001	Orders 41, 71	Approves and launches the first OAT site in Bishkek for HIV prevention. Sets conditions for program entry, such as two prior hospitalizations for OUD, no polysubstance use, and the prospective participant's agreement not to leave the city for at least a year.	50 (1)	(On Amendments to Order No. 71 of 2001 March 13 on the Conditions and Procedure for Substitution Therapy for Persons with Drug Dependence in the Kyrgyz Republic, 2002; Program "Methadone Substitution Therapy in Bishkek", 2001)
2002	Order 17	Opened the second OAT site in Osh and includes provisions for future program expansion in terms of numbers and sites.	50 (2)	(On Amendments to Order No. 71 of 2001 March 13 on the Conditions and Procedure for Substitution Therapy for Persons with Drug Dependence in the Kyrgyz Republic, 2002)
2005	Orders 6, 82, 149	Establishes health-care protections for PWH. Laws allow law enforcement to mandate the registration of dependent persons, linking substance use treatment for PWH and PWID.	100 (2)	(On HIV/AIDS in the Kyrgyz Republic, 2005; On the Prevention of Offences in the Kyrgyz Republic, 2005; On the Protection of Citizens' Health in the Kyrgyz Republic, 2005; Trends and Events in Harm Reduction in 2005: Countries with Predominantly Injection-Driven HIV Epidemics, 2006)
2006	Order 498, 759	Establishes a State Program for the Prevention of the HIV/AIDS Epidemic, supporting OAT expansion and allowing OAT introduction in prisons. Methadone is added to the essential medicines list in the Kyrgyz Republic, despite being on a list of dangerous drugs subject to national control.	100 (2)	(On the Extension of the State Program for Prevention of HIV/AIDS Epidemic and Its Socio-Economic Consequences in the Kyrgyz Republic for 2006-2010 until 2012, 2011)
2007-2008	Orders 15, 56	Further expands the methadone program by creating additional sites, including the first prison-based sites.	133 (16)	(On Expanding the Program of Substitution Maintenance Therapy with Methadone for Opioid Dependence in the Territory of Bishkek and Chui Region, 2011; On the Expansion of the Methadone Substitution Treatment Program in the Branches of the Organizations of the Ministry of Health of the Kyrgyz Republic, 2007)
2010	Order 494, Order 497	Permits a naloxone program for overdose prevention. The first formal methadone clinical protocol is developed, requiring daily clinic attendance with strict guidelines.	500 (20)	(Ministry of Health of the Kyrgyz Republic and Republican Narcology Center, 2015; On the Implementation of the Project GLO J71/ OFID-UNODC, 2010)
2012	Order 703	Develop official clinical guidelines for OUD treatment, including methadone.	1013 (20)	(Ministry of Health of the Kyrgyz Republic and Republican Narcology Center, 2017)
2014	Orders 91-r and 54	Order 91-r prohibits arbitrary detentions and searches of people who use drugs. Order 54 introduces an anti-drug program that includes OAT as a modality for secondary HIV prevention.	1227 (20)	(Matieva *et al.*, 2015; On Approval of the Anti-Drug Program, 2014; On Approval of the Fifth National Report of the Kyrgyz Republic on the Implementation of the International Covenant on Economic, Social and Cultural Rights from 2012 to 2019 Years, 2021)

(Cont'd...)

Table 1. ***(Continued)***

Year	Policy change	Activities	OAT Census (Sites)	Source
2015	Order 372	Creates a working group to revise the methadone treatment clinical protocol. New guidelines recommend maintenance doses as low as 60 mg for most patients and prohibit take-home dosing.	Approx. 1200 (31)	(Instructions on Implementation of Methadone Maintenance Therapy and Needle and Syringe Programs in Institutions of the State Penitentiary Service under the Government of the Kyrgyz Republic, 2015; On the Creation of a Working Group for the Revision of the Clinical Protocol "Treatment of Opioid Dependence Based on Maintenance Therapy with Methadone", 2015; Republican Narcology Center, 2015; Subata *et al*., 2015)
2016	Orders 161, 637	Order 637 abolishes the State Drug Control Service, a law enforcement branch focused on trafficking and drug use through punitive measures. Order 161 establishes that illicit drug trafficking will be regulated by the Ministry of Internal Affairs and legal circulation of narcotic drugs including methadone will be regulated by the Ministry of Health. This creates a more public-health-based approach to drug regulation. In 2016, the government produced its first training manual for dispensing methadone by nurses.	1505 (31)	(On Additional Measures for Counteraction of Illicit Trafficking of Narcotic Drugs, Psychotropic Substances and Precursors, 2011; On Measures to Reform the System of Law Enforcement Agencies of the Kyrgyz Republic, 2016; On the Liquidation of the State Drug Control Service under the Government of the Kyrgyz Republic, 2016; Republican Narcology Center of the Ministry of Health of the Kyrgyz Republic, 2016)
2017	Orders 584, 625, 1082, 131	Order 584 introduces a clinical protocol for children and adolescents with substance use disorders, allowing treatment of OUD in minors. Order 625 allows oversight of the methadone program. Order 1082 allows methadone treatment in inpatient facilities and introduces take-home dosing for select patients for up to five days, and Order 131 provides guidance on how to implement Orders 625 and 1082.	1455 (29)	(On Amendments to the Regulations "On the Conditions and Procedure for Conducting Methadone Maintenance Therapy for Persons Who Inject Drugs in the Kyrgyz Republic", 2017; On the Conditions and Procedure for Conducting Methadone Maintenance Therapy for People Who Use Injection Drugs in the Kyrgyz Republic, 2017; On the Implementation of Orders of the Ministry of Health of the Kyrgyz Republic No. 625 Dated July 17, 2017, and No. 1082 Dated November 28, 2017, 2017; Republican Narcology Center of the Ministry of Health of the Kyrgyz Republic, 2017)
2019	Orders 542, 749	Permit PWH to seek HIV services outside of specialized clinics, including receiving antiretroviral medications at methadone sites. These orders also provide a clinical protocol for people who use opioids and alcohol.	1123 (24)	(On Approval of Mechanisms for Decentralization of Medical Services for People Living with Human Immunodeficiency Virus in the Kyrgyz Republic, 2019; Republican Narcology Center of the Ministry of Health of the Kyrgyz Republic, 2019)
2020	Order 28	Expands take-home dosing of methadone during the COVID-19 pandemic to mitigate community transmission of COVID. Allows take-home dosing for up to five days for patients whose relatives apply on their behalf with identifying documents.	979 (24)	(On Measures to Prevent Coronavirus Infections (COVID-19), 2020)
2022	Order 1471	Updates official guidelines for OAT, incorporating input from international experts. The updated guidelines target higher dosing, earlier transition to take-home dosing, and faster induction strategies. For the first time, guidelines for buprenorphine treatment are introduced.	850 (24)	(Ministry of Health of the Kyrgyz Republic and Republican Centre for Psychiatry and Narcology, 2022)

Abbreviations: HIV: Human immunodeficiency virus; OAT: Opioid agonist therapies; OUD: Opioid use disorder; PWH: People with HIV; PWID: People who inject drugs.

Figure 1. Map of non-penitentiary methadone sites in the Kyrgyz Republic and their start years. Image created by the authors.

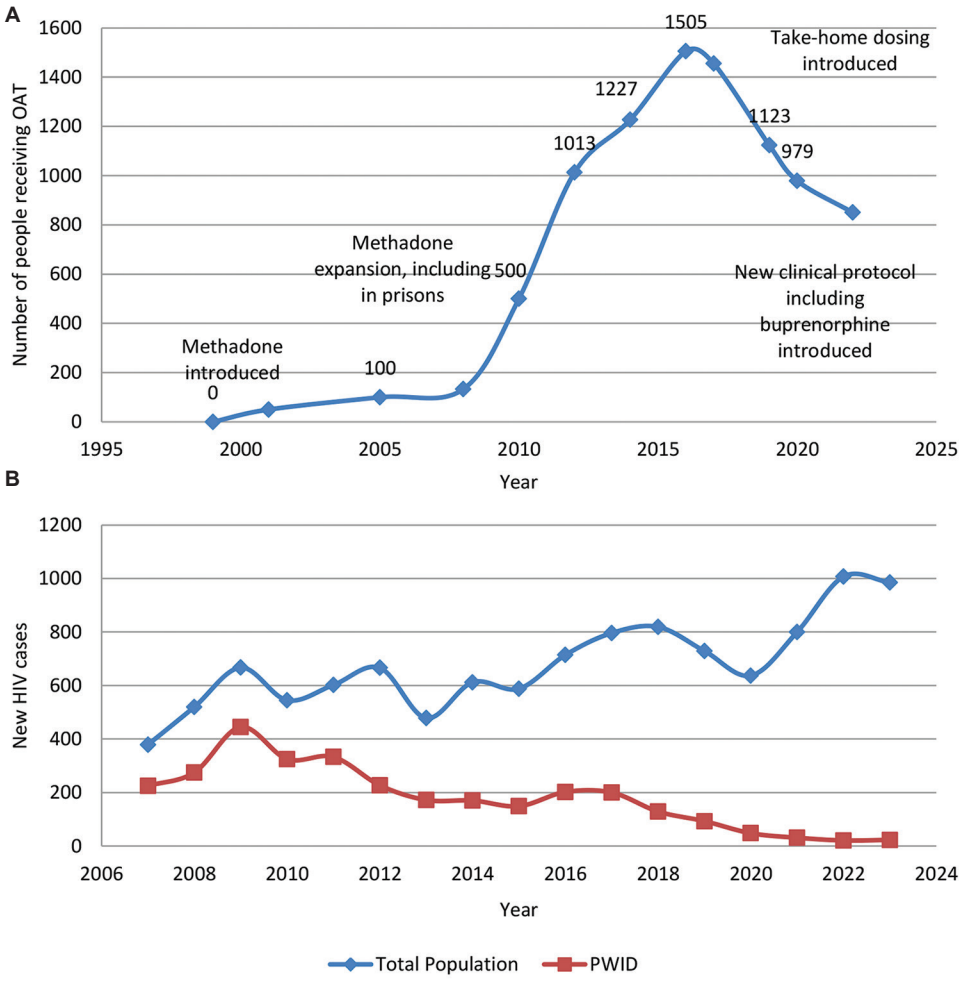

Figure 2. The number of new HIV cases among PWID decreases as OAT expands in the Kyrgyz Republic. (A) Total number of people receiving opioid agonist therapies by year in the Kyrgyz Republic. (B) Number of new HIV cases per year in the Kyrgyz Republic among the total population (shown in blue) and among people who inject drugs (PWID) (shown in orange) (Republican AIDS Center of the Ministry of Health of the Kyrgyz Republic, n.d.). In 2010, PWID accounted for nearly two-thirds of new HIV cases in the Kyrgyz Republic; by 2022, PWID represented only about 2% of new HIV cases.

were maintained on methadone at doses exceeding 80 mg/day (Bachireddy *et al*., 2022).

As described in Table 1, in 2015, clinical guidelines were released for in-prison or pretrial detention methadone treatment, covering post-admission and pre-release scenarios, such as treatment interruption. If the methadone treatment is interrupted by more than 2 days, patients must follow a treatment initiation protocol. Meanwhile, for interruptions of <2 days, patients can resume treatment at the previous dose after consulting with the site narcologist, a physician specializing in addiction treatment. One month before their release, patients must decide whether to continue treatment post-release. If they choose to discontinue the treatment, their clinician will follow a dose tapering protocol; meanwhile, those wishing to continue will be connected to a community methadone site (Republican Narcology Center, 2015).

3.2. Strategies to consider in other Central Asian contexts

The Kyrgyz Republic was an early adopter of methadone compared with other Central Asian countries, and it has the most experience in the region. In 2001, it became the first Central Asian country to offer methadone treatment, and in 2008, it became the first Central Asian country to offer methadone in prisons (on the extension of the State Program for Prevention of HIV/AIDS Epidemic and Its Socio-Economic Consequences in the Kyrgyz Republic for 2006-2010 until 2012, 2011); it is now approved but not implemented yet in Tajik prisons. OAT was expanded to pretrial detention (SIZO) in 2009 with the understanding that opioid use disorder (OUD) is a chronic, relapsing condition that should be continuously treated irrespective of location.

Ongoing collaborations between local and international organizations have resulted in multiple reports aimed at maximizing uptake and strengthening the country's methadone program (Bachireddy *et al*., 2022; Ivasiy *et al*., 2022; Katkalova, 2021; Latypov *et al*., 2012; Liberman *et al*., 2021; Liberman *et al*., 2022; Moeller *et al*., 2009; Subata *et al*., 2015). The program's strengths include sites in multiple regions within and outside of prisons, the integration of a one-stop-shop care model at certain sites (where individuals can receive HIV treatment and other health care at the site where they receive methadone), the recent addition of buprenorphine to clinical guidelines for OAT, and state and political support for the program. At present, funding for the program is divided between international organizations (Global Fund and PEPFAR) and the state budget, with plans to continue requesting international funding until at least 2026 (Kyrgyz Republic Funding Request Form, 2022). Notably, the Kyrgyz Republic is the only country in Central Asia to provide take-home dosing, which was expanded for methadone program participants in 2020 during the lockdowns related to the COVID-19 pandemic. It is the only Central Asian country to provide clinical guidelines for buprenorphine as OAT, which was introduced in 2022, thereby allowing patients to choose their preferred OAT.

The most recent clinical protocol for methadone dosing, developed in 2022, is an update from the previous protocol issued in 2015 (Ministry of Health of the Kyrgyz Republic and Republican Centre for Psychiatry and Narcology, 2022; Ministry of Health of the Kyrgyz Republic and Republican Narcology Center, 2015). The current guidelines reflect a review of OAT policies by domestic and international experts, as well as a review of the existing literature. The strengths of the updated protocol include the introduction of buprenorphine as an alternative to methadone, an emphasis on the importance of methadone for pregnant or breastfeeding individuals, appropriate dosing recommendations including early dose escalation, and no maximum treatment duration. The protocol provides updated guidance for transitioning patients between community and criminal justice settings, with the national OAT database allowing a patient to transition between sites. Although the protocol recommends psychological counseling for all methadone program participants, it does not require it, meaning that some patients may not receive psychological services alongside methadone treatment. Finally, the updated protocol recommends doses of at least 80 mg for most patients (previously 60 mg), though it allows for lower doses, and providers often prescribe subtherapeutic dosing (Ivasiy *et al*., 2022).

3.3. Ongoing challenges to OAT in the Kyrgyz Republic

Despite the strengths of the framework, the methadone program in the Kyrgyz Republic is currently declining in terms of the number of participants and program sites, as shown in Table 1 and Figure 2 (Katkalova, 2021). The decrease in the number of sites is mainly due to the consolidation of smaller sites into fewer, larger ones, whereas the decline in the number of participants is a more complex issue that is partially related to the introduction of stimulants, although opioids remain common (Katkalova, 2021). Notably, although the overall number of new cases of HIV cases in the Kyrgyz Republic has remained steady since the introduction of the OAT program, new HIV cases among PWID have dropped dramatically from 2010 to 2022 (Figure 2).

Table 2 summarizes the primary current legislative barriers to treatment scale-up and recommendations for sustainable program improvement. Subtherapeutic dosing

Table 2. Recommendations for reducing barriers to opioid agonist therapies and supporting sustainable scale-up of treatment

Observed barrier	Recommendation
Requirement for daily in-person treatment	1. Add sublingual and/or long-acting injectable buprenorphine to the national formulary. 2. Expand take-home dosing options, as during the COVID-19 pandemic, and allow longer periods of take-home self-administration.
Subtherapeutic methadone doses among many program participants (Ivasiy *et al*., 2022)	Encourage providers to prescribe higher doses, as indicated in the new 2022 clinical protocol, particularly for patients receiving treatment for HIV or tuberculosis.
Dilution of liquid methadone causes logistical shipping difficulties	1. Add sublingual buprenorphine to the national formulary. 2. Allow transport of more concentrated methadone formulations. 3. Allow tablets rather than liquid formulations.
Lack of OAT site accessibility and possible migration to areas without methadone sites	1. Allow any licensed prescriber to prescribe OAT, perhaps with limited training. 2. Expand the types of clinics allowed to dispense OAT (e.g., primary care clinics). 3. Create clear guidelines for transitioning into and out of the program to account for internal and external migration (e.g., if people go to work in the Russian Federation or another place without methadone). 4. Allow longer take-home dosing options for people who live remotely from OAT sites.
Patient fears of consequences of registration	Remove the registry entirely or establish clear guidelines for removing stable methadone patients from the narcological registry.
Police harassment of program participants	1. Incentivize police to refer people who inject drugs to needle/syringe exchange programs and/or OAT. 2. Foster partnerships between methadone programs and local police departments. 3. Train police on harm reduction and the benefits of OAT for public safety.

Abbreviation: OAT: Opioid agonist therapies.

of methadone, as described above, may also contribute to the declining number of participants. Despite efforts to reform law enforcement interactions with people enrolled in methadone programs (on Measures to Reform the System of Law Enforcement Agencies of the Kyrgyz Republic, 2016), police harassment of program participants remains common (Katkalova, 2021). Prescribed doses remain lower than those recommended by international guidelines (Ivasiy *et al*., 2022), and higher dosing is associated with better quality of care provision and increased willingness among patients to start and remain on methadone treatments (Farnum *et al*., 2021). Within prisons, individuals who wish to join the methadone program face significant social barriers (Liberman *et al*., 2021), including a social hierarchy that opposes methadone use and restricts access to work, food, and recreation incarcerated people (Azbel *et al*., 2022; Azbel and Altice, 2022; Meyer *et al*., 2020; Ponticiello *et al*., n.d.).

The Kyrgyz Republic's methadone program in the Kyrgyz Republic has also encountered several political challenges. Most notably, a 2011 documentary titled "The Trap" demonized the program, leading to calls for its closure (Trilling, 2012). Despite this, the program continued to expand until 2017, when the number of participants began to decline.

Individuals seeking treatment for substance use disorders, including methadone for OUD, must first be diagnosed with OUD and then officially register with the government – —a process that can bar them from future employment opportunities or even from obtaining a driver's license (Eurasian Harm Reduction Association, 2019; Regulations on the Rules and Procedure for Identifying, Registering and Recording in Public Health Institutions of the Kyrgyz Republic Persons Who Allow Non-Medical Consumption of Psychoactive Substances, 2001). Similar policies in other EECA countries have continued to hinder access to treatment (Bojko *et al*., 2013; 2015; Makarenko *et al*., 2016; Mazhnaya *et al*., 2016). By law, registered individuals are barred from working in state or municipal services, educational institutions, and taxi companies, among others (Eurasian Harm Reduction Association, 2019; Labor Codex of the Kyrgyz Republic, 2004). While the program aims to protect the community by preventing people who use psychoactive substances from operating heavy machinery or performing similar tasks, in practice, it creates a major barrier for individuals with substance use disorders to seek treatment. Before seeking treatment, a person may not be on the registry, but once a public clinic is aware of the person's substance use disorder, registration is required, leading to the loss of their driver's license and potential barriers to employment. In addition, once registered, it is difficult to be removed from the registry; although the laws and protocols dictating the registration process are detailed, the deregistration process is unclear.

The consequences of mandatory government registration have been discussed and analyzed extensively,

with numerous publications identifying it as a barrier to treatment (Aizberg, 2008; Alieva *et al*., 2013; Eurasian Harm Reduction Association, 2019; Katkalova, 2021; Latypov *et al*., 2012; Subata *et al*., 2015; Yesenamanova *et al*., 2014). Despite these findings, the registration process remains in place.

3.4. Comparison to neighboring countries

The Kyrgyz Republic has a strong, state-supported OAT program, although with several challenges, as outlined above. Its enabling framework is considerably stronger than programs in neighboring countries. Russia, Turkmenistan, and Uzbekistan do not currently have methadone programs–methadone and all other OAT programs are explicitly banned. Uzbekistan introduced methadone but discontinued the pilot program in 2009 (Khachatrian, 2009). Meanwhile, programs in Kazakhstan and Tajikistan are exceptionally small in terms of coverage, even when compared to the Kyrgyz Republic's suboptimal coverage rate of 4.4% (UNAIDS, 2022b). Similar to the Kyrgyz Republic, Kazakhstan and Tajikistan require mandatory registration for PWID. The methadone programs in Kazakhstan and Tajikistan also face numerous infrastructure challenges. Kazakhstan, for example, has struggled with procurement issues, leading to several program shutdowns (Kazakhstan Union for PLHIV *et al*., n.d.), endangering the lives of patients. In Tajikistan, the methadone program is limited to a few sites in major urban centers, restricting access for much of the population (Kluczewska and Korneev, 2021).

4. Conclusion

This article provides a review and timeline of the major legislative benchmarks in the Kyrgyz Republic's OAT program, highlighting the stepwise policy changes that have supported the program's sustainability since its inception as a pilot in 2001. It also identifies areas where improvements can be made to ensure the program's sustainability. The analysis included all laws relating to methadone, OATs, drugs/narcotics, and drug policies in the Kyrgyz Republic from its founding in 1991 to March 2023, as well as comparisons with OAT programs in other countries in the region. The article traces the trajectories of OAT scale-up in relation to overall HIV transmission, in particular, among PWID. It is evident that the Kyrgyz Republic's legislative framework has been more supportive than those of other countries in the region. Moving forward, implementing changes such as ensuring optimal methadone dosing (at least 80 mg per day), expanding access to buprenorphine, eliminating mandatory narcological registration, and improving law enforcement interactions with OAT participants can help sustain the Kyrgyz OAT program and provide a model for other countries in Central Asia.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: Frederick L. Altice, Amanda Liberman
Data curation: Ainura Kurmanalieva, Damira I. Biibosunova, Natalya Shumskaya
Formal analysis: Ainura Kurmanalieva, Damira I. Biibosunova, Natalya Shumskaya, Daniel J. Bromberg
Resources: Ainura Kurmanalieva, Damira I. Biibosunova, Natalya Shumskaya
Writing – original draft: Amanda Liberman
Writing – review & editing: Frederick Altice, Lynn Madden, Roman Ivasiy

Ethics approval and consent to participate

Not applicable.

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Not applicable.

Availability of data

All Kyrgyz Republic legislation is available through a state-run database at https://cbd.minjust.gov.kg/.

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PERSPECTIVE ARTICLE

How to minimize the impact of a pandemic on depression in older adults in the future

Celso Silva[1]*, Mónica Tomaz[2], Liliana Sousa[3], Rogério Ferreira[1], and César Fonseca[4]

[1]1School of Health, Polytechnic Institute of Beja, Beja, Portugal

[2]School of Management, Hospitality and Tourism, University of Algarve, Faro, Portugal

[3]Local Health Unit, Alentejo Central, EPE, Évora, Portugal

[4]Department of Nursing, University of Évora, Évora, Portugal

Abstract

Depression is a common mental illness that affects a significant number of older adults. Recently, we saw a considerable increase in the prevalence of depression during the COVID-19 pandemic. Studies have been able to discover many determinants of pandemic-related depression, which will aid in defining health policies to mitigate depressive symptoms during future pandemics. Thus, based on existing knowledge of the key factors contributing to the development of depression among older adults during the COVID-19 pandemic, our article aims to precisely reflect on and consider health policies in need of development. We hope these perspectives can help reduce the impact of future pandemics on the development of depressive symptoms.

Keywords: Pandemic; Older adults; Depression; Future situation; Minimizing impact

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***Corresponding author:**
Celso Silva
(celso.silva@ipbeja.pt)

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1. Introduction

Depression is a mental disorder that can manifest as persistent sadness, hopelessness, pessimism, loss of pleasure or interest in previously enjoyable activities, and a depressed mood. As a diagnostic criterion, these symptoms must be present for most of the day, almost every day, or for at least 2 weeks, with most episodes lasting much longer (American Psychiatric Association, 2014).

As per the World Health Organization (WHO), depression is a common mental disorder, and in the pre-COVID-19 period, it affected around 280 million people globally, an estimated 10.4% of adults, affecting about 5.7% of people aged over 60 years (WHO, 2021).

The initial cases of the SARS-CoV-2[1] infection were reported by the WHO in December 2019; thus, it proposed that governments must take measures to minimize the spread of the virus, including the implementation of social distancing and quarantine measures (Ganesan *et al.*, 2019; Islam *et al.*, 2020).

One of the consequences of the pandemic has been a considerable increase in the global prevalence of depression by 28.1% (Santomauro *et al.*, 2021). The older adult population

[1] New coronavirus SARS-CoV-2, responsible for COVID-19 (https://www.who.int/health-topics/coronavirus#tab=tab_1)

experienced a higher degree of functional impairment and a greater tendency to reliability on other people for help, presenting more comorbidities, coupled with the potential for adverse health consequences due to the limited availability of health services during the pandemic (Han *et al*., 2021; Yao *et al*., 2020). This sequence of events can lead to greater apprehension about contracting or succumbing to COVID-19 and regarding the ability to obtain medical services, thereby amplifying anxiety levels and triggering depressive indications (Yao *et al*., 2020; Zhang *et al*., 2019).

Older adults may find it challenging to access the Internet to search for information; moreover, their lack of ability to do so may further limit their accessibility to mental health care. Several additional factors associated with the pandemic also contribute to the decline in mental health in older adults, such as social isolation and the economic repercussions resulting from the pandemic (Santomauro *et al*., 2021; Yao *et al*., 2020).

Older adults' apprehensions regarding contracting the disease and the possible ramifications of the global health crisis may have been heightened by widespread media attention, which emphasized the high mortality rate or serious outcomes associated with COVID-19, especially among the older population. The media coverage also emphasized the effects of isolation and the socioeconomic implications arising from the pandemic (Murayama *et al*., 2016). The high risk of depression among older adults in the context of the pandemic suggests formulating effective strategies aimed at improving the mental well-being of older adults struggling with depression (Mishra *et al*., 2021).

Older adults display distinct personal attributes and often experience a high prevalence of various chronic conditions, further highlighting the importance of adapting intervention approaches to meet their specific needs. This is crucial as individuals with a higher education level are likely to exhibit a greater ability to manage their symptoms during a crisis, such as a pandemic (John *et al*., 2020; Pinho *et al*., 2021). Hence, health professionals must be aware of the factors that determine the onset of depression so that they can not only intervene to prevent it but also minimize its impact if contracted (Andrew *et al*., 2017; Mulango *et al*., 2018).

The pandemic has changed community life, making it crucial to understand the elements linked to depression in older adults, enable a correct diagnosis, and choose the most appropriate intervention (Andrew *et al*., 2017; Mulango *et al*., 2018).

At present, we have knowledge about the factors that have significantly contributed to the development of depression in older adults during the COVID-19 pandemic. Thus, based on this data, we will be reflecting and considering health policies that can be developed to decrease the impact of future pandemic crises on the development of depressive symptoms.

2. Impact of the COVID-19 pandemic on depression in older adults

The COVID-19 pandemic has increased the prevalence of depression by 28.1%, with particularly serious consequences in older adults (Santomauro *et al*., 2021).

Some of the most pertinent factors exacerbating depressive symptoms directly associated with the pandemic were stress, feelings or concerns associated with the pandemic, news about the pandemic through the media, news from health professionals, being acquainted with someone who has been infected, and the effects of the implemented lockdown measures to control the spread of COVID-19 (Silva *et al*., 2022; 2023).

Other factors, such as the feeling of high susceptibility to the risk of contracting COVID-19 and the fear of infecting others, have also been identified as potential factors for the onset of depressive symptoms in older adults, as well as the difficulties in receiving healthcare and obtaining medication (Erbesler & Demir, 2023).

Limited knowledge regarding the pandemic and the perceived insecurity of older adults have also been identified as factors that can exacerbate depressive symptoms (Yildirim *et al*., 2021).

Some other factors contributing to the onset of depressive symptoms were also identified during the pandemic; however, these factors are not novel as they have been widely described in the literature. These include female gender, low education levels, and low-income levels (Han *et al*., 2021; Sadighi Akha, 2018); loneliness and dependence when performing activities of daily living (Yao *et al*., 2020); medical comorbidities (Zhang *et al*., 2019); and poor quality of sleep (Tavares, 2022).

2.1. Variability of depression in different countries

Studies have shown that depression slightly varied in different countries. Regarding sadness and depression, there was a 21.9% increase in Europe and Israel during the pandemic. In Europe, Portugal showed the highest increase in mental health problems (39.4%), followed by Italy (30.8%) and Spain (28.2%). Conversely, countries such as Denmark (10.3%), Slovenia (10.6%), and the Czech Republic (10.8%) showed a lower prevalence of sadness and depression. In the USA, the prevalence of depression during the pandemic was 30.4% (Chao *et al*., 2022; Chao & Yu, 2021; Voss *et al*., 2021).

Increased levels of depression were also reported at 51.9% in Turkey (Irmak *et al*., 2021), 40.1% in Bangladesh (Mistry *et al*., 2021), 32.3% in Japan (Aihara & Kiyoshi, 2021), 7.8 % in South Korea (Kim *et al*., 2022), and 30.4% in Brazil (De Oliveira *et al*., 2019).

Zhang and Chen (2021) report that Africa and South Asia had the worst overall mental health symptoms, followed by Latin America. They also highlighted that Africa had the highest prevalence rate of depression at 45%, South Asia at 34%, and Latin America at 32%. This variability in depression prevalence rates may be associated with cultural issues, level of social support, intensity of pandemic-containing measures, and access to health care.

3. Measures to minimize depressive symptoms in older adults in future pandemic scenarios

It is impossible to control all factors contributing to depression in older adults; some factors will always be present despite efforts to minimize their impact. However, it is possible to intervene on some factors and develop strategies aimed at minimizing their impact on the development of depressive symptoms.

Primarily, the factors associated with stress, emotions, or anxieties associated with the pandemic, and exposure to COVID-19 news in the media are worth highlighting as they may be related to the way the information was presented, focusing on several catastrophic situations and only a few success stories. In addition, other news was ignored due to the media's constant focus on the pandemic, resulting in reduced coverage of other topics. So much so that during the COVID-19 pandemic, Director General Tedros Adhanom Ghebreyesus of the WHO said: "We are not just fighting an epidemic; we are fighting an infodemic" (Niblock, 2023).

In the event of a future pandemic, it is crucial to communicate information calmly to avoid creating panic and to highlight success stories rather than focusing on negative scenarios and complications from the virus. Health professionals who deal with older adults may advise reducing time spent watching the news or consuming other sources of information to prevent excessive worry that could lead to depression.

Interestingly, receiving news from health professionals can also lead to the development of depressive symptoms, contrary to what might be expected. It may be possible to rethink how pandemic-related information is transmitted and avoid spreading unnecessary and excessive worry, which can also contribute to reducing the impact of the following factors: having acquaintances who are infected, feeling highly susceptible to the risk of contracting COVID-19, and the fear of infecting other people.

Regarding the factors of insufficient knowledge about the pandemic and the insecurity perceived by older adults, health professionals and the media have an important role to play in transmitting information calmly, avoiding inducing panic, and forming a positive perspective of hope and trust in health institutions and professionals.

Regarding the factors linked to the isolation measures adopted to contain the spread of COVID-19, social isolation and loneliness are widely known as factors that can lead to depression. In such a challenging scenario, it is essential to reconsider limitations on socializing, especially for individuals who may already have restricted social contacts, as the negative effects of rigid isolation on mental well-being can be severe.

The factors of difficulty in receiving healthcare and obtaining medicines will also need to be addressed. During the pandemic, healthcare resources were increasingly directed toward COVID-19 healthcare, whereas healthcare for other diseases was neglected (Silva *et al*., 2023). In the event of a future pandemic, it is crucial to consider this data and implement measures to avoid overloading health services with non-urgent patients, prioritize individuals with other diseases that need treatment to avoid serious consequences, or prioritize other severe illnesses (e.g., mental health issues).

If a similar global health crisis occurs, it will be important to implement more balanced, thoughtful measures based on scientific evidence (Figure 1).

3.1. Shared decision-making

The results are much more favorable when health professionals involve citizens/patients in decisions. Healthcare planning must increasingly opt for person-centered care models and must be individualized, dynamic, flexible, and participatory (John *et al*., 2020; Pinho *et al*., 2021).

Shared decision-making leads to better results in patient adherence to medical recommendations, from a person-centered care perspective, and helps the individual better understand the need for specific measures (John *et al*., 2020; Pinho *et al*., 2021).

From this perspective, in a future pandemic, citizens/patients must be greatly involved in defining and developing the necessary measures, thereby avoiding the imposition of these measures, often without adequate explanation.

3.2. Partnerships with the education system/senior universities

The role of the education system could be of paramount importance. Partnerships between health systems and

Figure 1. Responses during a future pandemic (created using Microsoft PowerPoint)

the education system/senior universities can significantly benefit both parties and, most importantly, the final beneficiaries, that is, older adults (Dobransky-Fasiska *et al*., 2010; Wagner *et al*., 2022).

There are already some interesting prospects that need to be developed:

Health promotion programs: Senior universities can collaborate with the health system to develop health promotion programs aimed at older adults, which can include workshops on healthy diets, physical exercise suitable for seniors, fall prevention, mental healthcare, and other issues related to a pandemic (Dobransky-Fasiska *et al*., 2010).

Caregiver training: As family members of older adults are generally the primary caregivers, they can benefit from training programs offered by senior universities in collaboration with the health system. These programs can include information on how to deal with specific medical conditions, medication administration, hygiene care, and the role of caregivers during a pandemic (Brunet *et al*., 2021; Kuo *et al*., 2017).

Research and development: Senior universities, partnered with health institutions, can be involved in research projects to study issues relevant to the older population. Such projects can include research on the impact of certain health conditions on the quality of life of older adults and the evaluation of intervention programs (Dikhtyar *et al*., 2021; Manheimer & Moskow-McKenzie, 1995).

Health services: Senior universities can offer spaces for temporary or permanent health clinics, where older adults can receive basic medical care, such as blood pressure measurement, blood glucose, and vaccinations, which could be especially relevant during a pandemic (Kirkwood & Riegelman, 2011; Laanan, 2003).

Continuing education for health professionals: Senior universities can offer continuing education courses for health professionals working with older adults. These courses can include updates on best practices in caring for older adults and discoveries in the field of gerontology, which could be important during a pandemic (Bolante & Dykeman, 2015; Kirkwood & Riegelman, 2011).

4. Strengths and limitations

During the pandemic, older adults were found to be particularly vulnerable to depression. This paper reflects on how public health measures could be developed to prevent depression in older adults during a pandemic. As this paper is not a systeatic review, it provides suggestions from the authors' perspective, which can be seen as its limitation.

5. Conclusion

Only a few proposals have aimed at minimizing the impact of a future pandemic on the development of depressive symptoms in older adults.

Defining health policies will need to not only involve the health institutions themselves but also seek partnerships with the education system/senior universities and implement shared decision-making with citizens/patients.

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Conflict of interest

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Conceptualization: Celso Silva
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ACCSCIENCE PUBLISHING

Global Health Economics and Sustainability

PERSPECTIVE ARTICLE

Navigating the global health seas: A personal odyssey through the depths of COVID-19

Divya Chadha*

Department of Health and Human Sciences, College of Nursing and Health Sciences, Southeastern Louisiana University, Hammond, Louisiana, United States of America

Abstract

This study offers an extensive perspective on the COVID-19 pandemic through a unique lens, blending personal narratives with informative analysis. Owing to strained public health systems, individuals faced emblematic struggles – such as awaiting medical attention in overwhelmed emergency rooms and securing testing appointments–which symbolized universal experiences. Through depersonalized yet interconnected stories, this study elucidates systemic vulnerabilities in global health infrastructures. An examination of socioeconomic disparities through third-person narratives reveals communities grappling with layoffs and limited health-care access. This study seeks to offer an analytical yet empathetic exploration of the broader socioeconomic impact of COVID-19. The objective portrayal of the pursuit for equitable vaccine access mirrors global challenges in scheduling and supply shortages. Furthermore, the personal narratives highlight the connections forged, the information shared, and the resources pooled, emphasizing a shared commitment to overcoming challenges together. This study concludes with a collective call for adopting a resilient, equitable, and united approach to global health in which informed perspectives of collective struggle converge for a better future.

Keywords: COVID-19 pandemic; Global experience; Personal narratives; Public health systems; Socioeconomic disparities; Equitable vaccine access

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***Corresponding author:**
Divya Chadha
(divya.chadha@selu.edu)

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1. Strained foundations: A journey through the frailty of public health systems

In the early days of the COVID-19 pandemic, individuals found themselves navigating a health-care landscape characterized by uncertainty and strain. Individuals experienced challenges in receiving medical attention in overwhelmed emergency rooms and securing timely testing appointments, which were part of a broader global struggle (Mallah *et al.*, 2021). This section adopts a third-person lens to assess firsthand accounts of the complexities and vulnerabilities of public health systems during the global health crisis.

Many individuals have experienced the frailty of public health systems firsthand during the COVID-19 pandemic. In the midst of this global health crisis, the cracks in the system became palpable, affecting each individual on an intimate level (Bosland *et al.*, 2021).

For many, the strain was not merely a statistical abstraction but a tangible reality. The experience of waiting in overwhelmed emergency rooms felt such as standing at the forefront of a battle, witnessing the limitations of a system being pushed to its edge. The struggle to secure testing appointments also represented systemic challenges, underscoring the fragility of a structure unprepared for the unprecedented demands of a pandemic (Willows *et al.*, 2023).

As individuals faced delays, uncertainties, and an overwhelming sense of vulnerability, the public health infrastructure, once considered an impenetrable shield, revealed its delicate nature.

The challenges experienced are not merely a matter of statistics or policy; they constitute lived experiences, highlighting the critical need for bolstering public health systems (Weine *et al.*, 2021). The strain individuals experienced during this pandemic has underscored the necessity for informed, empathetic reforms that can fortify systemic foundations and ensure a more resilient response to future health crises.

2. Socioeconomic disparities: Navigating unequal waters through personal narratives

The socioeconomic disparities exacerbated by the COVID-19 pandemic revealed the stark reality of unequal vulnerabilities. Those in lower socioeconomic strata faced compounded challenges, with limited access to resources and health care (Casale, 2020). The pandemic disproportionately affected marginalized communities, with job insecurity, inadequate housing, and lack of health-care access intensifying the impact.

The pandemic exacerbated socioeconomic disparities through job loss, limited health-care access, and educational inequalities, disproportionately affecting marginalized communities. Low-wage workers experienced heightened financial insecurity due to layoffs, while disparities in health-care access were evident among those lacking insurance or transportation (Barbu, 2023).

Work-from-home opportunities were often a luxury; individuals in low-income jobs rarely had such opportunities and thus faced higher exposure risks. Access to quality health care became a privilege, further widening the health gap (Viscusi, 2020). Remote learning highlighted the digital divide, with disadvantaged students without access to technology or stable Internet connections losing out on scholastic education.

Financial strain forced difficult choices as families juggled between spending on essential needs and health precautions. Disparities in social support systems thus became evident, with vulnerable populations grappling with isolation and limited assistance (Sarkodie & Owusu, 2020).

As economies contracted, the socioeconomic fault lines deepened. Governments and organizations worldwide faced challenges in addressing these disparities, recognizing the need for a collective effort to mitigate the unequal impact of the pandemic (Farseev *et al.*, 2024). The lessons learned underscore the urgent need for comprehensive policies and systemic changes to build a more resilient, equitable society capable of addressing future global health-care challenges.

3. Vaccine diplomacy: Navigating the quest for equitable access

With the arrival of vaccines came a renewed sense of hope; however, the quest for inoculation mirrored other global challenges. Observations reveal that individual experiences in navigating vaccine access – including scheduling appointments and facing supply shortages – serve as a microcosm of the complexities surrounding equitable distribution (Cutlers & Summers, 2020). Disparities in vaccine access highlight the global struggle for fairness.

Vaccine diplomacy, while intended to foster global cooperation, has presented challenges during the COVID-19 pandemic. The distribution of vaccines became a geopolitical tool, with some nations securing large quantities for domestic use and leaving others grappling with insufficient supplies (Pilkington *et al.*, 2022). Such unequal access has deepened global disparities in health care.

By monopolizing vaccine stocks, wealthier nations contributed to delays in global immunization efforts. Developing countries faced prolonged vulnerability, leading to extended economic downturns and health crises (Sun *et al.*, 2024). The resulting inequality has strained international relations, exposing the limitations of a unified global response.

The effectiveness of international efforts on vaccine diplomacy warrants critical analysis. While initiatives such as COVAX aim to ensure equitable vaccine distribution, challenges such as supply shortages and vaccine diplomacy have been politicized, with some nations prioritizing geopolitical interests over global health equality (Manriquez Roa *et al.*, 2021). Developed nations have secured large quantities of vaccines for domestic use, leaving many low-income countries with limited access. In addition, the politicization of vaccine distribution has further complicated matters, with some countries using vaccines as diplomatic tools to advance their geopolitical interests (Rudan, 2023). As a result, the goal of achieving global vaccine equity remains elusive.

Addressing these challenges requires collaborative efforts, transparency, and commitment to prioritizing global health over political interests. The lessons from vaccine diplomacy during the pandemic emphasize the urgency of building a resilient, cooperative framework for future public health crises, ensuring that the well-being of all nations is prioritized for the greater good.

4. The crucial role of international collaboration: A personal stake in a united front

The pandemic revealed the extent to which countries were interdependent, and international collaboration emerged as a vital lifeline during this time. Observations reveal personal stories of connections forged, information shared, and resources pooled, underscoring the critical role of a united front against global threats. Individual stakes in this collaborative effort transcend diplomatic agreements; they represent a shared commitment to overcoming challenges together.

The COVID-19 pandemic underscored the indispensable role of international collaboration in combating global health crises (Wenham & Davies, 2023). Nations worldwide faced a common adversary, highlighting the interconnectedness of our global community. The urgent need for a united front became evident as the virus transgressed borders, emphasizing the need for a collective, cooperative response.

International collaboration played a pivotal role in the development of vaccines and treatment strategies and the sharing of critical data. Scientific communities, governments, and organizations collaborated to accelerate research, ensuring timely access to life-saving information (Tamara *et al*., 2023). This shared knowledge facilitated a more effective and coordinated pandemic response.

A personal stake in this united front emerged as individuals realized the direct impact of global cooperation on their well-being. Access to vaccines, treatments, and essential information became contingent on collaborative efforts. The pandemic demonstrated that countries are intricately linked with each other, and a resilient global health system relies on collective responsibility.

As we navigate the ongoing challenges of the pandemic, the lesson remains clear: a united front is essential for overcoming not only COVID-19 but also future global health threats. This shared responsibility extends beyond borders, emphasizing the interdependence of nations in safeguarding the health and well-being of individuals globally.

5. Conclusion: A call to action for a resilient global future

This extensive perspective on the COVID-19 pandemic weaves personal stories with informative analyses, offering a unique outlook on the shared global experience. As individuals navigated strained public health systems and grappled with socioeconomic disparities, the universality of their struggles became apparent. The exploration of vaccine diplomacy mirrored global challenges, emphasizing the need for equitable distribution; moreover, international collaboration emerged as a lifeline in overcoming a common adversary.

The journey through the strained foundations of public health systems illuminated not only individual struggles but also collective vulnerability, highlighting the interconnected nature of our global health landscape. The socioeconomic disparities exacerbated by the pandemic revealed harsh realities, indicating the need for comprehensive policies and systemic changes to address inequalities and build a more resilient, equitable society.

Moreover, vaccine diplomacy presented challenges, emphasizing the urgency of developing a cooperative framework for future public health crises. The personal stake in international collaboration became evident as the interconnected world realized the impact of collective responsibility on individual well-being.

As this quest concludes, it leaves a lasting imprint – a call to action for a resilient, equitable, and united approach to global health. In the convergence of personal stories and informed perspectives lies the blueprint for navigating the seas of global health, transcending borders, and safeguarding the well-being of all nations in the face of future challenges.

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ACCSCIENCE PUBLISHING

Global Health Economics and Sustainability

PERSPECTIVE ARTICLE

Assessing microbiology and sports' roles in promoting global peace, quality health, and entrepreneurship: A One Health approach

Benjamin Niriwa Pulle[1,2]*, Mabel Kissiwah Asafo[3], Mohammed M. Ibrahim[4], James Dumba[4], Deborah Ampofo[4], Solomon Saka Allotey[4], Simon Agongo Azure[4], Joseph Tabiri[4], Helina Gyamea[4], Elorm Kwame Nyinaku[4], Semefa Alorvi[4], Benjamin Asare-Kyei[4], Doogu Jonas[5], Ibrahim Batong Halidu[6], Mark Anthony Azongo[7], Elvis Batuu[4], and Samuel Delle[8]

[1]Department of Medical Laboratory Science, College of Health, Ministry of Health, Yamfo, Ahafo Region, Ghana

Abstract

Sporting activities provide valuable insights into how societal issues and health impact everyone. Both communicable and non-communicable diseases are prevalent today and are often diagnosed through medical laboratory investigations, including microbiology. The COVID-19 pandemic underscored the adage, "Your health is your wealth." Good health fosters wealth, which, in turn, enhances quality of life, overall health, peace, and entrepreneurship. During the pandemic's peak, economic activities nearly halted, illustrating how poor health affects peace and entrepreneurship. The societal challenges during lockdowns, including increased suicidal thoughts from economic crises, further demonstrated this impact. Wealthier individuals often live longer, highlighting the reciprocal relationship between wealth, health, and peace. Adopting the health-conscious behaviors of footballers can inspire individuals to prioritize their health. Microbiology plays a crucial role in diagnosing infections in sports, yet its connection to sports education remains underexplored. Integrating microbiology and sports education could improve well-being and productivity. This article discusses how microbiology and sports education collectively promote peace, healthy living, and economic progression. The study used various methods, including reviews and personal life experiences with infectious diseases and football. The synergy between microbiology and sports has the potential to reduce morbidity and mortality, ultimately boosting economic activity. However, issues such as honor crimes and societal problems across genders can hinder daily economic participation. Football matches and microbiological investigations can play a role in promoting health and well-being, which, in turn, contribute to peace and unity and the achievement of the Sustainable Development Goals. Football players, who routinely screen for infections, model behavior that could encourage a broader prioritization of health. Both microbiology and football generate wealth, and every profession should be treated as a business to foster wealth for health and peace.

Keywords: COVID-19; Diseases; Entrepreneurship; Health; Infections; Medical; Microbiology; Non-communicable; Peace

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***Corresponding author:**
Benjamin Niriwa Pulle
(benjamin.pulee@cohy.edu.gh)

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[2]Department Medical Microbiology, Faculty of the Medical and Scientific Research Centre, University of Ghana, Accra, Greater Accra Region, Ghana

[3]Ghana Health Service, Accra, Greater Accra Region, Ghana

[4]Health Tutors/Staffs, College of Health, Yamfo, Ahafo Region, Ghana

[5]Disease Control Unit, Karaga Health Directorate, Ghana Health Service, Karaga, Northern Region, Ghana

[6]Department of Medical Laboratory, Kintampo North Municipal Hospital, Kintampo, Bono East Region, Ghana

[7]Department of Peadiatrics, Bolgatanga Regional Hospital, Bolgatanga, Upper East Region, Ghana

[8]Judicial Service of Ghana, Adansi Fomena District Court, Fomena, Ashanti Region, Ghana

1. Introduction

1.1. Background

The laws governing sporting activities, such as football matches, are normally modified as a disease prevention strategy during disease outbreaks. In response to the SARS-CoV-2 pandemic, football match rules were globally changed to prevent the virus's spread (Harangi-Rákos *et al*., 2022; Peek *et al*., 2023). Most players were afraid of physical contact with their opponents. The arrival of SARS-CoV-2 brought unprecedented stillness worldwide. Using medical microbiological investigations, pathogens have been identified in most pandemics (Haykin, 2022).

Once a disease's causative agent is known, health experts can easily find prevention strategies to prevent its spread, as seen with COVID-19. Following the identification of SARS-CoV-2, prevention protocols were quickly published. When an outbreak is declared a pandemic, using COVID-19 as an example, it is normally based on the number of cases detected by medical laboratories per day or week. These figures, along with the number of reported cases, help determine how the outbreak spreads (Cucinotta & Vanelli, 2020; Huremović, 2019).

Commonly used microbiological investigations for detecting SARS-CoV-2 include rapid diagnostic tests that utilize antibodies specific to its antigens, as well as molecular investigations such as polymerase chain reaction (PCR) (Abdurrahman *et al*., 2022; González-Vázquez & Arenas, 2023; Navero-Castillejos *et al*., 2022). Gene sequencing following PCR has enabled experts to trace the origin of SARS-CoV-2 (Holmes *et al*., 2021). After detection, COVID-19 was declared a pandemic, which influenced public behavior, including changes in sporting activities (Cucinotta & Vanelli, 2020; Huremović, 2019).

There was more "fair play" in football matches (Kriz *et al*., 2022) when COVID-19 was at its peak; players were more careful compared to non-pandemic seasons. This strategy, implemented by the International Federation of Association Football (FIFA) (Historyofsoccer.info, 2023), helped prevent the spread of the virus. While the connection between peace and health is well established, there is limited literature on their relationship with entrepreneurship. Although Pulle (2022) has established the relationship among these three areas, the existing literature remains sparse.

Coaches employ different strategies to win matches for the clubs/teams that they manage (Ammann & Altmann, 2023; Díez *et al*., 2021; Ranchordas *et al*., 2017). The personal abilities/roles of each player in accomplishing tasks given by team managers determine their qualification for a particular jersey (Ammann & Altmann, 2023; Díez *et al*., 2021). In disease prevention, different strategies, known as the "One Health" approach, are also used (Ammann & Altmann, 2023; MacKenzie & Smith, 2020).

Sleep is essential for allowing key players to regain their vitality before facing a challenging team (Nédélec *et al*., 2015; Ranchordas *et al*., 2017). This principle also applies to military personnel, especially during wartime. Sleep is crucial for maintaining mission success and preventing health-related problems, like insomnia (Good *et al*., 2020). As described in various texts, individuals are designed to work during the day and sleep at night (Howard, 2021; Genesis 1:14-19). Therefore, sleeping for the required number of hours per day is a healthy behavior (Ramar *et al*., 2021).

A team coach, when losing a match, can strategically adjust the team's defense, midfield, or attack to change the course of the match (Ammann & Altmann, 2023; Díez *et al*., 2021). It is important for individuals to self-assess their actions and make re-adjustments for improvement (Burrows, 2018; Fishleder *et al*., 2022; Taylor *et al*., 2020). During the peak of COVID-19, many individuals experienced sudden changes in their lives. From these real-life experiences, readers can learn how to quickly adapt to changes in their lives.

Despite various strategies, such as defenders bringing down opponents to gain scoring advantages, team members and their supporters often feel disheartened when they lose (Fifa.com, 2018). However, using the "One Health" approach along with lessons from microbiology

and sports, humanity has made significant progress against COVID-19, preventing further harm.

The behavior of footballers can be realistically applied to daily life. For example, players who target opponents instead of the ball, or who exaggerate after being fouled, highlight the need for national/international judiciaries (Iacono, 2019; Mizrahi *et al*., 2020). Judges, lawyers, and police officers are there to protect individuals because most of them do not accept their own faults. This is why sporting activities have established rules. Through this paper, problems were discovered and addressed by the objectives that were set. These have help authors to provide practical suggestions or recommendations to help promotes global peace, quality health and entrepreneurship.

1.2. Problem statement

The COVID-19 experience reaffirmed the popular saying, "Your health is your wealth" (Zalmanoff, 2022; Carlson, 2016). Good health contributes to wealth, while wealth, in turn, enhances quality of life, promoting better health (Burton *et al*., 2021), peace, and entrepreneurship (Burton *et al*., 2021; Pulle, 2022). During the peak of the COVID-19 pandemic, global economic activities were halted due to lockdowns aimed at preventing the spread of the virus (Ibn-Mohammed *et al*., 2021; Wang *et al*., 2021). Most individuals received support to survive, clearly reaffirming that poor health negatively affects peace and entrepreneurship (Abuelaish *et al*., 2020; WHO, 2023). Furthermore, entrepreneurship can lead to both wealth and improved health, creating a reciprocal relationship.

During the COVID-19 lockdown, many nations reported an increase in societal problems. Poor health, especially psychological problems, led to suicidal thoughts among some citizens (Every-Palmer *et al*., 2020). Research shows that wealthy individuals tend to live longer than those with fewer resources (Finegood *et al*., 2021), highlighting the effect of wealth on health and peace. A peaceful mind is essential for longevity. By adopting the health-conscious behaviors of footballers, individuals can prioritize health in their New Year's resolutions, fostering a sense of peace.

This world would be nothing without people. Individuals bring joy and sorrow to one another (*Are You Threatened By Other Individuals's Success?*, n.d.; *Why Someone Else's Success Isn't a Threat to Yours*, n.d.; Gero *et al*., 2022), just as microbial infections like COVID-19 and lessons from football teach us. A world without individuals would be akin to hell. Tolerating others while avoiding incessant bullies is essential for promoting peaceful environments globally. However, excessive rivalry among some individuals (Guise, 2023; Robbins, 2021) contributes to the rise of "hate crimes" (Gero *et al*., 2022; Mellgren *et al*., 2021) and "human rights abuses" (Amanullah *et al*., 2022; WHO, 2023) globally.

Meanwhile, everyone on earth needs one another to synergize or work effectively and efficiently toward achieving the common good, particularly the sustainable development goals (SDGs). Sick individuals face challenges in contributing to these goals, and the prevalence of hate crimes is associated with morbidities (Liu *et al*., 2023; Mellgren *et al*., 2021) and mortalities (AlQahtani *et al*., 2023). In the metaphor of "the journey of life" (Madry, 2019; Pulle, 2022; Rogers *et al*., 2023), travelers may share the same path, but they often have different destinations. Recognizing this reality, there is no need to antagonize others, as has been observed in some workplace relationships and during the peak of the COVID-19 pandemic.

Whatever one achieves legally in life contributes to the advancement of the SDGs (Martins & Paes-Sousa, 2024; Helldén *et al*., 2022). Unfortunately, individuals striving to improve their family circumstances are often perceived as competitors and targeted by others (Guise, 2023; Robbins, 2021). This is where hatred emerges, which undermines the achievement of the United Nations (UN) SDGs, especially Goals 1 – 5, 8 – 12, and 16.

Although all the SDGs are very important (Martins & Paes-Sousa, 2024), it is not possible to "end poverty" (Goal 1) or "end hunger" (Goal 2), while the successes of others are viewed as threats (Guise, 2023; Robbins, 2021). Promoting "healthy lives" and "well-being" (Goal 3) starts with recognizing the successes of others, which can ultimately contribute to ending poverty and hunger. In this context, medical microbiology plays a significant role in accurately diagnosing infections, thereby facilitating quality health care delivery.

By applying lessons from microbiology, particularly in the context of COVID-19, and embracing the unifying spirit of successful football teams, individuals can work together peacefully. In soccer, individuals with unique abilities from different origins come together with a shared goal. These contributory qualities and disciplines of individual players contribute to the successes of many national teams in the FIFA World Cup Finals (Historyofsoccer.info, 2023). Violence/hatred create division, making it challenging to achieve the UN SDGs without unity or a common vision. This is akin to a camel trying to pass through the eye of a needle (Luke, 18:15 – 26; Matthew, 19:13 – 25).

1.3. Significance of the study

Although a lot has been done to prevent infectious diseases and reduce the world's instability, violence remains a major public health issue that requires solutions (Oliveira *et al*.,

2022). This research aims to address identified gaps, providing policymakers with findings that can inform their decision-making processes. The results would serve as important literature for microbiology, public health, social sciences, and sports medicine. The findings and the recommendations of this study can contribute to fostering a peaceful and healthy environment conducive to economic growth.

It is often said that "health is wealth" and "wealth is health." Both concepts are essential for individuals to maintain a peaceful mindset that supports work and entrepreneurship, facilitating national and global economic growth. If the world has healthy and peaceful individuals who can work happily without fear, the common good of the world (SDGs) can be achieved easily. In contrast, a violent environment can lead to injuries, incapacitation, and even death, severely undermining efforts to achieve SDGs. It can even contribute to cyclic poverty, hunger, human rights abuses, and widening inequality – issues that the UN is trying earnestly to address. These challenges can be drastically reduced or eliminated by applying the findings of this research and valuing everyone. The "One Health" approach used in this study would help individuals recognize the importance of prioritizing their health, using footballers as role models.

Prioritizing health is essential, as health, peace, and entrepreneurship are vital triads needed to survive and enjoy life (Pulle, 2022). In the "new hierarchy of needs" (Pákozdi & Bárdos, 2022) or "Maslow's hierarchy of needs" (Cherry, 2022; Montag *et al*., 2020), one cannot enjoy them without peace, quality health, and entrepreneurship. One must be healthy with a peaceful mind/environment to work for these needs. Furthermore, without peace/health, enjoying them is a mirage. Prioritizing one's health first is tantamount to helping individuals pay more attention to their lives: quality health or healthy living contributes to promoting internal peace in work. Those who prioritize health are likely to adopt health-conscious behaviors similar to those of footballers, utilizing health services such as medical laboratory screening to manage or prevent infections.

1.4. Study's objectives

1.4.1. Main objective

To assess how microbiology and lessons from sporting activities contribute to reducing infections and crimes, ultimately benefiting global economies.

1.4.2. Specific objectives

The specific objectives are to:

1. Review the literature on the relationship between sports-related infections and their impacts on global peace, quality health, and entrepreneurship, drawing insights from microbiology and sports lessons
2. Identify how lessons from COVID-19 and football can help mitigate rising global hate crimes, contributing to the common good and the achievement of the SDGs
3. Assess available literature on honor crimes and honor murders, exploring whether these acts discriminate among genders or similar to how infectious pathogens affect all genders.

Through these objectives, findings, suggestions, and recommendations will be presented.

2. Methods

2.1. Sampling procedure

Multiple study designs were used: observations, authors' experiences, and comprehensive literature reviews. Some comparisons were made using real-life situations. For example, the scoring of a goal brings unity among team members and supporters. In real life, social activities such as weddings, naming ceremonies, parties, congregational worship, and sports – like athletics, basketball, and boxing – unite individuals.

Using the design, multiple techniques were synergized to retrieve relevant literature. Observations of football matches played in the stadium, especially those held during FIFA World Cups, provided valuable life experiences. These experiences led to the identification of gaps that needed further exploration. To find solutions, comprehensive literature reviews were conducted. Tasks were assigned to co-authors, who were grouped by specific topics, while each member independently searched for information as reviewers.

Keywords and phrases such as "medical microbiology," "COVID-19 pandemic," "highest paid job," or" World Cup dominant winners" were employed to exclude unrelated literature. Literature on social issues was used as examples to help individuals understand how others are affected in the 21st century and how lessons from football can offer solutions. Only articles published from the year 2000 onward were considered (Figure 1). For example, the inquiry "Who are the world's highest-paid football players in 2022?" is presented in Table 1.

The dominant online search engines utilized to retrieve literature were PubMed, newspaper websites, Google Scholar, Web of Science, professional blogs, and Science Direct (Table 2). Unhealthy past experiences and articles with unhealthy information that could lead to societal problems were excluded from the study. The only exception was using those experiences purposely to advise others nicely, contributing to healthy and peaceful coexistence for smooth economic activities.

Figure 1. Flow chat of the review process. Source: From Ben Pulle's Peace Designs. Created using Microsoft PowerPoint

Table 1. The top ten highest paying sports globally

Ranking	Sport's name	Players on field	Highest-paid player	Player's average pay ($)
1.	Boxing	2	Floyd Mayweather Jr.	600 million
2.	Golf	1	Tiger Woods	127 million
3.	Auto racing	-	Michael Schumacher	127 million
4.	Football	22	Christiana Ronaldo	125 million
5.	Basketball	10	LeBron James	97.1 million
6.	Tennis	2 or 4	Roger Federer	90 million
7.	American football	22 (53 backup)	Tom Brady	75 million
8.	Baseball	18	Alex Rodriguez	38 million
9.	Ice hockey	12	Connor McDavid	12.5 million
10.	Wrestling	2 (4 or over)	Brock Lesnar	12 million

Sources: (Retrieved from; Johnson, 2023; Knight, 2023; Scholars Den., 2023; Icehockeyuk.co.uk., 2022; Maglovski, 2022).

2.2. Inclusion/exclusion criteria

The following are the inclusion and exclusion criteria for the literature review.

2.2.1. Inclusion criteria

The following criteria were used to select related articles for review by independent reviewers:

(i) Current articles/reliable information on microbiology or diseases (mostly infectious diseases and a few non-communicable diseases), as well as articles on peace, health, and entrepreneurship
(ii) Current articles/reliable information on football/sport in relation to the SDGs or the common good.

2.2.2. Exclusion criteria

To ensure the relevance and realism of the information, specific keywords such as "microbiology," "infections/diseases," "non-communicable," "medical or health," "peace," "entrepreneurship," "COVID-19," "football," "fair play," and "sport" were utilized to exclude unnecessary articles from the review. The following criteria were applied:

(i) Articles published before the year 2000 were excluded from the study
(ii) Unhealthy experiences were strictly avoided, except when providing advice
(iii) Literature that addressed different issues unrelated to the subject matter was not included.

While this study is a comprehensive literature review, aspects of a systematic review were incorporated. To minimize bias, literature review tools such as the PRISMA checklist (Sohrabi *et al.*, 2021) were used as a guide for including and excluding literature.

2.3. Study's limitations

A questionnaire should have been utilized to gather respondents' insights on the lessons that they have learned from COVID-19 and sporting activities, particularly football. Answers on medical laboratory diagnosis

roles, such as microbiological investigations for disease prevention, treatment, and management, would have been beneficial. In addition, interviews and focus discussions could have effectively achieved the same objectives. Further research is required.

2.4. Statistical analysis

Table 2. Types of search engines used and data retrieved from each

Information source	Number of literature
Journal articles (total)	200
PubMed-articles	112
Web of Science	54
ScienceDirect	37
Scopus	24
Google Scholar	20
Books	28
Bible quotes	23
Academic books	3
Quran quotes	2
News websites	122
Blog posts	10
Videos	4
Press releases	2
WHO websites	1
Encyclopedia	3

Note: Forty-seven of the journal articles were retrieved from multiple search engines, resulting in a total of 247 references here instead of the actual 200 journal articles used. Source: Ben Pulle's Peace Designs and Writing. Created using Microsoft Word Office, Version 2021. Abbreviation: WHO: World Health Organization

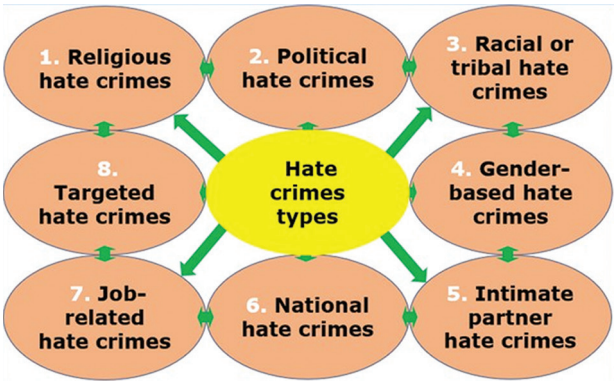

Figure 2. The inter-connected octagonal causes of 21st century's hate crimes. Sources: Gill (2022a); Lopez & John (2023); Peeples (2020); Schwacke (2022); Shier & Shor (2016); Tavone *et al.* (2022). The individual ideas were combined to create this diagram, using Ben Pulle's Peace Designs and writings through Microsoft PowerPoint 2010 and 2021

This study was written and stored using Microsoft Office 2010 (Microsoft Corporation, United Kingdom). Some of the pictures or figures were designed using Microsoft PowerPoint, after which they were screenshotted and used for their desired purposes. For example, pictures showing some football players celebrating their goals or referees showing cards to some players (Figures 4 and 5) were retrieved and designed using Microsoft PowerPoint in ways that fit their intended use. Statistical analysis, including the number of references retrieved from each search engine, was analyzed using Microsoft Excel 2010 and International Business Machines Statistical Package for the Social Sciences version 25 (Fotaraki *et al.*, 2022; Masuadi *et al.*, 2021). Tables and figures/pictures were used for data presentation.

3. Results

3.1. Results' background

A total of 370 references were reviewed. Over half of these, specifically 200 literature, were journal articles. In addition, 122 pieces of literature were retrieved from news

Figure 3. Postures of players shown yellow and red cards. Sources: (Retrieved from; Nalwala, 2022; Owayo.com., 2020)

Figure 4: Ghana national men football team praying before a match (Source: Retrieved from; https://www.gettyimages.com/search/2/image-film?page=33&phrase=soccer+prayer on 15.10.2024 at 5:50 PM).

Figure 5. Players use religious signs to reveal their religions in celebrating goals. Source: OperaNews (2021)

Figure 6. (A and B) Picturesque demonstration of sports promotion of peace and health football. Sources: (Brophy, 2022; Gokhale, 2022)

websites. Among the remaining sources, 28 were from books, including 23 quotations from the Holy Bible, three from academic books, and two from the Holy Quran. The review also included 10 blog posters, four videos, three encyclopedias, two press releases, and one reference from the WHO website obtained through search engines. Three specific objectives guided this review, and the results provided answers to these objectives, as outlined below.

3.2. Description of results

Peace building and maintaining quality health for successful entrepreneurship is akin to constructing a home's foundation, where elements such as water, cement, quarry dust, and iron rods are essential (Kissam, 2022; Cowii, 2019; Drummond, 2019; Figure 6). The relationships between peace and quality health have been explored by many researchers (Weeks *et al.*, 2024; Pulle, 2022; Abuelaish *et al.*, 2020; Arya, 2019) and emphasized by the WHO's Director-General (WHO, 2023). Dr. Tedros stated, "There cannot be health without peace, and there cannot be peace without health" (WHO, 2023). Sport-related infections can hinder an athlete's performance (DeNizio & Hewitt, 2019).

Abuelaish *et al.* (2020) illustrated the connection between peace and health using the "One Heath" approach, describing their linkage with terms such as "interrelated" and "interdependent." Hence, in football, the celebration of a goal/victory by players (Figure 6A) or shaking hands after being shown a card (Figure 6B); practically demonstrates the interconnectivity of peace, health, and entrepreneurship. They explained how promoting one can benefit the other and how conflicts can positively/negatively affect this relationship.

The FIFA World Cup, played in the last quarter of 2022, might have been postponed due to the severe spread of the COVID-19 pandemic (Fifa.com, 2022). Entrepreneurs who normally strategize to do their businesses (entrepreneurship) during the World Cup would also have been impacted. The dominant winners presented in Table 3, along with the most talented/best players, achieved their success by competing in peaceful and healthy environments.

Even in a peaceful environment, if players are unwell, they cannot perform at their best; likewise, being healthy without peace does not guarantee success. Football is one of the highest-paid sports on earth (Table 1), and "sports physicians" are among the highest-paid professionals. This reveals the fact that football is not just a game but also a business where individuals earn a living.

To prevent honor crimes, one must know what causes them. Multifaceted causes of hate crimes, like honor killings or honor crimes, have been revealed by the research findings. Using them, assassinations for honor are like infections, COVID-19, that infect all. This is why "One Health" ideas are needed to deal with them. An example of how knowing the causes can help address that the problem is the issue of honor murders (Gill, 2022). Falsely tagging honor murders as only feminine issues would shift policymakers' attention toward addressing them as such, ignoring other major causes.

From the literature, the inter-connected octagonal causes of 21st century hate crimes include religious,

Table 3. The FIFA World Cup dominant winners, number of wins, host locations, and years of victory

FIFA history	Winning nation	Hosting nation	Victory scores	Year won
The dominant nation	Brazil	Sweden	5 – 2	1958
		Chile	3 – 1	1962
		Mexico	4 – 1	1970
		USA	0 – 0 (3 – 2, pens)	1994
		Japan/Korea	2 – 0	2002
2nd dominant nation	Italy	Italy	2 – 1	1934
		France	4 – 2	1938
		Spain	3 – 1	1982
		Germany	1 – 1 (5 – 3, pens)	2006
3rd dominant nation	Germany	Germany	2 – 1	1974
		Italy	1 – 0	1990
		Brazil	1 – 0	2014
3rd dominant nation	Argentina	Argentina	3 – 1	1978
		Mexico	3 – 2	1986
		Qatar	3 – 3 (4 – 2, pens)	2022
4th dominant	France	France	3 – 0	1998
		Russia	4 – 2	2018
5th dominant	Uruguay	Uruguay	4 – 2	1930
		Brazil	2 – 1	1950
6th dominant	West Germany	Switzerland	3 – 2	1954
7th dominant	Spain	South Africa	1 – 0	2010
8th dominant	England	England	4 – 2	1966

Note: For national teams that have the same number of wins for the World Cup's final, their numbers of run-ups are used to determine their positions.
Source: (Historyofsoccer.info, 2023).
Abbreviation: FIFA: International Federation of Association Football.

political, racial or tribal, gender-based, intimate partner, national or state-level, professional or job-related, and targeted hate crimes (Figure 2).

Irrespective of unavoidable human differences, achieving the common good (SDGs), has put all human races in one boat, like COVID-19. In a boat, no one is cleverer or more important than the other. If two or more individuals are crossing to the other bank of the river in a boat but want to all sit at one side, they will drown. The 21st-century world is like individuals crossing rivers in a boat/canoe in the middle of the river. To be able to cross this river, disease prevention is paramount.

The literature revealed that, like SARS-CoV-2, it infects everyone without discrimination; every human being can be victimized by honor-based murder. Some writers falsely tagged "honor crimes" as feminine issues; there are research findings that revealed that honor crimes affect all genders (Table 4). There are multiple causes of honor crimes; every human being is a victim (Figures 2 and 7), like infections. These are further discussed below.

4. Discussion

4.1. Objective one: To determine the linkage between sports-associated infections and global peace, quality health, and entrepreneurship – The case of football matches

Every footballer is a valuable human resource of a team or club; without them, there is no team. It takes individual players to form a team. The beginning of winning a football match is the unifying spirit of the team (Robles-Palazón *et al.*, 2022). This and love among players helped them freely pass the ball among themselves to score (Pulle, 2018a). Evidence of unity among players is shown in Figures 3 and 4. Figure 3 shows a referee maintaining peace. If a player refuses to pass the ball to another due to hatred, it does not affect only the player but the whole team. For a national team, it negatively affects the whole nation. The same happens if the players are infected.

Robert Kennedy said in 1968 that "What we need in the United States is not division" (Staff, 2022). Rephrasing

Table 4. Some literature on honor crimes or honor killings

Literature	Information	Author (s)/Year
Some literature tags honor crimes and honor killings as a feminine problem		
Honor killings in the Eastern Mediterranean Region	The criminal behavior of killing individuals to allegedly cover family/societal shame. The practice hurt families and society, hurting individuals more than the "shame."	AlQahtani *et al.*, 2023
There's No Honor in Honor Killing: The Paradox of Femicide in Palestinian Media	Family murdered a 19-year-old lady to allegedly cover family shame. Palestinians condemned the act and campaign against honor killings.	Abushkhaidem, 2022
Between Two Worlds: The Racialization of Femicides in German News Reports	"Femicide" is the global murder of women. Targeted honor-based crimes against some racial minority females exist.	Schwacke, 2022
Some literature shows that honor crimes target not only females		
Between Two Worlds: The Racialization of Femicides in German News Reports	For honor-based killing, both the "victim" and criminal are mostly from "majority" societies and are migrants. These are examples of religious or tribal honor crimes that do not target only females.	Schwacke, 2022
Coethnic Concentration and Asians' Perceived Discrimination Across U.S. Counties during COVID-19	Asians were hated, stigmatized, and discriminated against during COVID-19. Hatred against Asians increased to 150%. These are racial/tribal honor crimes.	Lee *et al.*, 2022
Problematizing "Honor Crimes" within the Canadian Context: A Postcolonial Feminist Analysis of Popular Media and Political Discourses	Honor crimes are new societal problems championed by tribalism and racism. It also revealed "honor crime" as a tagged feminine issue after colonialism.	Gill, 2022

Figure 7. Peace building and quality health for successful entrepreneurship are like constructing a home's foundation. Sources: Retrieved from; (A) (Kissam, 2022); (B) (Cowii, 2019); (C) Drummond (2019)

him: "The world does not have an interest in division; it needs loving and united individuals;" this will help create a good environment to support the achievement of the common good (SDGs). Football is full of aggression with very aggressive players, leading to injury (Yan *et al.*, 2022). However, football matches are full of "rules" that govern them (Ammann & Altmann, 2023); so, despite soccer aggressiveness, they end peacefully.

In a divided and envious environment, violence thrives, overshadowing peace. Injuries from violence (Paalo, 2017) make individuals incapacitated, preventing them from working. Violence displaces individuals and violates their human rights, destroying valuable human resources and property (Paalo, 2017). In violence, individuals cannot go out or do their work/businesses (Awkwa, 2022), which negatively impacts economic activities/entrepreneurship.

With experience, the only thing that mostly divides Ghanaians or some nations is "dirty politics" (Paalo, 2017). Dirty politics and over-politicization of issues of national importance have led to increased politics of insults (Pulle, 2021).

But once the national team scores, all Ghanaians are always happy. Scoring a goal brings unity to the team, their supporters, and Ghanaians. The same is said about football in reality. This agrees with FIFA World Cups and other Confederation Football, where Nations and Team Supporters are seen happily jubilating when their national team scores/wins (Historyofsoccer.info, A., 2023; Aljazeera.com., 2022). In Ghana, though dirty politics divide citizens, the National Men's Football Team scoring always unites the citizens.

If you are destroying someone for alleged competition, you are sabotaging the achievement of the world's common good (Helldén *et al.*, 2022). Unity makes it easy for teams to win their matches/games. The ball is normally beautifully passed, without bias, to any player with the opportunity to create more chances to score. Team members' ability to

tolerate their differences creates a peaceful environment for winning; these are applicable to human lives.

Without peaceful team members, maintaining team unity is difficult. Nations with mixed races in international soccer have been sending beautiful messages globally worthy of emulating. They do not normally allow their racial differences to affect their performances (Sportnewsafrica.com., 2022). The message from their admirable performances is that forsaking our differences, there is nothing that we cannot achieve. This unity helped the world contain COVID-19.

With the exception of only two nations, nations with mixed races who qualified for the global football competition have been victorious (Historyofsoccer.info, 2023; Table 3). As of now, Brazil, which is one of the national teams with mixed races, is the dominant winner in the "FIFA" World Cup's history. Like infectious diseases that do not discriminate, they normally give no room for discrimination, so white players are seen passing the "football" to Black players just like the Blacks also do. There would be no best goal scorer, too, without these inbuilt attributes of the game (Table 5).

The same could be said about nations with their national football teams being mixed races. This beautiful revelation agrees with current results where the most dominant nations in the current FIFA World Cup's history are national teams with mixed races (Table 3). In the recent Qatar's FIFA World Cup, 14 nations had mixed-race players (Sportnewsafrica.com., 2022). One of these (France), the 2018 FIFA World Cup champion, played competitive finals again.

Table 5. Current top 12 male football goal scorers as of 2022

History	Player's name	Player's nation	Scores	Matches played
1.	Cristiano Ronaldo	Portugal	118	196
2.	Ali Daei	Iran	109	148
3.	Lionel Messi	Argentina	98	172
4.	Mokhtar Dahari	Malaysia	89	142
5.	Ferenc Puskas	Hungary	84	85
6.	Sunil Chhetri	India	84	131
7.	Ali Mabkhout	United Arab Emirates	80	109
8.	Godfrey Chitalu	Zambia	79	111
9.	Hussein Saeed	Iraq	78	137
10.	Robert Lewandowski	Poland	78	138
11.	Pele	Brazil	77	92
12.	Neymar	Brazil	77	124

Source: Retrieved from (Johnson, 2023; Knight, 2023; Icehockeyuk.co.uk., 2022).

Entrepreneurs need peace and health to do effective entrepreneurship; their customers also need to be healthy in a peaceful environment to do business without fear. No profession/athlete practices preventive medicine and curative health more than footballers. Applying unity and health-conscious behaviors of footballers creates unity and a peaceful and healthy environment for global businesses/economic growth.

Every success is preparation, which goes with "self-assessment." Using "self-assessment" inbuilt in it helps correct mistakes for success (Burrows, 2018). This is how using yellow/red cards originated. Introducing red/yellow cards in football was done not only to protect players' health but to promote peaceful football matches. From past experiences, players were frequently injured. In the 1966 England FIFA World Cup, confusion emerged between players and referees (Historyofsoccer.info, 2023).

The "Argentina and England" match led to too aggressive players, resulting in some being expelled. A heated misunderstanding emerged between "two players" of each national team and the referee. When the players could not understand Ken Aston's verbal warning,

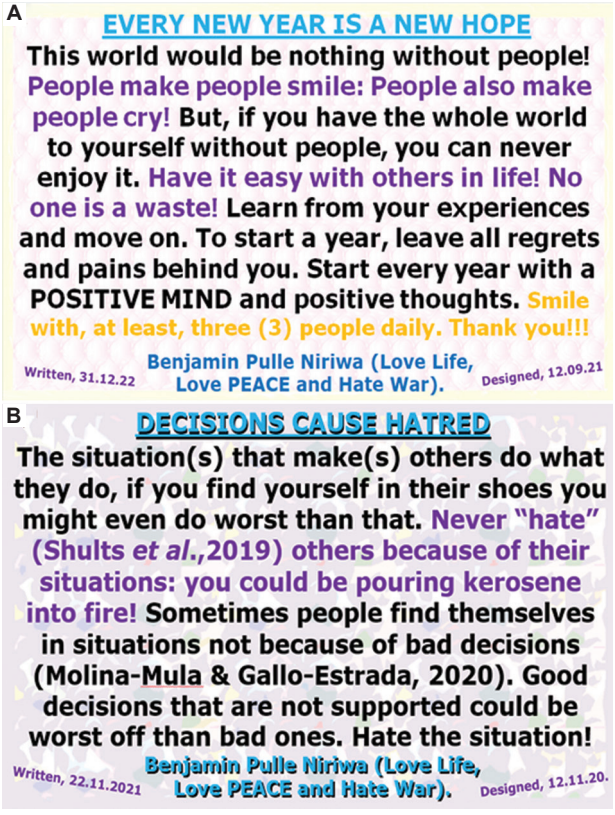

Figure 8. (A and B) The daily decisions that people make could be their sources of hatred. Source: Adapted from Ben Pulle's Peace Designs, created using Microsoft PowerPoint.

he resorted to using two cards' colors (yellow and red) for his seriousness.

FIFA first used colored cards in the Mexico 1970 World Cup, based on self-assessing the 1966 World Cup. This change contributed to a drastic reduction in injuries or violent behaviors; cards were issued against "abusive" or violent players. Preparation and self-assessment are not the only strategies used by FIFA and coaches; all the "5Ps of life" (Pulle, 2022) are also used. Players pray before each match and after scoring (OperaNews, 2021) (Figure 4). These practices are needed for peace, health, and entrepreneurship (Pulle, 2022).

Most men, unlike women, do not consider their health seriously; men adopt risky behaviors to prove their masculinity. For male footballers, the story is different, as displayed on the field when playing. With a small touch from the opponent, the football player rolls over several times while moaning as if he is almost dying. If male footballers are able to change this old cyclic perception negatively affecting the health-seeking behaviors of men, anyone who prioritizes health would be able to behave likewise.

A player seen playing in the stadium, especially the FIFA World Cup (FIFA.com, 2022), means that he/she is healthy/fit without injury. A national team with sick or injured players would perform poorly (Yi *et al*., 2019), irrespective of how good the players are. This perfectly agrees with the saying, "Your health is your wealth." Before every match, each player's health and physical fitness are assessed.

These findings align with the idea that players take their health seriously; a player's health status is the primary criterion for training and football matches (Bennett *et al*., 2022). To do any training or play for one's team, one must be fit and healthy without injury (Bok & Foster, 2021). Even if a player is healthy and fit with no injury, some specific positions require specific physical abilities such as talents, tactical awareness, running speed, and technical skills of specific players (90mins, 2022; Bok & Foster, 2021).

4.2. Objective two: To identify how COVID-19 and football lessons can help reduce rising global hate crimes for the global common good

With the exception of the Holy Books (Bible/Quran), nothing on earth teaches how to love and live in unity more than sporting activities (Pulle, 2018a). Every 4 years, football brings the whole world together as one big family to entertain and make money (History.com, 2023; Historyofsoccer.info, A., 2023). These sporting activities give participating nations opportunities to practice the "Parable of the Good Samaritan."

Nations that qualify to play the FIFA World Cup mostly get similar treatment; they all receive appearance fees. They get equal environmental treatment; similar training pits, dressing rooms, and hostels. These fair treatments are missing in most national educational systems. But to solve most of the world's problems, it must start with academic institutions. How some individuals are treated while on campus determines how most of them would behave after completion, except for a few who might behave differently.

Fair play experiences in football matches are not applicable in all life situations, like the COVID-19 pandemic. Every nation has some regions or states that are always described as the poorest. Individuals would appreciate the special initiatives taken by various nations to end poverty/hunger in these regions/states. Eradicating poverty in these regions is linked to the UN SDG 1.

It makes no sense to talk about "inclusive and equitable education" (UN DESA, United Nations, 2022) when students in poor regions/states continue studying under dilapidated structures with limited resources, with their mates studying under the best infrastructures (Cedering & Wihlborg, 2020; Medium.com, 2019; Smith, 2017). The problem is that they write the same examination with the same assessment. These realities agree with facts globally (Cedering & Wihlborg, 2020), where rural schools lack funding.

It is difficult for deprived areas students to get leaked examination materials (Menon & Thane, 2020; Manjunath, 2019). Sadly, the same cutoff points are used to admit them into colleges and universities. Painfully, those who attended the best schools use that to stigmatize their colleagues for attending "village school" (Cedering & Wihlborg, 2020; Medium.com, 2019; Smith, 2017).

Some educated persons, after completion, become addicted to the superiority complex due to their actions as students on campus; they still have a negative mentality about those from "villages" (Togioka *et al*., 2022). Individuals like that also mostly become racists/tribalists; they discriminate against certain races/tribes (Togioka *et al*., 2022), sick/disabled persons (Togioka *et al*., 2022), and poor individuals (Togioka *et al*., 2022). They discriminate against and stigmatize such individuals in every social relationship intellectually, as exposed by COVID-19 (Togioka *et al*., 2022; Pulle, 2021).

These realities agree with findings where discriminations and stigmas against different kinds of individuals were identified (Togioka *et al*., 2022; Pulle, 2021). In the murder and burning of a female student for alleged blasphemy, those who led the attack were her own classmates (Blessing, 2022). All these behaviors create anger and bitterness in some individuals who feel disenfranchised/neglected. The

SDGs cannot be achieved with these mentalities creating pain, hurt, and hatred.

Some hate crimes/honor killings are a result of some individuals harboring pains in their hearts, like in the case of the "Monterey Park mass shooting" (BBC, 2023), where the perpetrator revealed that he was hated by individuals (Taxin *et al*., 2023). The murderer has reported to police that "he was the victim of fraud, theft, and poisoning by family members." His friend also revealed that he did not trust individuals and complained that "individuals at the clubs didn't like him" (Taxin *et al*., 2023). These revelations are clear exposes of hatred and pains within his heart.

Honor crimes/murders originated from the Holy Books as warnings against their consequences, not as encouragement. Unfortunately, there are religious honor crimes/murders targeted at some renowned men of God (Lopez & John, 2023) and some believers (Blessing, 2022; Ussanews.com., 2022; Drelichman *et al*., 2021). Both western nations like the United States and African nations like Nigeria have reports of men of God being murdered for honor recently (Lopez & John, 2023).

Painfully, some political leaders (Ussanews.com., 2022), lawyers or judges (Doski, 2022), and even some traditional rulers (John 19:1 – 22; Mark, 6:12 – 28) hands are tired by religion in religious majority nations, resulting in biased judgments (Best, 2022; Meterko & Cooper, 2022; Peeples, 2021).

4.3. Objective three: To assess available literature that honors crimes or honor murders as old cancers affecting all genders, like infectious diseases

Hate crimes are like microbial pathogens that infect everyone. The findings from this research disagreed with research findings that created the perception that murder for honor is gender-based violence targeting only females (AlQahtani *et al*., 2023; Gill, 2022). There is no disputing the fact that women are victims of honor-based violence, but they are not the only ones affected. Results from this study agree with findings that men are also victims of honor-based crimes committed in so many ways (AlQahtani *et al*., 2023).

Violent crimes mostly occur because someone or a group is not happy about something (Figure 8). This underlying discontent contributed to the origins of World Wars I and II (Williams, 2022). Honor crimes or murders are hate-related crimes offenses in which individuals are murdered for allegedly bringing shame to a family or particular group. Wars originating from hatred or honor murders can lead to the use of "biological weapons" derived from microbial agents (de Miranda, 2022; Williams, 2022). Any form of murder can create an unsafe and unhealthy environment, resulting in psychosocial and mental health issues (O'donovan, 2020), negatively affecting UN/WHO objectives of providing safe environments for "quality health" or "quality healthcare" delivery (Nicklin, 2023; O'donovan, 2020).

The increased homicides that target young men "especially in the Latin America and Caribbean (LAC)" are issues of honor murders (Canudas-Romo & Aburto, 2019). These agree with similar recorded trends where males are mostly targeted with "overkill" or "homicides" (Tavone *et al*., 2022). Among reasons given for targeted murder of males, murder for "honor" is one of them (Tavone *et al*., 2022). Honor crimes can be due to other issues such as culture/religion (Shier & Shor, 2016), racism/tribalism (Schwacke, 2022), politics (Gill, 2022), and even social "inequalities" or poverty (Durante & Fiske, 2017); tagging it as a feminine problem only exacerbates the issue.

For example, even if honor crimes are not caused by politics, if the political environment is against them, they cannot survive their resistive environment. Research findings like that of Gill (2022a) have provided evidence that some politicians promote honor crimes for their political victories. Political honor crimes/murders target more men than women (Pulle, 2021).

In the 21st century, though females are affected, men are also increasingly becoming victims of hate or honor crimes (AlQahtani *et al*., 2023; Iddriss, 2022; Pulle, 2021). Enacting "hate crime laws" agrees with the reality of increased hate crimes (Green *et al*., 2021; Prairie *et al*., 2022), where individuals need to be protected. These hate crimes target all genders. One of the reasons why females are killed for honor is "forced marriage" (AlQahtani *et al*., 2023; Gill, 2022). This agrees with current literature where their male counterparts are also abused or murdered for similar reasons (Iddriss, 2022).

Honor crimes originated from the Holy Books, where the majority of the victims were men (Sciomer & Moscucc, 2022; Mark, 6:12 – 28). Falsely describing them as feminine issues would rather promote them. The following are some men in the Holy Bible murdered for honor:

(i) *The Beheading of St. Valentine:* On the 14th of every February, Valentinegt Day is celebrated (Ratner, 2018). St. Valentine is usually remembered, but he was "asembered (Ratner, 2018). The murder of St. Valentine was a religious persecution where he was accused of secretly blessing marriages for the Roman soldiers who were forbidden. This agrees with current honor murders, though these are mostly about forced marriages (AlQahtani *et al*., 2023; Iddriss, 2022).

(ii) The Beheading of John the Baptist for Herodias: He was beheaded to honor the wife of King Herod, Herodias. She was at loggerhead with John the Baptist

for speaking the truth that the King had married his niece, who was also a wife of his brother (Strugnell, 2023; Leviticus., 18:6-24; 18:16; 20:21; Mark, 6:12-28).

(iii) *The Crucifixion of Jesus:* Jesus Christ was also murdered for honor. Just like John the Baptist, no serious offense could be traced back to him, though he was dead and had ascended into heaven. Accusations that: "hat a good work we stone thee not but for blasphemy; and because that thou, being a man, makest thyself God.e (John 10:24-39), "0: heard him say, I will destroy this temple that is made with hands, and within 3 days I will build another made without handsu[58] (Mark, 14:57-58), "4: called himself kinge (John 19:7, 19:12, John 19; Luke, 23:2), "3:2), healed on the Sabbath" (Kinsolving, 2020) and so on revealed pictures of hatreds.

(iv) *The Assassination of Martin Luther King Jr.:* He was also assassinated out of hatred, but up to now, he is still remembered and celebrated (Historyofsoccer.info, 2023; Staff, 2022). The murder of Dr. Martin Luther King Jr. has revealed three realities about current days honor crimes or murders. There are targeted murders of civil rights or human rights activists (Aidoo, 2022; Graphic.com, 2021); journalists (Aidoo, 2022); and political members (Gill, 2022). Most of these normally start by first accusing the victim(s), like in the case of "fseim(s),scc (Aidoo, 2022).

They agreed that Dr. Martin Luther King Jr. was assassinated mainly due to his civil activism (Historyofsoccer.info, 2023). The decision one makes could be the cause of hatred (Figure 7); agreeing that both genders are victims of honor murder (Maina, 2022; Mansoor, 2022).

4.3.1. Other targeted hate crimes or murders

In addition to the victims mentioned in the Holy Books, some renowned personalities have also been murdered out of hatred or honor. Philosophers like Socrates were murdered for these reasons (Hotti, 2016), and another philosopher died under mysterious circumstances (Sava *et al.*, 2019). These findings still agree with current hate/honor crimes where both genders are victims. For instance, the "Monterey Park" shooting, which resulted in the deaths of five men and six women, was a clear hate crime (Taxin *et al.*, 2023). These can lead to mistrust issues. For further details, stay tuned for part two of this discussion, titled "Preventing Infections Is a Multifaceted One Health Approach That Needs Microbiology, Part 2." You may also find interest in "Sexual Satisfaction: Husband or Wife's Responsibility? Part 1" (Pulle, 2022). Victim(s) of indefinity can face violent repercussions fueled by hatred, resulting in injuries/diseases.

5. Recommendations

Through sporting activities like football, players can perform at their best due to the supportive environment provided by their teammates. Although football is one of the most aggressive games and often leads to injuries, measures are put in place to minimize/prevent these injuries (Bennett *et al.*, 2022). Effective injury prevention also prevents painful emotions that might cause players to cry (Bylsma *et al.*, 2019).

To be able to achieve the SDGs, which have put the world in one boat like COVID-19, the world needs this unifying spirit of sporting activities. Individuals need to balance the boat to cross the river.

These recommendations can help in this regard:

(i) Everyone should prioritize their faith and make it a habit to pray regularly

(ii) Everyone needs to prioritize health first in every New Year's resolution

(iii) All humans must always prepare for everything in life, especially before marriage and childbirth. Poor preparation is an obstacle to peace, health, and entrepreneurship

(iv) All workers should see their professions/jobs as their businesses, like in football

(v) Everyone should eat nutritious meals daily, like football players do, and visit qualified nutrition officers at least once a year

(vi) Everyone needs to exercise daily, like footballers, or at least 3 times weekly to help boost the body's immune system

(vii) Individuals should always resort to peaceful alternatives for solving interpersonal problems, resorting to peaceful dialogue, but do not accept incessant bullying or cheating

(viii) It is healthier that everyone speaks his/her mind than harbor offenses. If one can forgive, do that considerably. If not, handle it politely/peacefully

(ix) Everyone needs someone. Always maintain healthy relationships with everyone. Tolerance is better than intolerance (Figures 2 and 7)

(x) All humans must flee from spreading false rumors. They cause hate crimes, leading to honor crimes/murders.

6. Conclusion

Researchers have explored the relationships between peace and quality health (Pulle, 2022), including insights from the WHO's Director-General (WHO, 2020). However, there is limited literature linking microbiology and sports to the promotion of global peace, quality health, and entrepreneurship. This study addresses that

gap. As we strive for wealth, we must also consider the "common good." Prioritizing health is essential, as is actively rejecting hatred.

If individuals consistently prioritize their health, we could see a reduction or elimination of crimes, and acceptance of health prevention protocols will always be beneficial. Research on the "Prevention of 21st century emerging pandemics, COVID-19, and the use of face masks" (Pulle, 2021) investigates whether individuals complied willingly with these protocols. Compliance often hinges on trust, and hate crimes can undermine that trust among individuals. Another study by Pulle (2021) examines whether trust issues influenced individuals' compliance.

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Some initial ideas for this project were first posted on Facebook on June 23 (https://m.facebook.com/story.php?story_fbid=pfbid0t5sBqisTCvxUx4k7BWXCZMkm7E52xfwN5zzrTi9BZbNB7QS8kWvzyAN1P3JYtvznl&id=100001454655409&mibextid=Nif5oz.), August 5 (https://m.facebook.com/story.php?story_fbid=pfbid0GrmFmSvq7LvmcTe1wnxKJccBYDKMayQZVBS79CD24xjbfP3VoBbz85zCkALBbGKjl&id=100001454655409&mibextid=Nif5oz.), September 19 (https://m.facebook.com/groups/477275048955909/permalink/2338426319507430/?mibextid=Nif5oz.), 2018. Last year, the same ideas were published on the principal investigator's blog on HubPages (Pulle, 2023).

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ACCSCIENCE PUBLISHING

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ORIGINAL RESEARCH ARTICLE

Effectiveness of the lockdown policy in Vietnam during the COVID-19 pandemic

Duy-Ha Lai[1], Thai-Ha Le[2,3]*, and Binh Tran-Nam[4]

[1]Fulbright School of Public Policy and Management, Fulbright University Vietnam, Ho Chi Minh City, Vietnam

[2]VinFuture Foundation, Hanoi, Vietnam

[3]IPAG Business School, Paris, France

[4]School of Accounting, Auditing and Taxation, UNSW School of Business, University of New South Wales (UNSW Sydney), Sydney, New South Wales, Australia

Abstract

In response to the COVID-19 pandemic, in the absence of vaccines and effective treatments, governments worldwide have implemented lockdown policies as non-pharmaceutical interventions to flatten the infection curve. This study evaluates the effectiveness of containment policies implemented at the local level in Vietnam. Data were synthesized from 143 policy interventions across 49 provinces and centrally run cities from April 27 to October 1, 2021, and an interrupted time series (ITS) analysis was used to estimate the effectiveness of each intervention. A random-effects meta-analysis was then conducted to combine the results based on different criteria. This analysis found that Directives No.15/CT-TTg and No.16/CT-TTg were successfully implemented in the provinces of Northern Midlands and Mountains, Red River Delta, North Central, Central Coastline, and Central Highlands. However, these directives were less effective when employed in the Southeast and the Mekong Delta areas. Furthermore, the ITS analysis indicates that Ho Chi Minh City and provinces in the Southeast region implemented stringent lockdown directives later than other regions, leading to the loss of control over the pandemic during the study period. In-depth studies on lockdown interventions could provide valuable insights for policymakers in managing future outbreaks, particularly considering the time required for the development of vaccines and drugs.

Keywords: COVID-19; Social distancing; Interrupted time series; Vietnam

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Mihajlo Jakovljevic M.D. Ph.D. MAE

***Corresponding author:**
Thai-Ha Le
(thai1@e.ntu.edu.sg)

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1. Introduction

From 2020 to 2022, the COVID-19 pandemic has swept across the globe, forcing governments to make difficult choices with significant trade-off decisions when implementing restrictive policies, especially between economic prosperity and public health. Although there has been considerable debate regarding the effectiveness of containment policies, research indicates that lockdowns and social distancing measures can break the chain of infection (Haug *et al.*, 2020). Vietnam successfully implemented strict social distancing policies, which helped flatten the infection curve in the first, second, and third waves of COVID-19 (spanning from January 23, 2020, to April 26,

2021), as illustrated in Figure 1 (Nguyen *et al.*, 2021). However, as new virus variants emerged, especially the highly transmissible Delta variant, the country struggled to respond effectively to the new wave beginning April 27, 2021. As a result, the effectiveness of the disease control tactics diminished during this period, leading to an exponential increase in confirmed infection cases, rising from around 200 to 17,427 between April and October 2021 (Dong *et al.*, 2020).

To enforce these intervention policies, the Vietnamese government issued three primary directives (No.19/CT-TTg, No.16/CT-TTg, and No.15/CT-TTg), with local governments implementing measures based on these directives. Table 1 outlines the differences between the three directives.

Among the three directives, Directive No.19/CT-TTg is the least stringent, whereas Directive No.16/CT-TTg is the most restrictive. As a result, Directive No.16/CT-TTg is expected to significantly reduce the spread of the coronavirus. However, applying Directive No.16/CT-TTg involves trade-offs, as it mandates the closure of businesses and requires people to stay at home, potentially causing substantial economic harm. According to the collected data, only 22 out of 49 local administrations implemented Directive No.16/CT-TTg across their entire area, with most of these administrations located in the Mekong River Delta region.

In addition to the Directives No.15/CT-TTg and No.16/CT-TTg, Ho Chi Minh (HCM) City issued two additional policies: Directives No.10/CT-UBND and No.11/CT-UBND. On June 19, 2021, the city issued Directive No. 10/CT-UBND, which is stricter than Directive No.15/CT-TTg but not as strict as Directive No.16/CT-TTg. However, the number of infection cases continued to rise sharply, and even the implementation of Directive No.16/CT-TTg (announced on July 7, 2021) failed to halt the spread of infection. Therefore, the city promulgated Directive No.11/CT-UBND on August 22, 2021, which was the strictest policy among all, exceeding even the restrictions of Directive No.16/CT-TTg.

During this period, when the pandemic was raging in HCM City and Southern provinces, other local governments implemented additional restriction policies, such as medical isolation or the refusal of returnees from pandemic-hit areas, to prevent the virus from spreading to other areas. This study categorized these measures as the "restriction on internal movement" policies.

It is important to note that during this period, Vietnam's government pursued a dual-target strategy aimed at controlling COVID-19 while supporting economic recovery. As Prime Minister Pham (2021) stated:

> *"We cannot afford to commit all available resources to fight the virus. Conversely, we cannot put the people's wellbeing at risk for the sake of economic development."*

This study measures the effectiveness of containment policies in the context of local governments operating under the pressure of a dual-target strategy and with COVID-19 vaccines not yet available for widespread coverage. While the COVID-19 pandemic in Vietnam has since been controlled through a comprehensive vaccine strategy, in-depth studies on lockdown interventions remain valuable for policymakers dealing with future outbreaks, particularly when vaccine and drug development may take 1 – 2 years or longer.

More specifically, this research aims to analyze the impact of lockdown policies on controlling the spread of the COVID-19 virus, using the metric of new infections per day. Our main research question is: "How effective were lockdown directives that were implemented at the provincial level during the fourth wave of the COVID-19 pandemic?"

To answer this question, this study primarily employed interrupted time series (ITS) analysis to estimate the

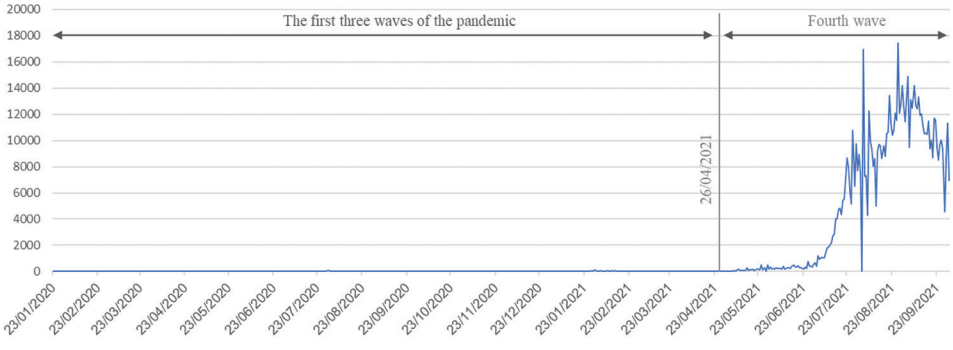

Figure 1. Daily confirm new cases in Vietnam from January 23, 2020, to October 1, 2022
Source: COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University

Table 1. Differences between the directives No. 19/CT-TTg, No. 15/CT-TTg, and No. 16/CT-TTg

	19/CT-TTg	15/CT-TTg	16/CT-TTg
Gathering	(i) Stop all religious rites and activities with more than 20 participants in religious establishments. (ii) Stop all cultural, sports, and recreational activities in public places.	Stop all meetings and gatherings with more than 20 people in one room.	Everyone is required to stay at home, except for essential trips such as buying food and medicine for emergency circumstances and going to work at factories and businesses that are not closed or suspended for operation.
	Do not form crowded groups of people outside office buildings, schools, or hospitals.	Do not form groups of more than 10 people outside office buildings, schools, or hospitals.	Do not form groups of more than two people outside office buildings, schools, or hospitals.
The minimum distance in public space	1 m	2 m	2 m
Business	Non-essential service businesses (e.g., game and entertainment centers, beauty salons, karaoke rooms, massage establishments, bars, nightclubs), and several other businesses will remain closed.	Stop all businesses and services that are not essential.	Stop all businesses and services that are not essential.
	Trading and service businesses such as wholesalers, retailers, lottery businesses, hotels, lodging establishments, restaurants, and food stores will be allowed to reopen.		
Transportation	No restriction.	Travel will be restricted from pandemic-hit areas to other localities.	Public transportation services will be suspended, and travel from region to region will be minimized, except for essential goods and services

Source: Authors' consolidation of data from the Department of Health of Ho Chi Minh City, available at: https://medinet.gov.vn/giam-doc-cac-benh-vien-can-biet/su-khac-biet-giua-chi-thi-15-chi-thi-16-va-chi-thi-19-cua-thu-tuong-chinh-phu-s-c1780-44712.aspx (Last accessed: March 2, 2022)

impact of lockdown policies that were implemented in 49 provinces and centrally run cities of Vietnam from April 27, 2021, to October 1, 2021. The appropriateness of ITS as a method of analysis is further discussed in the next section. Based on the results of the analysis, this study evaluates the effectiveness of lockdown interventions in controlling the infection rate of COVID-19 during this period.

Physical separation is considered the most practical strategy to combat the pandemic in the absence of vaccines and pharmaceutical therapies. This strategy aims to reduce person-to-person contact, thereby impeding the spread of the virus (Qualls, 2017). The primary purpose is to buy time and flatten the curve, preventing the health-care system from collapsing due to a lack of beds, health-care staff, and personal protective equipment, as witnessed in Italy and Spain (Busch *et al.*, 2020). This method has been used in previous pandemics, e.g., the influenza A pandemic (Jones & Adida, 2013; Monto, 2006).

Alfano & Ercolano (2020) demonstrated that social distancing is an effective non-pharmaceutical intervention to reduce the spread of infectious disease, using a cross-country panel analysis. Similarly, Islam *et al.* (2020), applying the ITS method to data drawn from 149 countries, found that enforcing social distancing policies can reduce COVID-19 incidence by 13%. Moreover, the authors suggested that the rapid implementation of such policies can significantly lower the infection rate.

ITS is widely used to measure the effect of lockdown policies in specific countries. For example, Thayer *et al.* (2021) employed the ITS design and found an average 8% (95% confidence interval [CI]: 6 – 9%) reduction in the daily infection rate after the implementation of Lockdown 1.0 in India. A study by Silva *et al.* (2020) provided evidence of a reduction of 37.85% in São Luís and 33.4% in Fortaleza in the average daily deaths when lockdown policies were enforced. Siedner *et al.* (2020) identified a 0.9% (95% CI: −1.4 – 0.4%) daily decline in COVID-19 growth rates 4 days after implementing the first statewide social distancing measures. In Europe, Tobías (2020) showed that the incidence trend was considerably reduced in Italy and Spain after the first lockdown, though it continued to rise. After the second lockdown, which was with more restrictions, the trend's slope changed and became negative.

Several Vietnamese studies have investigated the consequences of government policies during the COVID-19

pandemic. Most research indicates that Vietnam's government successfully managed COVID-19 throughout the first three pandemic waves by responding swiftly to the virus. Tran *et al.* (2020) synthesized and compared Vietnam's results with those of nine other Southeast Asian nations using the Oxford COVID-19 Government Response Tracker dataset (Hale *et al.*, 2021). Le *et al.* (2021) evaluated Vietnam's policy responses to the COVID-19 pandemic by synthesizing and assessing 959 pertinent policy documents across various categories, finding that Vietnam's policy system responded quickly, proactively, and successfully at multiple levels of authority. Nguyen *et al.* (2021) utilized a case study approach to highlight the importance of early technical preparedness and solid political commitment in ensuring an effective COVID-19 response in Vietnam.

However, none of the previous Vietnam-based research applied quantitative methods, and thus, no rigorous analysis has been performed. Therefore, to address this gap, the present study employs the ITS analysis approach to examine the effectiveness of lockdown policy intervention in Vietnam. Furthermore, unlike previous research, which focused on the first three waves, this study examines the fourth wave of the pandemic (from April 27, 2021, to October 1, 2021), during which the number of COVID-19 cases grew exponentially compared to earlier periods.

The remainder of this article is organized as follows: Section 2 explains the analytical framework, data, and models used in this study. Section 3 discusses the empirical results. Section 4 concludes the study and provides policy implications.

2. Methods

2.1. ITS models

ITS models are increasingly employed to evaluate public health interventions, particularly well-suited to those implemented at a population level over a clearly defined period (Bernal *et al.*, 2017; Wagner *et al.*, 2002). In addition, some studies consider ITS design to be the most reliable quasi-experimental approach for evaluating the effectiveness of interventions in time series data (Cook *et al.*, 2002). The main advantage of the ITS approach is its intuitive and graphical illustration, allowing for a clear comparison of the effect of an intervention by visualizing the distribution of the outcome variable before and after the intervention.

An ITS regression model with a single intervention can be explicitly expressed by the following equation:

$$Y_t = \beta_0 + \beta_1 T + \beta_2 X_t + \beta_3 Z \quad \text{(I)}$$

where Y_t represents the number of new infection cases at time t; T represents the number of days since the start of the study period (i.e., April 27, 2021); X_t is a binary dummy variable indicating the pre-intervention period (coded as 0) and the post-intervention period (coded as 1); and Z represents the number of days since the intervention was implemented.

For example, the dataset prepared for the ITS model of Lang Son province, with one intervention on May 29, 2021, is described in Table 2.

In Equation I, β_0 represents the baseline level at $t = 0$; β_1 and β_2 represent the change in the level of the outcome for each day in the pre- and post-intervention periods, respectively, whereas β_3 is a primary parameter of interest, representing the difference in the slope of the post-intervention period.

The β_0 coefficient is considered to be positive, as the number of cases typically grows before the intervention occurs. Since local governments generally issue interventions when infection cases are rising, the β_2 coefficient is also expected to be positive. Based on previous studies (Islam *et al.*, 2020; Silva *et al.*, 2020; Thayer *et al.*, 2021; Tobías, 2020), a negative trend in new infection cases is expected following the policy intervention, so β_3 is assumed to be negative.

During the study period, local administrations typically implemented multiple interventions rather than just one. Therefore, to estimate the effects of each intervention simultaneously, this study expands Equation I to employ the following regression model:

$$Y_t = \beta_0 + \beta_1 T + (\beta_{x1} X_1 + \beta_{z1} Z_1) + (\beta_{x2} X_2 + \beta_{z2} Z_2) + \ldots + (\beta_{xk} X_k + \beta_{zk} Z_k) \quad \text{(II)}$$

where k is the number of interventions; X_j is the dummy variable, taking the value 0 for the pre-intervention period and 1 for the post-intervention period of intervention j. The Z_j variable takes either a value of 0 before the implementation of intervention j or the number of

Table 2. Example of a dataset for interrupted time series model of Lang Son province with a study period from April 27, 2021, to August 10, 2021

t	*Y*	*T*	*X*	*Z*
2021-04-27	0	1	0	0
2021-04-28	0	2	0	0
2021-04-29	0	3	0	0
2021-05-28	10	33	0	0
2021-05-29[a]	7	34	1	1
2021-08-08	2	104	1	71
2021-08-09	0	105	1	72
2021-08-10	0	106	1	73

Notes: *Y* represents the number of new infection cases which is collected from the Ministry of Health's data gateway. [a]*X* and *Z* values are derived from the intervention date of May 29, 2021

days since the date on which intervention j occurred. In *Equation II*, the β_{zj} coefficient represents the difference in the slope due to intervention j compared to the slope due to intervention $(j-1)$.

For illustration, Table 3 describes the dataset used in the ITS model for Dong Thap province, which had two interventions on July 11, 2021, and July 19, 2021.

Figure 2 illustrates the change in slope following two interventions in Dong Thap province during the study period. The first intervention, which is Directive No.16/CT-TTg, was applied to targeted areas but was insufficient to control the infection rate, as indicated by the continued upward trend in the post-intervention slope ($\beta_{z0} = 16.22>0$, $p = 0.01$). However, after the Dong Thap government extended Directive No.16/CT-TTg to the entire area, the slope decreased significantly ($\beta_{z1} = -18.63>0$, $p = 0.00$).

2.2. Random-effects meta-analysis

Meta-analysis is the technique used to synthesize the results of multiple studies, combining them in a quantitative manner to derive a single estimated result, known as the "effect size" (Harrer *et al.*, 2021). Given that some degree of between-study heterogeneity is almost always expected, it is common practice in many fields, including medicine and the social sciences, to use a random-effects model (Harrer *et al.*, 2021). Therefore, to adhere to this common practice, we employed a random-effects meta-analysis to aggregate the results and analyze comparative efficacy based on several factors (e.g., government directive, region). Section 3 presents the results of this experiment.

After performing the random-effect meta-analysis, we employed a forest plot to visualize the result. The plot graphically displays each empirical analysis, showing the observed effect, confidence interval, and the weight of each study.

Table 3. Example of a dataset for interrupted time series model of Dong Thap province with a study period from April 27, 2021, to October 1, 2021

t	Y	T	X_1	Z_1	X_2	Z_2
2021-04-27	0	1	0	0	0	0
2021-04-28	0	2	0	0	0	0
2021-07-11[a]	50	76	1	1	0	0
2021-07-19[b]	53	84	1	9	1	1
2021-09-30	9	157	1	82	1	74
2021-10-01	13	158	1	83	1	75

Notes: Y represents the number of new infection cases which is collected from the Ministry of Health's data gateway. [a]X_1 and Z_1 values are derived from the intervention date of July 11, 2021. [b]X_2 and Z_2 values are derived from the intervention date of July 19, 2021

2.3. Data

Previous studies have shown that early lockdown policies effectively helped Vietnam control the pandemic during the first three waves (Le *et al.*, 2021; Nguyen *et al.*, 2021; Tran *et al.*, 2020). However, during the fourth wave, when infection cases surged exponentially, the lockdown policies appeared less effective. Therefore, this study focuses on the fourth pandemic wave of the pandemic, starting from April 27, 2021, as the starting date of the research period, as it marks the onset of the fourth wave (Minh *et al.*, 2021).

To measure the impact of lockdown policies without the influence of other policies (e.g., vaccination policy), the study period ends on October 1, 2021. After September 2021, with increased vaccination coverage, the government announced that Vietnam would follow a "new normal" strategy (The Government Office, 2021). At this point, the number of infection cases was no longer the primary metric for evaluating the effectiveness of local governments. Furthermore, on October 1, 2021, in response to the evolving situation at the country's epicenter of the COVID-19 pandemic, the HCM City government issued Directive No.18/CT-UBND to ease lockdown measures

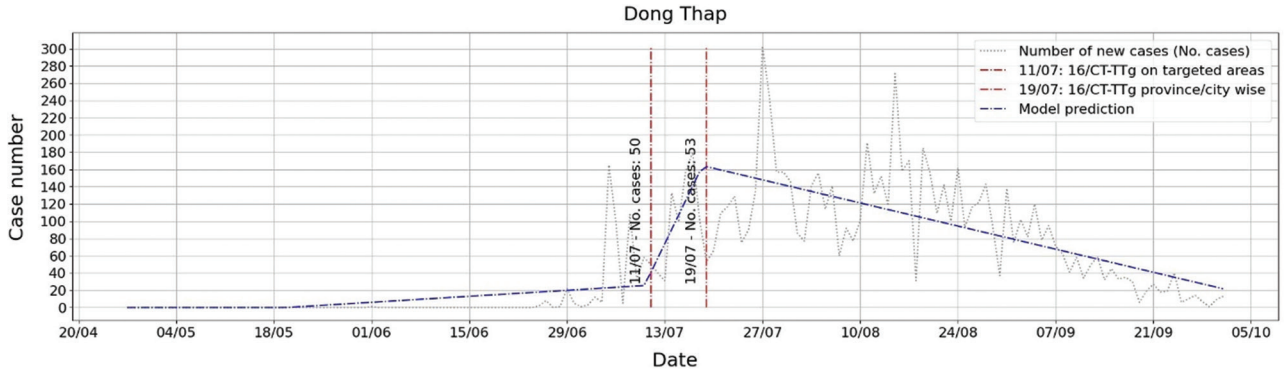

Figure 2. Interrupted time series model showing the slope change following two interventions in Dong Thap province

after the second-dose vaccination coverage surpassed 45% (The People's Committee of HCM City, 2021).

We synthesized data on policy interventions from government portals and mainstream media, identifying 148 interventions across 49 provinces and centrally run cities. Interventions were considered to occur together only if they were implemented under the same directive within a 7-day timeframe during the data collection process. This assumption was tested and validated using sensitivity analysis in a previous study (Islam *et al*., 2020).

Unlike some previous studies (Islam *et al*., 2020; Tran *et al*., 2020), we did not use the Oxford dataset (Hale *et al*., 2021). While the Oxford dataset is valuable for cross-country comparisons (e.g., evaluating how well Vietnam performs relative to other Southeast Asian countries), this study focused exclusively on Vietnam, with the implementation of government directives as the primary type of intervention collected.

In our study, data on the number of new confirmed cases per province and centrally run city were collected through the Ministry of Health's data gateway for the period from April 26, 2021, to October 1, 2021. Twelve provinces were excluded from this study due to the unavailability of data on policy interventions or because the number of new cases was insufficient for meaningful analysis.

All statistical analyses were performed using Python version 3.6 (Python.org, 2016) and R version 4.0.0 (R Core Team, 2018). First, the data were cleaned and preprocessed before being fitted into the Ordinary Least Squares model provided by the statsmodels package (Jonathan, 2009). The model results were then plotted using the matplotlib package (Matplotlib, 2021). Finally, the results were combined and analyzed using a random-effects meta-analysis with a meta package in R.

3. Results and discussions

3.1. ITS model results

In this study, we applied the ITS model to 49 provinces and centrally run cities in Vietnam. The results are grouped by region for easier interpretation, as localities within the same region tend to have similar pandemic responses and government interventions. The regions are presented from north to south, beginning with Northern Midlands and Mountain, followed by the Red River Delta, North Central, Central Coastline, Central Highlands, Southeast, and concluding with the Mekong River Delta.

3.1.1. Northern midlands and mountain areas

In this region, the ITS analysis was conducted for three provinces: Bac Giang, Lang Son, and Son La. The region experienced two significant pandemic waves: the first from May to July 2021, and the second from July to September 2021.

During the early stages of the COVID-19 outbreak, Bac Giang was the hardest-hit province. On May 25, 2021, the number of new confirmed cases reached 375. In response, local governments implemented Directive No.16/CT-TTg in specific areas to curb the virus's spread. Unfortunately, the initial intervention on May 16, 2021, was insufficient to control the infection rate, as indicated by a positive slope change of 11.9 ($p = 0.036$) in the post-intervention period. However, subsequent interventions proved more effective, with the trend shifting to a negative slope change of −12.1 ($p = 0.045$) and −3.31 ($p = 0.249$), respectively.

In contrast, the pandemic's impact on Lang Son and Son La was less severe during this time. The implementation of Directive No.16/CTT-TTg in targeted areas effectively controlled the number of new daily cases to fewer than 20. In addition, Son La implemented restrictions on internal movement during the second stage, which required people returning from pandemic-affected areas to undergo centralized quarantine. Although this intervention did not reverse the trendline (slope value = 0.39 with $p = 0.008$), it created the conditions for subsequent interventions to be more effectively executed.

3.1.2. Red river delta

This study divided the Red River Delta region into two subgroups based on the severity of the pandemic. The first group included Bac Ninh, Ha Nam, and Ha Noi, while the second group included Hai Duong, Hung Yen, Nam Dinh, Ninh Binh, Thai Binh, and Vinh Phuc.

In the first group, Bac Ninh and Ha Nam used the same strategy, implementing Directive No.16/CT-TTg in targeted areas. This tactic was effective, as the infection trendline shifted to a negative trajectory within <2 months, with the peak number of new infections not exceeding 100 cases/day. In Ha Noi, as illustrated in Figure 3, a restriction on internal movement was applied on July 7, 2021, followed by the city-wide enforcement of the strictest directive (Directive No.16/CT-TTg) on July 24, 2021. These interventions successfully reversed the trend from positive to negative (slope change value = −4.7, $p = 0$).

In the second group, the provinces mainly implemented Directives No.15/CT-TTg and No.16/CT-TTg for specific locations. As a result, the infection trendline in the post-intervention period was successfully controlled. Furthermore, between July 25, 2021, and August 15, 2021, five out of six provinces implemented restrictions on internal movement to prevent further spread of the virus. These policies were effective, leading to a negative infection rate in all affected localities.

3.1.3. North Central and Central Coastline

Among the six provinces of the North Central region, Nghe An and Quang Binh experienced the most severe situation, with daily new infections peaking at over 100 cases. However, the targeted application of Directive No.16/CT-TTg in specific areas proved successful. In Nghe An, the intervention applied Directive No.16/CT-TTg to 14 out of 21 districts/cities, resulting in a negative slope of −1.49 (p = 0.223). Quang Binh required the implementation of Directive No.15/CT-TTg across the entire province when daily cases surged beyond 120. This intervention reduced the trend with a slope change of −1.32 (p = 0.054). Thanh Hoa, Thua Thien Hue, Ha Tinh, and Quang Tri implemented restrictions on internal movement, followed by Directive No.16/CT-TTg, effectively controlling the infection rate to under 100 cases/day.

The pandemic mainly escalated in Da Nang, Quang Nam, and Quang Ngai at the end of June. Quang Nam and Quang Ngai first imposed internal movement restrictions before implementing Directive No.16/CT-TTg in specific areas, resulting in predominantly negative post-intervention slopes. However, in Da Nang, as shown in Figure 4, the targeted application of Directive No.16/CT-TTg appeared ineffective, with the trend remaining positive after the intervention. Therefore, the local authorities extended Directive No.16/CT-TTg to the entire city on July 31, 2021, when the infection rate increased to 55 cases/day. This broader intervention significantly reduced the post-intervention slope to −4.02 (p = 0.062).

In the remaining provinces, the pandemic situation was more complicated. Khanh Hoa and Phu Yen managed to control the outbreak only after applying Directive No.16/CT-TTg across the entire province on August 6, 2021, and July 23, 2021, respectively.

3.1.4. Central Highlands

All provinces in the Central Highlands area effectively controlled the pandemic during the study period. Despite their proximity to the pandemic epicenter in the Southern region, the peak infection rate in these provinces remained below 200 cases/day. The combination of internal movement restrictions and the implementation of Directive No.16/CT-TTg were sufficient to control the outbreak in this region. For example, in Dak Lak province, following the implementation of a policy on August 06, 2021, that refused returnees from pandemic-affected areas, the local

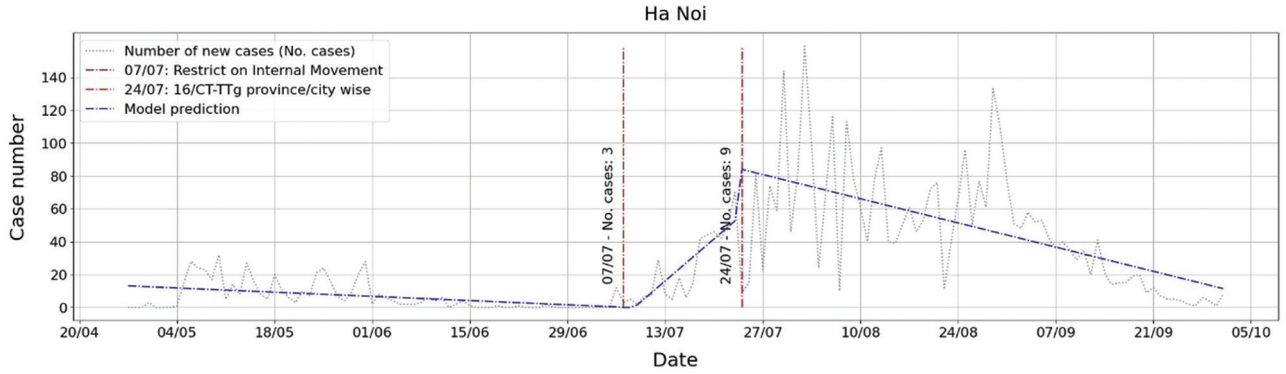

Figure 3. Interrupted time series model result for Ha Noi

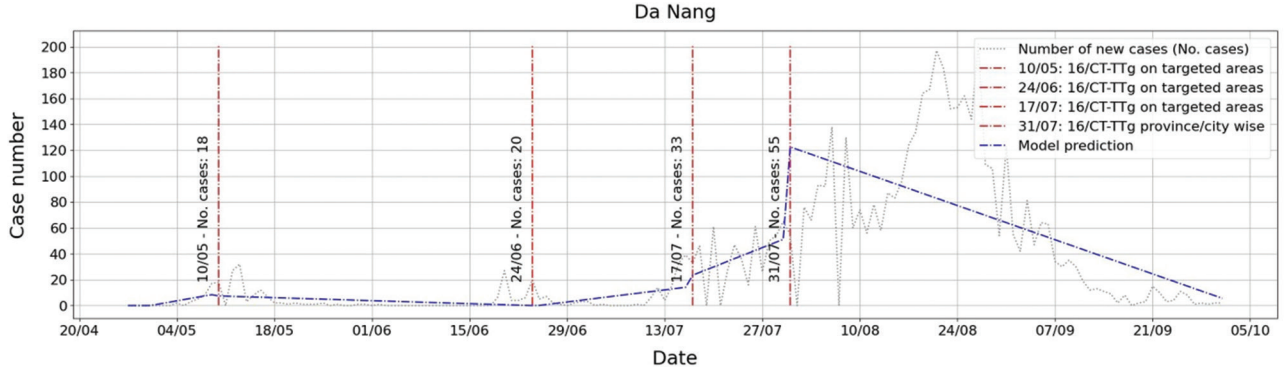

Figure 4. Interrupted time series model result for Da Nang City

administration implemented Directive No.16/CT-TTg in Buon Man Thuot City, which successfully reduced the infection rate, resulting in a slope of −2.06 (p = 0.006).

3.1.5. South-east

In the South-east region, this study categorized provinces into two groups based on the severity of the pandemic. The first group included Ba Ria–Vung Tau, Tay Ninh, and Binh Phuoc, while the second group comprised HCM City, Binh Duong, and Dong Nai.

In the first group, the situation remained under control with the province-wide application of the strictest Directive No.16/CT-TTg. During the study period, the number of new infections in these provinces did not exceed 500 cases/day. The statistical values for trendline changes in the post-intervention periods were all negative. For Ba Ria–Vung Tau, this value was −2.57 (p = 0.1), while in Tay Ninh and Binh Phuoc, the values were −9.98 (p = 0.666) and −0.74 (p = 0.74), respectively.

In contrast, the situation was quite severe in the second group. Unlike the localities investigated in the previous sections, the province-wide application of Directive No.16/CT-TTg did not significantly impact Binh Duong and Dong Nai, as the slope changes for the post-intervention period continued to increase positively. In Binh Duong, the slope change value was 30.1 (p = 0.006), while in Dong Nai, it was 9.73 (p = 0.0).

Particularly in HCM City, the infection rate rose dramatically despite the city-wide implementation of strict policies, such as Directives No.15/CT-TTg, No.10/CT-UBND, and No.16/CT-TTg, as shown in Figure 5. The pandemic was only brought under control after August 22, 2021, when the local administration issued the most restrictive directive (No.11/CT-UBND). The trendline value following this intervention was significantly negative at −59.14 (p = 0).

It is important to note that these local governments implemented interventions relatively late. For example, Binh Duong applied Directive No.16/CT-TTg when the number of daily new cases had already reached 503, while in HCM City, Directive No.16/CT-TTg was applied on July 9, 2021, when there were already 1,729 new daily cases.

3.1.6. Mekong River Delta

As a neighboring region to the Southeast, the epicenter of the outbreak, the Mekong River Delta was massively impacted when the pandemic escalated in the South-east. To prevent the spread of the coronavirus, all provinces and cities in the Mekong River Delta implemented Directive No.16/CT-TTg in its strictest form on July 19, 2021 (The Prime Minister, 2021).

This intervention proved effective in Tra Vinh, Vinh Long, Ben Tre, Dong Thap, and Hau Giang provinces. The ITS model results show a negative slope change in the post-intervention period for these provinces, indicating a decline in infection rates.[1]

A similar pattern was observed in Can Tho, Long An, and Tien Giang, where the pandemic was gradually controlled following the province-wide application of Directive No.16/CT-TTg. However, the effectiveness of this intervention was not as pronounced as in the previously mentioned provinces. By the end of the study period, the number of daily new infection cases remained relatively high in Can Tho (30 cases), Long An (117 cases), and Tien Giang (71 cases).

For the remaining provinces in the region, the effectiveness of lockdown policies was limited. Despite the implementation of Directive No.16/CT-TTg, the infection rate continued to rise significantly. For example, in Kien Giang province, as illustrated in Figure 6, the number

[1] The results are not reported here to conserve space but available upon request.

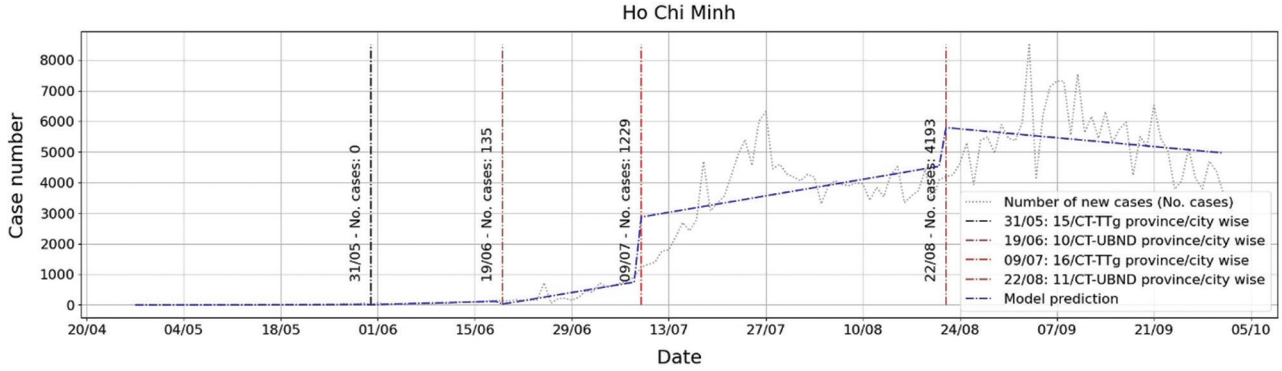

Figure 5. Interrupted time series model result for Ho Chi Minh City

of cases continued to increase daily even after Directive No.16/CT-TTg was applied, reaching a peak of 345 cases on September 5, 2021, with an average daily increase of 0.64 cases.

It is worth noting that when Directive No.16/CT-TTg was implemented in these provinces, the number of new infections was still relatively low compared to other South-east provinces. Therefore, it cannot be concluded that the local governments were slow in executing the interventions, as seen in Binh Duong or Dong Nai. However, the testing efforts were ineffective, as infections were not detected promptly, allowing the virus to spread within the population.

3.2. Discussion on policy implementation effectiveness

This study focused on the coefficient representing the post-intervention slope change value to analyze the effectiveness of policy interventions. The results of these coefficients were synthesized and classified into different groups. In *Section 3*, the first subsection analyzes the results based on geography, while the second subsection groups the results based on policy characteristics.

Table 4. Meta-analysis results: Policy interventions based on their region

Region	Pooled effect result	95% confidence interval	I^2 (%)
Northern Midlands and Mountain	−0.1	−0.74 – 0.54	85
Red river delta	−0.02	−0.32 – 0.28	87
North-central and central coastline	−0.25	−0.99 – 0.49	87
Central highlands	−0.15	−0.55 – 0.25	62
Southeast	0.36	−11.62 – 12.34	86
Mekong river delta	−0.11	−0.56 – 0.34	50%

Source: Authors' work

3.2.1. Comparative analysis based on geographical locations

Table 4 presents the meta-analysis results of interventions grouped by their region. Except for the Southeast area, which was the epicenter of the fourth pandemic wave, all other regions exhibited negative pooled effect results. This finding indicates that the policy interventions were generally effective in these regions.

Figure 7 illustrates the meta-analysis results for the South-east region. Despite the strictest directive (Directive No.16/CT-TTg) being implemented across all cities and provinces in this region, most policy interventions were ineffective, as indicated by positive post-intervention slope change values. Notable exceptions were Directive No.11/CT-UBND in HCM City (intervention code HCM-CT11-1) and Directive No.16/CT-TTg applied in Tay Ninh province (intervention code TayNinh-CT16-2), both of which had significant effects. The post-intervention slope change was −59.14 (95% CI: −86.7 – −31.58) for HCM-CT11-1 and -9.98 (95% CI: −55.18 – 12.34) for TayNinh-CT16-2.

In contrast to the South-east, the Northern Midlands and Mountains areas and the Central Highlands provinces managed to keep the pandemic under control, as indicated by pooled effect results of −0.1 (95% CI: −0.74 – 0.54) and −0.15 (95% CI: −0.55 – 0.25), respectively.[2] A common characteristic of these provinces is their sparse population density, which hinders the spread of the virus and makes it easier for authorities to implement containment measures. Therefore, local administrations in these provinces only needed to apply Directive No.16/CT-TTg to targeted areas to control the pandemic effectively.

The situation in the Red River Delta and North-Central and Central Coastline was similar to that of the Northern Midlands and Mountains areas and the Central Highlands

[2] The results are not reported here to conserve space but available upon request.

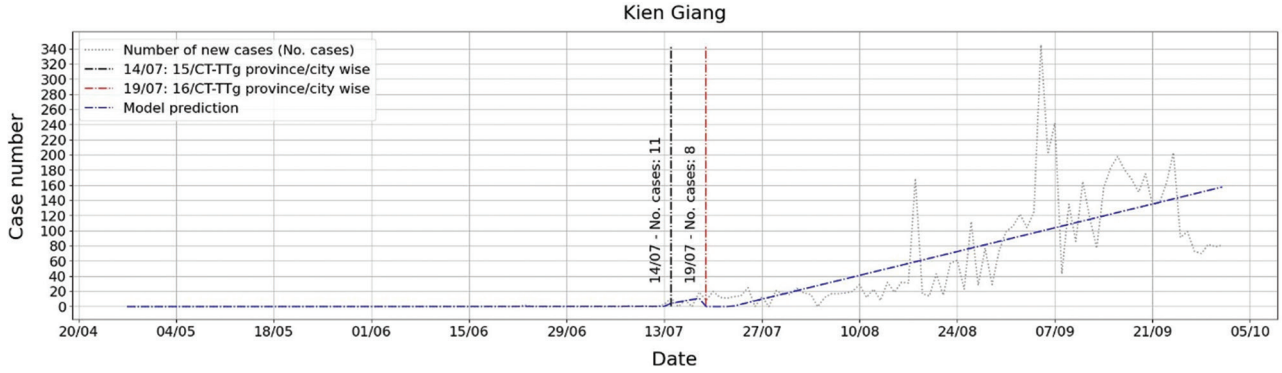

Figure 6. Interrupted time series model result for Kien Giang province

provinces. Most provinces in these regions successfully controlled the pandemic by implementing Directive No.16/CT-TTg in specific locations. However, Phu Yen, Da Nang, Khanh Hoa, and Ha Noi had to implement Directive No.16/CT-TTg province- or city-wide to combat the pandemic. The HaNoi-CT16-1 intervention resulted in a negative trendline value for the post-intervention period of −4.7 (95% CI [−6.78; −2.62]). For PhuYen-CT16-3, DaNang-CT16-4, and KhanhHoa-CT16-2, the slope change values for the post-intervention period were 2.32 (95% CI: −0.84–5.48), −4.02 (95% CI: −8.19–0.15), −10.81 (95% CI: −12.83–8.79), respectively.

As shown in Figure 8, the provinces in the Mekong Delta applied Directive No.16/CT-TTg across entire provinces relatively early, even when the number of infections was still low. However, the effectiveness of these interventions

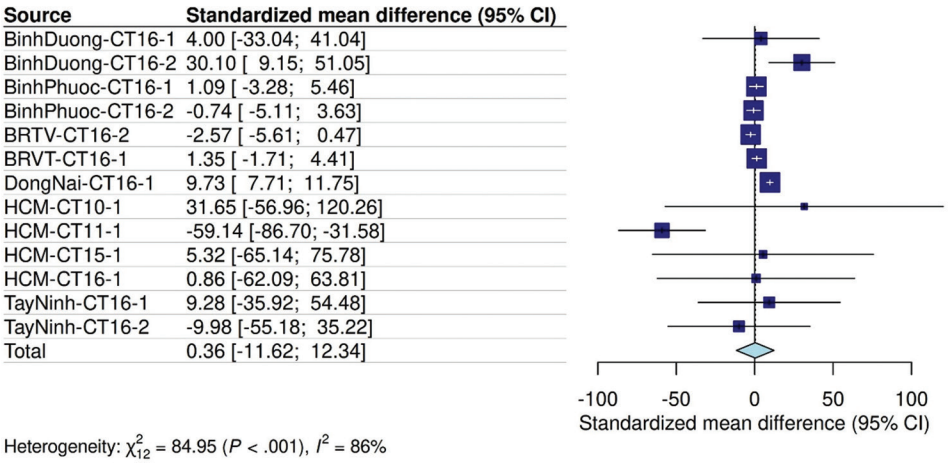

Figure 7. Forest plot of meta-analysis applies to the Southeast region
Abbreviation: SMD: Standardized mean difference.

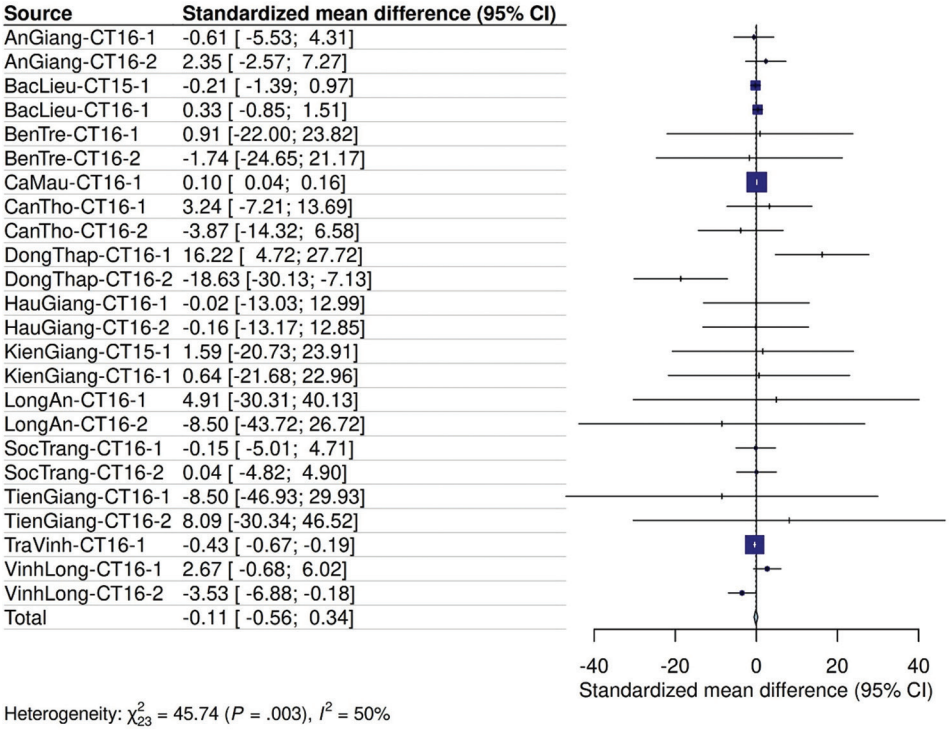

Figure 8. Forest plot of meta-analysis applied to the Mekong River Delta area

was not as high as in other regions. As discussed in the previous section, this result could be attributed to limited testing capacity, which hindered the timely detection of the disease, allowing the virus to spread throughout the community.

3.2.2. Comparative analysis based on policy characteristics

After merging the ITS results with policy characteristics, this study discovered that the more stringent the policy, the more effective it intended to be. Table 5 summarizes the meta-analysis results of interventions based on their characteristics.

For example, restricting internal movement is primarily used to prevent the spread of the coronavirus into specific areas; hence, the pooled effect result of this policy is positive (0.11, 95% CI: −0.17–0.39).[3]

[3] The results are not reported here to conserve space but available upon request.

Directives No.15/CT-TTg and No.16/CT-TTg were particularly effective tools in flattening the curve and reversing the trend during the post-intervention period. Their pooled effect results were −0.11 (95% CI: −0.25 – 0.03) and −0.26 (95% CI: −0.81 – 0.26), respectively.

Furthermore, the effectiveness of lockdown measures increased significantly when implemented on a province-wide scale. As shown in Figure 9, the pooled effect result

Table 5. Meta-analysis results: Policy interventions based on their characteristics

Policy characteristic	Pooled effect result	95% confidence interval	I^2 (%)
Restrictions on internal movement	0.11	−0.17 – 0.39	91
15/CT-TTg	−0.11	−0.25 – 0.03	40
16/CT-TTg	−0.26	−0.81 – 0.29	86
Province-/city-wide	−1.14	−3.50 – 1.22	88

Source: Authors' work

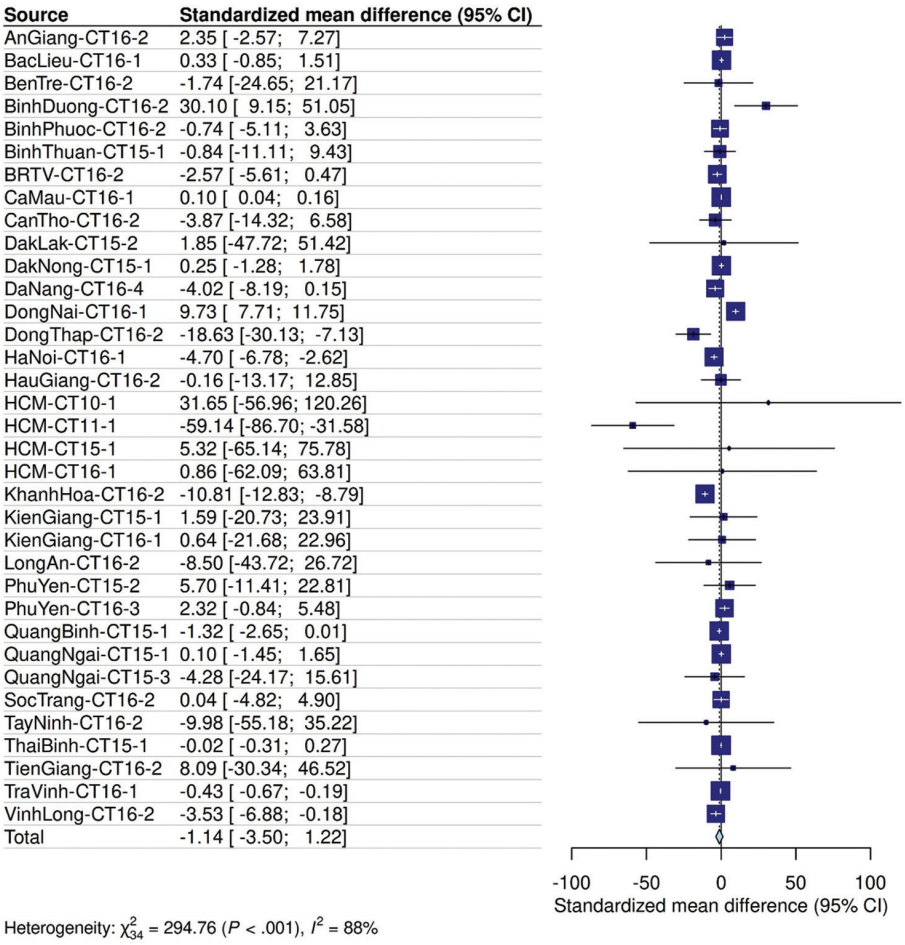

Figure 9. Forest plot of meta-analysis applied to interventions on the province-/city-wide scale

for these interventions was −1.14 (95% CI: −3.5 – 1.22). However, in HCM City, an exception occurred where the local government needed to develop its own, more stringent policy (Directive No.11/CT-UBND) to control the infection rate effectively. This intervention, referred to as HCM-CT11-1 in the forest plot, had a significant impact, with a trendline value of −59.14 (95% CI: −86.7 – −31.58) for the post-intervention period.

3.3. Limitations of the technical analysis

While ITS analysis with regression-based models is widely used for evaluating public health interventions, it does not account for some key characteristics of time series data, such as autocorrelation, overdispersion, and seasonal trends.

Autocorrelation in time series data can lead to an underestimation of true variability, which in turn affects the validity of statistical inferences. We conducted the Durbin-Watson test (Durbin & Watson, 1950) across 49 provinces and found that 18 models exhibited significant autocorrelation. This finding indicates that residual autocorrelation is a notable issue in our analysis. To address this limitation, future studies could explore methods such as autoregressive integrated moving average (ARIMA) models (Schaffer *et al*., 2021), which can account for autocorrelation and seasonal characteristics. Overdispersion can affect the accuracy of statistical inferences by inflating the variance. Although our current analysis does not directly address overdispersion, future research should consider using models that can handle overdispersed data to enhance the robustness of the findings.

Seasonal trends can significantly impact the outcomes of health programs and policies. While techniques such as seasonal decomposition or the use of Fourier terms in regression models are often employed to address this issue, the unique circumstances of the lockdown period likely overshadowed any typical seasonal patterns in our study. Given the limited timeframe and the atypical citizen behavior observed during the lockdown, we believe that seasonality is not a major factor in this analysis. However, future studies with longer observation periods should adjust for seasonal trends to better isolate the true effects of the interventions.

In summary, while our analysis provides valuable insights into the effects of public health interventions during the pandemic, certain limitations exist. Addressing these issues in future research by incorporating models like ARIMA, which can handle autocorrelation and seasonality, and using techniques to adjust for overdispersion and confounding factors, will enhance the robustness and validity of the findings.

4. Conclusion and policy implications

This study examines the effectiveness of lockdown directives at the province level in Vietnam. For this purpose, we applied the ITS model, along with graphical analysis, to examine the changes in the trendline of newly confirmed COVID-19 cases following the implementation of interventions in 49 provinces and centrally run cities from April 27, 2021, to October 1, 2021. The empirical analysis reaffirms the evidence from previous research that government lockdown policies are effective in curbing the spread of the virus. However, the effectiveness of these policies is influenced by various factors.

Geographically, the model results reveal that provinces in the Northern Midlands and Central Highlands were more successful in implementing lockdown interventions, largely due to their low population density. In addition, provinces in the Red River Delta, North Central, and Central Coastline achieved better outcomes in controlling the COVID-19 pandemic than the Southern provinces.

Regarding policy stringency, Directive No.16/CT-TTg in targeted areas is only effective when the number of infections is relatively low. For example, Northern provinces applied this directive effectively, maintaining low infection rates and preventing the pandemic from spreading as it did in the Southern provinces.

However, when the number of new confirmed cases exceeds a certain threshold, Directive No.16/CT-TTg for specific locations becomes less effective. Therefore, local governments must act decisively by applying province-/city-wide Directive No.16/CT-TTg. Ha Noi, Da Nang, Khanh Hoa, and Phu Yen successfully implemented Directive No.16/CT-TTg province- or city-wide after recognizing that targeted lockdowns were insufficient to control the spread of the virus.

Delayed implementation of Directive No.16/CT-TTg at a province- or city-wide level can have harmful effects when it is no longer effective. This was evident in the three Southeast provinces of Binh Duong, Dong Nai, and HCM City. By the end of the study period, Binh Duong and Dong Nai had failed to reverse the trendline. In HCM City, the local government had to apply Directive No.11/CT-UBND with the highest level of stringency to successfully reverse the trend.

Furthermore, it is essential to note that timely testing and case detection are crucial for the effective implementation of lockdown policies. This study did not include testing capacity in its measures due to limited data availability. However, based on the model results, the Mekong River Delta provinces failed to detect COVID-19 cases early, allowing the virus to spread silently throughout the region.

Consequently, local authorities were not able to intervene in a timely manner to prevent further spread. As a result, by the end of the study period, some provinces in this region were unable to control the pandemic, and infection rates rose significantly.

Finally, future research could extend the study period to a later stage when the vaccination strategy becomes effective. With this approach, the number of new confirmed cases may no longer be a valid outcome variable; instead, further research could use the number of severe infections or deaths as an outcome measure to assess effectiveness. Additionally, future studies could employ the ITS model to assess the effectiveness of other policy interventions, such as the decision to care for F0 and F1 quarantine patients at home or the stratification of COVID-19 patients for hospitalization.

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Conflict of interest

The authors declare that they have no conflicts of interest.

Author contributions

Conceptualization: Duy-Ha Lai
Investigation: Duy-Ha Lai
Methodology: Duy-Ha Lai, Thai-Ha Le
Writing – original draft: All authors
Writing – review & editing: Thai-Ha Le, Binh Tran- Nam

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

Data used in this work are available from the corresponding author upon reasonable request.

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ACCSCIENCE PUBLISHING

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ORIGINAL RESEARCH ARTICLE

Acceptability of the National Health Insurance scheme and preferred benefit package among civil servants in Rivers State, Nigeria

Foluke Olukemi Adeniji[1,2]* and Chinonso Chukwudi Onyechi[2]

[1]Department of Preventive and Social Medicine, Faculty of Clinical Sciences, College of Health Sciences, University of Port Harcourt, Choba Rivers State, Nigeria

[2]Department of Community Medicine, University of Port Harcourt Teaching Hospital, Choba Rivers State, Nigeria

Abstract

Health-care insurance is one of the financial risk protection tools available to clients in the health-care industry. In most developing countries, citizens are in favor of paying for their health-care expenses out of pocket, a payment mode that potentially tips these people into poverty. This study aims to determine the level of acceptance of and the preferred benefit package available in the National Health Insurance Scheme (NHIS) among civil servants in Rivers State, Nigeria. In this descriptive cross-sectional study, respondents were selected through simple random sampling. The collected data were cleaned and analyzed with Statistical Product and Service Solution version 23. Out of the 351 respondents, male subjects accounted for the big majority of the sample (n = 208; 59.3%); only 30 (8.5%) had any form of health insurance; and about two-thirds of the respondents, at around 223 (63.5%), expressed acceptance of using NHIS as a strategy for payment. The most preferred benefits package was the one that covers all services 178 (50.7%). The poor and the poorest showed a preference for the health-care benefits package that covers all expenses, whereas the rich showed a preference for services covering basic diseases. The overall acceptability of the NHIS was statistically associated with socio-economic status ($p \leq 0.05$). Thus, the opinions of the consumers and their health needs must be taken into consideration when planning a health insurance benefits package.

Keywords: Acceptability; Health insurance; Benefit package; Health care

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***Corresponding author:**
Foluke Olukemi Adeniji
(foluke.adeniji@uniport.edu.ng)

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1. Introduction

Globally, the health-care financing system is established to fund health-care services so as to reduce the financial risk imposed on consumers by the burden of ill health. In Nigeria, the sources of health-care financing include taxes, household out-of-pocket health-care spending, private sector funding, community-based health financing, and the National Health Insurance Scheme (NHIS) (Eboh *et al*., 2016). These revenues are then pooled and used to purchase goods and services from public and private providers to cater to the identified population needs, such as capitation, fees for service, budgeting, and salaries (Uzochukwu *et al*., 2015). After being established in 1999 by an act of legislation, the NHIS was introduced in 2005 in Nigeria to guarantee

accessibility to health care for Nigerians. However, it was not made mandatory at inception (Anderson & Adeniji, 2019; Okpani & Abimbola, 2015). Following the establishment of the National Health Insurance Authority (NHIA), the amendment under ACT 17 of the NHIA makes it mandatory for all Nigerian citizens and legal residents to be covered under the NHIS, with the scheme administered by the Health Maintenance Organizations, or registered third-party administrators (the Federal Government of Nigeria, 2022). There are different types of programs under the NHIS, namely Formal Sector Social Health Insurance Program, Voluntary Contributors Social Health Insurance Program, Students of Tertiary Institutions Social Health Insurance Program, Informal Sector Social Health Insurance Program, Vulnerable Group Social Health Insurance Program, Physically Challenged Persons Social Health Insurance Program, Prison Inmates Social Health Insurance Program, Children Under Five (5) Social Health Insurance Program and Refugees, Victims of Human Trafficking, Internally Displaced Persons, and Immigrants Social Health Insurance Program (NHIS, 2020).

The scheme commenced with the formal sector, where most government employees (federal civil servants) serve, the organized private sector, and the armed forces. The NHIS covers the principal and spouse with four children under 18 years, providing access to primary health care and referral for secondary or tertiary care. The public sector employees are expected to contribute 1.75% of their salary while the employer contributes 3.25%. For the private sector, the employees are expected to contribute 5% of their salary while the employer contributes 10% (NHIS, 2020; Eboh *et al*., 2016).

Since its establishment, the NHIS has experienced a rise in coverage. In 2005, the enrollees were <150,000, but in 2014, the number had risen to about 5 million, which is approximately 3% of the Nigerian population. However, as of 2016, <5% of the Nigerian population had coverage, with higher coverage among those in the federal sector. This leaves the majority of the population uninsured (Ahmed & Aliyu, 2019; Erinoso *et al*., 2023).

Thus, out-of-pocket payments remain the primary mode of payment for health-care expenses. Such payments account for over 90% of personal health-care expenses, placing a disproportionately heavy financial burden on low-income earners, who end up paying more for the expenses due to delays in seeking medical care (Ahmed & Aliyu, 2019).

A key factor in achieving universal health coverage lies in how a nation finances its health-care system. This is because they determine whether health services exist, are available, are accepted, and if people can afford to use them when required (Uzochukwu *et al*., 2015). According to the World Bank, the rise in the number of individuals living in extreme poverty has a close correlation with out-of-pocket payment of health-care expenses (Claeson *et al*., 2002). Thus, establishing a financial risk protection system to prevent the approximately 90 million Nigerians who already live in poverty from being forced into extreme poverty due to the unaffordable health-care expenses is essential (Erinoso *et al*., 2023). Health-care services consumer acceptance and satisfaction are important, but it appears that the majority have not fully accepted the NHIS, with others still hesitant to take a stand, as they are all suspicious of government motives, desires, and strategies, especially when they realize that a monthly deduction from their salaries will be made as their contribution into the commonality pool to operate the scheme (Ahmed & Aliyu, 2019). This may be one of the reasons why Rivers State is the last state in Nigeria to commence the state-run health insurance scheme, namely the Rivers State Contributory Health Protection Program. This program enables the state to access the basic health-care fund from the federal government.

It is, however, worthy of note that previous researches have demonstrated that limited coverage throughout the nation, low health-seeking behavior among Nigerians, and numerous exclusions from the NHIS benefit package have all contributed to the low utilization of the NHIS across the country (Ahmed & Aliyu, 2019; Anderson & Adeniji, 2019; Latunji & Akinyemi, 2018). In Nigeria, the acceptance of the NHIS services varies from region to region and from state to state. This underscores the necessity to periodically determine the baseline level of NHIS acceptance and the preferred benefit package among the employees in the formal sector, where most civil servants serve, to aid in the assessment and improvement of the health insurance program. These data will also serve as an important source for comparison in future research, especially concerning the civil servants in the state. Since a health insurance scheme was previously not launched in the state, there is no concrete information about the civil servants' acceptance and preferences for health insurance program.

The findings of this study will serve as a guide for the state government health insurance policy formulation, implementation as well as evaluation concerning the different potential health benefit packages available to the formal sector in the state. This study aims to determine the level of acceptance and preferred benefit package of the NHIS among civil servants in Rivers State as well as the association between the acceptability of the NHIS and the socioeconomic status of civil servants.

2. Data and methods

2.1. Study design and setting

This study was a descriptive cross-sectional study of civil servants in Rivers State, Nigeria, which is one of the states of the Niger Delta region with three senatorial districts and 23 Local Government Areas with Port Harcourt City as the state capital (Rivers State MOH, 2010; Uriah *et al*., 2015). The population is estimated to be over 7 million (Nigeria: Administrative Division (States and Local Government Areas) – Population Statistics, Charts and Map, 2024). Rivers State has a rich cultural heritage with various ethnic groups. It has two seaports and the second-largest economy in Nigeria and is now home to several multinational oil companies. Before the discovery of oil, agriculture and fishing were the major economic activities in the state.

At the time of data collection, Rivers State Civil Service had 26 ministries domiciled at the state secretariat. These professional civil servants, led by the head of the service, carry out the state government policies concerning health, social service delivery, and infrastructural growth and development. Each ministry is headed by a commissioner assisted by the administrative head the permanent secretary (Wikipedia, 2020).

2.2. Variables of interest

In this study, the variables studied were socioeconomic status which is the independent variable, whereas acceptability of NHIS and preferred health benefits package are the outcome variables.

2.3. Sample size and sampling

A minimum sample size of 351 was derived using the formula for a descriptive cross-sectional study (Jerkel *et al*., 2007). The data of a big proportion of the sample, at 72.8%, were obtained from a study carried out in North Central Nigeria (Doku, 2012). A 5% margin of error at a 95% confidence level was used and adjusted for a 10% non-response rate and approximated to the nearest whole number.

Nine ministries at the secretariat were randomly selected using the total list of the 26 ministries as the sampling frame, thereafter a proportion-to-size allocation based on the total number of staff in the selected ministries was carried out to arrive at the number of respondents per ministry. At each ministry, a systematic random sampling using the list of staff was carried out; respondents who were randomly selected but unavailable were replaced with those respondents on the ground till the sample size was obtained.

Only respondents who have worked for at least 12 months before the study were included. Those who were on leave or unwillingly to participate or were away for official assignments were excluded from the study.

2.4. Research tool

A semi-structured questionnaire comprising of four sections was used. Section A questions on sociodemographics such as age and sex. Section B questions on acceptability of and perception about the NHIS. On acceptability, respondents were asked if the NHIS is acceptable to them as a payment strategy for health-care services. Questions on perception similar to that used by Onwujekwe *et al*., 2010 were asked on a Likert-type scale, *e.g.*, (1) From either your experience or understanding, how would you rate the potential financial risk protection by NHIS against the cost of illness? (2) What do you think is the potential level of household access to affordable health care covered by NHIS? (3) How would you rate the potential of NHIS to improve household health consumption patterns by ensuring that health-care costs are reduced? (4) How would you rate the potential of NHIS to improve the quality of services provided by health-care givers? (5) How would you rate the potential of NHIS to ensure constant availability of drugs at health facilities in the state? The response could be chosen from a range of options: "none," "low," "medium," and "high." Section C includes questions on preferred health benefits package on a Likert scale (Anderson & Adeniji, 2019), *for example*, respondents were asked to rate the type of package they preferred, with response options such as "most preferable," "more preferable," "medium preferable," "less preferable," and "least preferable." The respondents were asked to rate the following packages:

1. Type I: Package covering everything (including all inpatient and outpatient services and emergencies)
2. Type II: Package covering only basic disease control services, like the prevention and treatment of common illnesses such as malaria, typhoid, and diarrhea.
3. Type III: Package covering only outpatient services: (a) outpatient care including necessary consumables; (b) essential drugs and essential diagnostic tests; (c) maternity care for up to four live births; (d) preventive care such as immunization, health education, family planning, antenatal, and postnatal care; and (e) consultation with specialists such as physicians, pediatricians, obstetricians, gynecologists, and general surgeons
4. Type IV: Package covering only inpatient services allowing for hospital care in a standard ward limited to a cumulative 45 days per year
5. Type V: Package covering only emergencies, such as emergency obstetric care, accidents, and traumas and medical emergencies such as diabetic coma and stroke heart attack.

The preferred benefit package was scored from 5 points representing the "most preferred" to 1 point denoting the "least preferred" in descending order. The mean score and standard deviation were then presented in a table. Furthermore, the cost implication of each package was explained: the more coverage and services provided, the higher the premium payment required. Type I benefit package is the most expensive followed by Type IV, Type V, and Type III, while Type II is the least expensive. The premium from the least to the most expensive was found to vary by approximately 15%. It is also assumed that out-of-pocket costs will reduce with the increase in the premium paid.

Section D questions on the ownership of certain household items and assets, similar to what was done in the Nigeria Demographic and Health Survey. This set of questions was used to classify respondents into socioeconomic classes (The Federal Republic of Nigeria, Nigeria Demographic and Health Survey 2018 National Population Commission Abuja, Nigeria, 2019). The assets and household items included source of drinking water; type of toilet facility; ownership of items such as radio, air-conditioner, television, refrigerator, power generator, electric fan, motorcycle, bicycle, car, and others; and ownership of a private residence and land.

2.5. Data collection and statistical analysis

An interviewer-administered questionnaire with closed and open-ended questions through an android mobile device using the Open Data Kit (ODK) was used. Data were collected over a 4-week duration by research assistants in October 2018. Afterward, the data were downloaded from ODK to Excel and then cleaned and analyzed using Statistical Product and Service Solution (SPSS) version 23.

Data on sociodemographic variables are expressed as frequencies and percentages. Socioeconomic status was determined using principal component analysis (PCA) through SPSS. PCA allows the serial conversion of ownership variables into socioeconomic status. PCA on SPSS was also used to generate Eigenvector weights for each item of asset. The first component of the PCA was used to derive weight to form an assets-based socioeconomic index, which was used to categorize the respondents into five socioeconomic quintiles (q1 – q5): The poorest, poor, middle, rich, and the richest quintile. The lowest class is the poorest while the highest class is the richest class. The measure of inequality was the ratio of the mean of the poorest socioeconomic group over that of the richest. The relationship between acceptability and preferred benefit package of the NHIS and social class was determined using the Chi-square test with p-value set at ≤ 0.05.

Ethical approval for this study was obtained from the ethics committee of the University of Port Harcourt Teaching Hospital (UPTH) (UPTH/ADM/90/S.II/VOL. XI/654). Permission was also obtained from the office of the head of the service and the heads of the various ministries. Informed consent was obtained from the respondents.

3. Results

3.1. Sociodemographic characteristics

Table 1 shows that the mean age of the respondents was 40.60 (±7.33). Most of the respondents were in the age

Table 1. Sociodemographic characteristics of respondents (*n*=351)

Variables	Proportion
	n (%)
Age group	
21 – 30	26 (7.4)
31 – 40	156 (43.9)
41 – 50	134 (38.2)
>50	57 (10.5)
Total	351 (100)
Mean (SD)	40.60 (±7.33)
Sex	
Male	208 (59.3)
Female	143 (40.7)
Total	351 (100)
Marital status	
Single	99 (28.2)
Married	251 (71.5)
Widowed	1 (0.3)
Divorced	0 (0)
Separated	0 (0)
Cohabits	0 (0)
Total	351 (100)
Education level	
Primary	4 (1.1)
Secondary	55 (15.7)
Tertiary	292 (83.2)
None	0 (0)
Total	351 (100)
Religion	
Christianity	351 (100)
Islam	0 (0)
Traditional	0 (0)
Total	351 (100)

Abbreviation: SD: Standard deviation.

group of 31 – 40 years, measuring 156 people (43.9%), and 134 (38.2%) were in the 41 – 50 years age group. The majority of the respondents were males (208; 59.3%), married (251; 71.5%), Christian (351; 100%), and tertiary-educated individuals (292; (83.2%).

Table 2 shows that the majority of the respondents (242; 68.9%) have children between the number 3 – 4 (145; 41.3%).

Table 2. Sociodemographic characteristics of respondents (*n*=351)

Variables	Proportion
	n (%)
Having children	
Yes	242 (68.9)
No	109 (31.1)
Total	351 (100)
Number of children	
0	109 (31.1)
1 – 2	75 (21.3)
3 – 4	145 (41.3)
5 – 6	22 (6.3)
Total	351 (100)
Mean (SD)	3.04±1.11
Number of households	
0	4 (1.1)
1 – 4	146 (41.6)
5 – 7	184 (52.5)
8 – 10	17 (4.8)
Total	351 (100)
Mean (SD)	4.33±2.17
Income	
<N40,000	44 (12.5)
N40,000 – N89,999	113 (32.2)
N90,000 – N139,999	106 (30.2)
N140,000 – N189,999	54 (15.4)
N190,000 – N239,999	19 (5.4)
≥N240,000	15 (4.3)
Total	351 (100)
Socioeconomic status	
Poorest	70 (19.9)
Poor	70 (19.9)
Middle	68 (19.4)
Rich	77 (21.9)
Richest	66 (18.8)
Total	351 (100)

Abbreviation: SD: Standard deviation.

About half of the respondents (184; 52.5%) had household members between 5 and 7. A third of the respondents (106; 30.2%) receive incomes between N90,000 and N139,999. One in five of the respondents (77; 21.9) belongs to the rich socioeconomic class. Only 8.5% of the respondents ($n = 30$) have any form of health insurance.

3.2. Acceptability and perceived benefits of NHIS

Table 3 shows that about two-thirds of respondents (223; 63.5%) expressed acceptance of NHIS as a strategy for payment. Most of the respondents gave a medium rating for the financial risk protection of NHIS (123; 35.0%), the level of access to affordable health care (125; 35.6%), health improvement with NHIS through cost reduction (121; 34.5%), quality of service given by health providers (116; 33.0%), and availability of drugs by NHIS (124; 35.3%).

Table 4 shows the respondents in the poor socioeconomic class (62; 27.8) found the NHIS acceptable as a payment strategy for health-care services. Acceptability of NHIS was seen to be significantly associated with socioeconomic status ($p \leq 0.05$). Twenty-three respondents (31.9%) in the poorest socioeconomic class rated the NHIS as having a high potential for conferring financial risk protection. Respondents in the poorest (20; 27.8%) and poor (20; 27.8%) socioeconomic class rated the NHIS as having a high potential for improving the level of access by households to affordable health care. Respondents in the poorest (22; 27.8%) and poor (22; 27.8%) socioeconomic class also rated the NHIS as having a high potential to improve the household health-care consumption patterns by reducing health-care costs. Separately, respondents in the poorest socioeconomic class (23; 28.8%) rated that the NHIS has a high potential for improving the quality of services provided by health-care givers. The NHIS was also perceived by 22 poorest socioeconomic class respondents (28.9%) and 22 poor socioeconomic class respondents (28.9%) for its high potential to ensure constant availability of drugs at health facilities.

The NHIS's potential for financial risk protection, potential to increase level of access of household to affordable health care, potential to improve household health consumption patterns by controlling health-care costs at relatively lower levels, potential to improve the quality of services provided by health-care givers, and potential to ensure constant availability of drugs at health facilities were all statistically associated with socioeconomic status ($p \leq 0.05$).

3.3. Preferred benefit package

Table 5 shows that among the surveyed respondents, the package that covers all services stands out as the most preferred benefit package, with 178 (50.7%) expressing

Table 3. Acceptability and perceived rating of NHIS by respondents (*n*=351)

Variables	Proportion
	n (%)
Acceptability of NHIS as strategy for payment	
Yes	223 (63.5)
No	128 (36.5)
Total	351 (100)
Financial protection of NHIS	
None	101 (28.8)
Low	55 (15.7)
Medium	123 (35.0)
High	72 (20.5)
Total	351 (100)
Level of access to affordable Healthcare	
None	99 (28.2)
Low	55 (15.7)
Medium	125 (35.6)
High	72 (20.5)
Total	351 (100)
Health improvement through cost reduction	
None	101 (28.8)
Low	50 (14.2)
Medium	121 (34.5)
High	79 (22.5)
Total	351 (100)
Quality of service by health providers	
None	100 (28.5)
Low	55 (15.7)
Medium	116 (33.0)
High	80 (22.8)
Total	351 (100)
Availability of drugs by NHIS	
None	101 (28.8)
Low	50 (14.2)
Medium	124 (35.3)
High	77 (21.9)
Total	351 (100)

Abbreviation: NHIS: National Health Insurance Scheme.

the highest level of preference, 63 (17.9%) finding it more preferable, and about a third (106; 30.2%) indicating medium preferable. The benefit package that covers all services has the highest mean score of 4.18 ± 0.92.

Table 6 shows that the respondents from the poor (4.49 ± 0.10) and the poorest socioeconomic class (4.19 ± 0.11) had a preference for a benefits package cover all health-care services, whereas the rich respondents were in favor of a package covering services for basic diseases (2.20 ± 0.08).

4. Discussion

The current study examined the acceptance level of the NHIS and preferred benefit package among respondents who were civil servants in Rivers State. This index study revealed that the average age of the respondents was 40.60 ± 7.33 years, with the majority of them classified in the 31 – 40 age group. This age range indicates that a significant number of respondents in this study are currently in their productive years. Notably, the study findings demonstrated a lower mean age compared to prior research conducted among civil servants in Sokoto, where the majority of the respondents were in the 40 – 50 age group with an average age of 41.75 ± 9.3 years (Ahmed & Aliyu, 2019). Such age trend resembles that among federal civil servants in the state where the prevalent age group was 36 – 45 years (Adebiyi & Adeniji, 2021). The observed differences are probably due to variations in the study respondents, sampling techniques as well as differences in the employers between state governments and other government. Most of the respondents in this study were married, Christians, and tertiary-educated; these findings are similar to those reported by another study in a similar setting (Adebiyi & Adeniji, 2021). The socioeconomic categorization shows that almost 1 in 5 of the respondents were among the "poorest"; this is understandable as our result showed that more than one in ten earned below the minimum wage of 30,000 naira (approximately <100 USD) as these workers belong to the lowest cadre. However, our finding is in contrast to the Nigeria Demographic Health Survey where 47.2% of respondents were reported to be in the highest wealth quintile and only 1.8% in the lowest (The Federal Republic of Nigeria, Nigeria Demographic and Health Survey 2018 National Population Commission Abuja, Nigeria, 2019). This is not surprising as the various multinational companies in the state pay far better than government and will most likely impact the socioeconomic status of the respondents in the state.

The findings of this study depicted that the low level of coverage any health insurance, which may be connected to the national health insurance program has just been promoted in Rivers State. Similarly, low coverage has been reported most especially in places where the scheme has just commenced (Amu *et al*., 2018; Erinoso *et al*., 2023).

The National Health Insurance was acceptable as a strategy for payment of health-care expenses by only two-thirds of the study respondents, implying that when given

Table 4. Acceptability and perceived benefits of NHIS by various socioeconomic classes

Variables	Total (%)	Poorest	Poor	Middle	Rich	Richest	χ^2 (*p*-value)
Potential for financial risk protection	72 (100)	23 (31.9)	17 (23.6)	19 (26.4)	10 (13.9)	3 (4.2)	81.10 (0.000)*
Potential to improve level of access by households to affordable healthcare	72 (100)	20 (27.8)	20 (27.8)	19 (26.4)	10 (13.9)	3 (4.2)	90.94 (0.000)*
Potential to improve household health consumption patterns	79 (100)	22 (27.8)	22 (27.8)	19 (24.1)	13 (16.5)	3 (3.8)	86.46 (0.000)*
Potential to improve the quality of health services	80 (100)	23 (28.8)	22 (27.5)	21 (26.3)	11 (13.8)	3 (3.8)	86.48 (0.000)*
Potential to ensure constant availability of drugs	77 (100)	22 (28.9)	22 (28.9)	19 (24.7)	11 (14.3)	1 (3.9)	84.47 (0.000)*
Acceptability rating of NHIS as strategy for payment	223 (100)	60 (26.9)	62 (27.8)	50 (22.4)	38 (17.0)	13 (5.8)	98.16 (0.000)*

*Statistically significant ($p<0.05$); χ^2=Chi-square. Notes: Except for χ^2 (*p*-value), the corresponding data for every socioeconomic class is expressed as count (percentage).
Abbreviation: NHIS: National Health Insurance Scheme.

Table 5. Perceptions of respondents on the benefit packages rolled out by NHIS (*n*=351)

Variables	Proportion	Mean score	SD
	n (%)		
Package covering all services			
Least preferable	1 (0.3)	4.18	0.92
Less preferable	3 (0.9)		
Medium preferable	106 (30.2)		
More preferable	63 (17.9)		
Most preferable	178 (50.7)		
Total	351 (100)		
Package covering only treatment of basic diseases			
Least preferable	125 (35.6)	1.83	0.73
Less preferable	164 (46.7)		
Medium preferable	60 (17.1)		
More preferable	1 (0.3)		
Most preferable	1 (0.3)		
Total	351 (100)		
Package covering only outpatient services			
Least preferable	142 (40.5)	1.72	0.69
Less preferable	168 (47.9)		
Medium preferable	39 (11.1)		
More preferable	1 (0.3)		
Most preferable	1 (0.3)		
Total	351 (100)		
Package covering only inpatient services			
Least preferable	147 (41.9)	1.67	0.66
Less preferable	177 (50.4)		
Medium preferable	25 (7.1)		
More preferable	0 (0)		
Most preferable	2 (0.6)		
Total	351 (100)		
Package covering only emergency services			
Least preferable	164 (46.7)	1.57	0.58
Less preferable	174 (49.6)		
Medium preferable	12 (3.4)		
More preferable	1 (0.3)		
Most preferable	0 (0)		
Total	351 (100)		

Abbreviation: NHIS: National Health Insurance Scheme.

Table 6. Average ranking of preferred NHIS benefit package by various socioeconomic classes

Variables	Poorest	Poor	Middle	Rich	Richest	χ^2 (*p*-value)
Package covering all services	4.19 (0.11)	4.49 (0.10)	4.10 (0.11)	4.10 (0.11)	4.02 (0.12)	20.22 (0.210)
Package covering only basic disease control services	1.66 (0.08)	1.57 (0.08)	1.78 (0.10)	1.95 (0.09)	2.20 (0.08)	50.66 (0.000)*
Package covering only outpatient services	1.54 (0.07)	1.56 (0.08)	1.57 (0.09)	1.87 (0.09)	2.06 (0.07)	50.88 (0.000)*
Package covering only inpatient services	1.53 (0.07)	1.53 (0.08)	1.50 (0.07)	1,84 (0.08)	1.94 (0.07)	37.26 (0.000)*
Package covering only emergency services	1.44 (0.06)	1.41 (0.06)	1.44 (0.07)	1.69 (0.07)	1.88 (0.06)	39.12 (0.000)*

*Statistically significant ($p<0.05$); χ^2=Chi-square. Notes: Except for χ^2 (*p*-value), the corresponding data for every socioeconomic class is expressed as mean (SD).
Abbreviation: NHIS: National Health Insurance Scheme.

the opportunity more than a third will not enroll for the NHIS, potentially affecting the program's coverage. This result was lower than the proportion reported among the informal sector in Rivers State (Anderson & Adeniji, 2019). The observed variation may be due to differences in the studied population – one from formal sector while the other from the informal sector. Another study among federal civil servants in the state reported a higher level of enrollment among them, indicating high-level acceptance, especially since the scheme was not made mandatory (Adebiyi & Adeniji, 2021). Findings from this study were similar to those reported among civil servants in Sokoto, northern Nigeria, potentially due to similarities in the study groups (Ahmed & Aliyu, 2019). This is, however, varied from a study that measured levels of acceptance of NHIS among clients already registered with the scheme. The proportion with the highest level of acceptance was lower than that of this study (Marvel, 2018). Another study among civil servants in Kwara State, North Central Nigeria, reported an acceptance level lower than that of this study, which may be related to the economic downturn and unwillingness to deplete their much-needed fund in a contributory scheme (Omole *et al*., 2023).

Acceptability of the NHIS in this study was significantly associated with socioeconomic status. Similar association has been reported by some studies in the state, as those who earn less were reportedly more likely to accept the scheme (Adebiyi & Adeniji, 2021; Anderson & Adeniji, 2019). However, a study among civil servants reported no association between income and acceptance (Omole *et al*., 2023)

Among the respondents who found the insurance schemes acceptable, more than half had a medium or high rating for the potentials of the scheme to provide financial risk protection, improve the level of access, reduce health-care costs, improve quality of service, and ensure availability of drugs, all of these are known benefits of the social health insurance schemes with the potential to help achieve universal health coverage (Adebiyi & Adeniji, 2021; Aregbeshola, 2018; Shobiye *et al*., 2021; Uzochukwu *et al*., 2015). This shows that these respondents are aware of the benefits of the social health insurance scheme and are likely to want to enroll in the scheme.

The preferred health benefits package in this study was that covering all types of care, including emergency, inpatient, and outpatient care. This is understandable as respondents want the best value for their money. Two out of five of the respondents belong to the poorest and poor socioeconomic groups and they arguably want a scheme that will give them financial risk protection. However, no one package can cover all services as the scheme may not be able to afford and sustain the financial cost of running such a service. Similar preferences have been reported among respondents (Anderson & Adeniji, 2019; Onwujekwe *et al*., 2010). Likewise, a study in Kenya reported a preferred package that covered all types of care including inpatient and outpatient care, drugs, and emergency care (Mulupi *et al*., 2013). However, this health benefit package (type I) was not statistically associated with the socioeconomic status, as the poor and the poorest showed a high preference for this package.

The next preferred health benefits package is that covering care for basic diseases (type II). Respondents probably viewed this package as a means to meet their basic health needs and maybe a cost-cutting strategy aimed at meeting their immediate health needs while attempting to reduce the premium paid since the participants in the NHIS will pay out a portion of their salaries, albeit not set at a fixed amount. This was the preferred package among the rich. This finding was different from another study that reported outpatient care only as the "next" preferred benefit package (Onwujekwe *et al*., 2010). Another reason for this preference could be the fact that it is the least expensive, aside from a general distrust for public-funded health-care provision (Ahmed & Aliyu, 2019). Likewise, there is a preference for paying out of pocket for health services received (Marvel, 2018).

Irrespective of the final package provided, it is imperative to consider the opinion of the end users to ensure a successful implementation of the health insurance scheme. Various studies are also in agreement with the involvement of the consumers in designing the various health benefit packages (Anderson & Adeniji, 2019; Onwujekwe *et al*., 2010). There is a range of health-care benefit packages, and helping consumers to choose an appropriate one requires constant review of the scheme.

4.1. Further research considerations

Following the commencement of the health insurance program, there is a need for a follow-up study to help unveil the actual preferences. Willingness-to-pay studies should also be carried out in this study population.

The implication of these findings for the health insurance plan is as follows: it is necessary to set up one all-inclusive health-care benefit package for the workers serving the formal sector, due to the varying preferences toward the benefit packages across the range of socio-economic groups. These evidence-based informations should be taken into consideration in the designing of the benefit packages. This will also help the uptake and utilization of the health-care insurance scheme as meeting the health needs of clients will make the health insurance more acceptable.

4.2. Limitations

Most of the respondents do not have a health insurance plan since the scheme was launched not too long ago. The different benefit packages had no price tag although the potential consumers or users of insurance plans have been informed that the packages with wider coverage of health-care services are more costly. Furthermore, the respondents' perceptions and requirements after using the state health insurance scheme may change.

5. Conclusion

The civil servants in the Rivers State were minimally covered by any type of health insurance. About two-thirds of respondents found the NHIS acceptable, and the majority, especially those in the poor and the poorest wealth quintiles, preferred an all-inclusive health-care benefit package, while the richest preferred the benefit package covering basic diseases. Acceptability of the scheme was found to be statistically associated with the socioeconomic status of respondents. There is a need to intensify efforts to increase the acceptability of the health insurance scheme. The opinions of the consumers and their health needs must be taken into consideration when planning a health insurance benefit package. Evaluation studies of the acceptability and preferred benefits should be carried out by the NHIA periodically.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: Foluke Olukemi Adeniji
Investigation: Foluke Olukemi Adeniji
Methodology: Foluke Olukemi Adeniji
Writing–original draft: All authors
Writing –review & editing: All authors

Ethics approval and consent to participate

Ethical approval for this study was obtained from the UPTH Research Ethics Committee (UPTH/ADM/90/S. II/VOL.XI/654). Written informed consent was obtained from the study participants before the study.

Consent for publication

Informed consent was obtained from the study participants. Their data were coded and confidentiality maintained.

Availability of data

Data are available from the corresponding author on reasonable request.

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ACCSCIENCE PUBLISHING

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ORIGINAL RESEARCH ARTICLE

Measuring health services quality: Nurses' perceptions and the SERVPERF scale

Ammar Ali Alraimi* **and Abhijeet Shelke**

Department of Management Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra, India

Abstract

This study aimed to assess service quality in the health-care sector by employing the SERVPERF scale, with a particular focus on the perceptions of nursing staff, which have a significant impact on patient care. Utilizing the SERVPERF scale, this research investigates the perceived quality of health services in hospitals and examines the predictors of service quality based on the scale's dimensions and items. The five dimensions under consideration include tangibility, reliability, responsiveness, empathy, and assurance. The data were collected from a sample of 214 nurses who completed the research survey to determine their perception of service quality. The questionnaire demonstrated high reliability, with an overall Cronbach's alpha value of 0.72. The study was conducted in private hospitals situated in Yemen's largest city. The findings revealed that the dimensions of health-care service quality were highly rated, with the safety dimension scoring the highest and the reliability dimension scoring the lowest. These results have significant implications for measuring health-care service quality. Although the study is limited by the use of a sample from five hospitals in nursing departments, the findings offer valuable insights for health-care sector leaders to assess service quality in hospitals.

Keywords: Quality health service; Service quality measurement; Yemen hospitals; SERVPERF

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***Corresponding author:**
Ammar Ali Alraimi
(ammar_alraimi@su.edu.ye)

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1. Introduction

Health-care service quality is an important aspect of health-care systems worldwide, as it directly affects patient outcomes and satisfaction (Prakoeswa *et al.*, 2022; Ghildiyal *et al.*, 2022; Pratama & Hartini, 2020). The World Health Organization defines health service quality as "the degree to which health-care services for a population increase the likelihood of desirable health outcomes" (Manyazewal, 2017, p. 2). While most studies of service quality focus on patients' perspectives, nurses play an important role in shaping patients' perceptions and experiences (Fabrellas *et al.*, 2020; Athanasakis, 2020; Habahbeh & Alkhalaileh, 2020). Professional competence is critical for achieving the mission of the health system, and professional performance plays an important role in achieving organizational goals (Halabi *et al.*, 2021). The quality of nursing care is associated with patient satisfaction, shorter hospitalization times, and lower health-care costs (Molina-Mula & Gallo-Estrada, 2020; Apriana & Ratnasari, 2021; Mynaříková *et al.*, 2020).

Many studies have explored the factors that contribute to high-quality nursing care. Li *et al.* (2022) reported that spiritual care competence is positively associated with the perceived professional usefulness of nurses. Haldane *et al.* (2022) highlighted the challenges nurses faced during the COVID-19 pandemic, emphasizing the need for adequate support and resources to maintain high-quality care. Yanti & Suarningsih (2022) explored the role of spiritual care training in enhancing nurses' ability to meet the spiritual needs of patients during care. On the other hand, a few studies have examined nurses' perceptions of service quality (Dureab *et al*., 2020; Ryan *et al*., 2017). The perceptions of service quality can significantly affect patient care (Mert *et al*., 2020). A study by Alsufyani *et al.* (2020) examined nurses' perceptions of health service quality in Saudi Arabia and revealed that nurses perceived the quality of care to be moderate, with room for improvement in all dimensions of the SERVPERF scale. Similarly, a study by Al-Kandari & Ogundeyin (1998) in Kuwait reported that nurses perceived the quality of care to be satisfactory. Several studies have examined different approaches to measuring service quality and identifying factors that influence nursing staff perceptions (Koy *et al*., 2020; Khodayari-Zarnaq *et al*., 2021). Previous studies have used the SERVPERF scale to assess the quality of health services in different countries and contexts, providing valuable insights into the factors that contribute to high-quality care (Endeshaw, 2020; Shafei *et al*., 2019).

The SERVPERF scale is a widely used tool for measuring service quality and assesses five dimensions: Tangibility, reliability, responsiveness, assurance, and empathy. It has been adapted for use in health-care settings (Akdere *et al*., 2020). Previous studies have demonstrated the validity and reliability of the SERVPERF scale for assessing the quality of nursing services (Akdere *et al*., 2020). Shafei *et al.* (2019) reported that the scale was useful for identifying areas for improvement in nursing care, while Labrague *et al.* (2022) reported a positive relationship between SERVPERF dimensions and nurses' performance. In countries facing conflict and fragile health-care systems, measuring the quality of health services becomes even more important for identifying areas for improvement and ensuring the delivery of safe and effective care (Dureab *et al*., 2020; Qirbi & Ismail, 2017).

The health-care system in Yemen has been severely affected by ongoing conflict, which has led to a decline in health-care delivery and access to services (Dureab *et al*., 2020; Qirbi & Ismail, 2017). In addition to the many challenges that health-care providers face in providing quality care (Dureab *et al*., 2020), understanding and improving health service quality are crucial to ensuring that the limited resources available are used effectively and efficiently (Li *et al*., 2022). Given the limited research on nurses' perceptions of the quality of health services in Yemen, this study aimed to fill this gap using the SERVPERF scale to assess the quality of health services in the country. The findings of this study will contribute to the literature on the quality of health services in conflict-affected countries and provide valuable insights for policymakers and health-care providers in Yemen to improve the quality of health services.

2. Methodology

2.1. Research design

This study employed a non-experimental descriptive correlational research design, using the descriptive correlation method to examine the correlations of nurses' perceptions of service quality dimensions across hospitals. Descriptive correlational designs are appropriate when seeking to describe the characteristics of a population and determine relationships between variables without manipulation.

2.2. Sample and data collection

The data were collected from five hospitals. The sample size was determined based on a table by Krejci & Morgan (1970). A total of 214 nurses were randomly selected from the hospitals and asked to provide their views on each item listed on the questionnaire. The participants were mostly female (52.3%) and aged between 30 and 39 (46.6%).

2.3. Questionnaire

The SERVPERF scale was adopted and includes the following dimensions: Tangibility, reliability, responsiveness, assurance, and empathy. The SERVPERF model, which was used to assess perceptions, examines service quality across five key dimensions:

- Tangibility refers to the physical environment of the service, including equipment, facilities, and the appearance of personnel. This dimension considers whether the hospital environment appears modern and is pleasant and reassuring for patients.
- Reliability focuses on the ability to perform the promised service dependably and accurately. It assesses whether hospital staff provides reliable care and maintains accurate patient records.
- Responsiveness concerns the willingness or readiness of employees to provide services. It evaluates whether staff are helpful and responsive when patients have issues or requests.
- Assurance evaluates whether patients feel safe in their

interactions and are protected from risk or danger. It gauges whether hospital practices help prevent errors, transmission of infections, and other risks to patient well-being.

- Empathy encompasses caring, individualized attention provided to patients. It assesses whether staff pays attention, communicates well, and understands specific patient needs and preferences.

The Cronbach's alpha test was used to measure the reliability of the questionnaire, while Pearson's coefficient test was used to measure validity. Table 1 clearly shows that Cronbach's alpha coefficient is 0.938, which means that the questionnaire is characterized by high reliability. In addition, Table 1 shows that all values are in the range of 0 – 1, indicating a positive and strong correlation between questions and dimensions, as well as between dimensions and the total average of the questionnaire.

2.4. Statistical analysis

Statistical analysis was conducted to analyze the data collected from a sample of 214 nurses in Yemen's largest city. The aim of the analysis was to assess service quality in healthcare, focusing on the perceptions of nursing staff using the SERVPERF scale.

2.4.1. Descriptive statistics

Descriptive statistics were calculated to provide an overview of the data collected from the research survey. These included measures such as the mean, standard deviation, minimum, maximum, and frequency. Descriptive statistics helped to summarize the responses of the nurses and provided insights into the overall perception of service quality.

2.4.2. Reliability analysis

To assess the internal consistency of the SERVPERF scale, reliability analysis was conducted using Cronbach's alpha coefficient. Cronbach's alpha measures the extent to which the items within a dimension or scale are interrelated. A higher Cronbach's alpha value indicates greater internal consistency. In this study, an overall Cronbach's alpha value of 0.72 was obtained, indicating satisfactory reliability of the questionnaire.

Table 1. Cronbach's alpha test and correlation coefficient test

Dimensions	Number of items	Cronbach's alpha	Correlation coefficients	Significance
Tangibility	9	0.661	0.72	0.001
Reliability	5	0.79	0.843	0.001
Responsiveness	5	0.9	0.895	0.001
Assurance	5	0.81	0.901	0.001
Empathy	5	0.908	0.933	0.001
Total	29	0.938		

2.4.3. Dimension analysis

The five dimensions of service quality (tangibility, reliability, responsiveness, empathy, and assurance) were analyzed separately to determine nurses' perceptions of each dimension. Mean scores and standard deviations were calculated for each dimension. This analysis helped identify the dimensions that were rated highly and those that scored lower in terms of service quality.

2.4.4. Inferential statistics

To determine the predictors of service quality, inferential statistics were employed. Multiple regression analysis was conducted to examine the relationship between the dimensions of service quality and the overall perception of service quality. This analysis allowed us to identify which dimensions had a significant impact on nurses' perceptions of service quality.

2.4.5. Comparative analysis

To gain further insights, a comparative analysis was conducted to compare the perceptions of service quality across the different dimensions. The *t*-tests or analysis of variance were used to determine whether there were significant differences in the nurses' perceptions of service quality across the dimensions. *Post hoc* tests, such as Tukey's honestly significant difference test, were performed to identify which dimensions significantly differed from each other.

3. Results

The statistical analysis of the data was performed using Statistical Package for the Social Sciences. The mean, standard deviation, and relative weight of each dimension of health service quality were calculated, as shown in Table 2.

Table 2. Dimensions of the quality of health services

Estimate	Percentage	Standard deviation	Mean	Dimension
High	82.3	0.49	4.12	Tangibility
High	81.3	0.58	4.07	Reliability
High	82.8	0.67	4.14	Responsiveness
High	84.5	0.56	4.23	Assurance
High	83	0.68	4.15	Empathy
High	82.8	0.51	4.14	Quality of health services (average)

Table 2 indicates that the average quality of health services was high, measuring 4.14, with a standard deviation of 0.51 and a percentage of 82.8%. Assurance was the most common dimension applied in hospitals, with a mean of 4.23, a standard deviation of 0.56, and a percentage of 84.5%. While the dimension of reliability was least common in the hospitals under study, with a mean of 4.07, a standard deviation of 0.58, and a percentage of 81.3%.

A one-sample *t*-test was used. A comparison of the calculated mean with the hypothesized mean (3), as shown in Table 3, revealed that the quality of health services is of a high level, with statistical significance ($p < 0.05$).

Table 4 illustrates the differences in nurses' perceptions of health service quality across different hospitals. There was a statistically significant difference ($p < 0.001$) between the hospitals. These findings suggest that the hospital variable plays a role in determining nurses' views on quality (Table 4). With a $p < 0.05$ indicating statistical significance, it is evident from Table 4 that there are differences in the responses of the individuals in the research sample regarding the quality of health services attributed to the hospital variable.

The study used the least significant difference (LSD) test for multiple comparisons, as shown in Table 5. The purpose of the LSD test was to identify which specific hospital differences were the least significant. This helps determine where the most or least difference in quality perceptions between pairs of hospitals. The test compares the mean quality rating of each hospital to that of every other hospital to determine significant differences.

Figure 1 illustrates the results of the LSD multiple comparisons, depicting the statistically significant and non-significant differences in quality perceptions between each pair of hospitals, as indicated by the *p*-values reported in Table 5. This helps interpret the specific hospital differences identified through the LSD test.

4. Discussion

This research aimed to evaluate health-care service quality in Yemeni hospitals from the perspective of nursing staff using the SERVPERF scale. The statistical analysis revealed that health-care service quality in these hospitals is relatively high, with the assurance dimension being the most prominent and the reliability dimension being the least prominent. Furthermore, the study identified statistically significant differences in the opinions of the interviewed nursing staff on health-care service quality across different hospitals under study. These findings align with previous research by Ghimire *et al.* (2020), Dalle *et al.* (2020), and Sulistyorini *et al.* (2021), who emphasized the impact of factors such as assurance, reliability, and tangibility on patient

Table 3. T-test for quality of health services

Significance	T	Standard deviation	Mean	The dimension
0.001	20.776	0.51	4.14	Quality of health services (average)

Table 4. Differences in nurses' perceptions of health service quality across different hospitals

Significance	F	Standard deviation	Mean	*n*	Hospitals
0.001	4.865	0.55289	3.7802	40	Hospital A
		0.40403	4.1668	14	Hospital B
		0.46198	4.0377	14	Hospital C
		0.78522	3.664	10	Hospital E
		0.46477	4.4065	10	Hospital D
		0.51466	4.1398	88	Total

Table 5. Pairwise comparison in nurses' perceptions of health service quality between hospitals

Significance	Average difference (I-J)	Standard error	Hospital for comparison (J)	Hospital (I)
0.033	0.38655*	0.1785	Hospital A	Hospital B
0.354	0.12901	0.13838	Hospital C	
0.053	0.50275	0.25612	Hospital E	B
0.075	−0.23977	0.13305	Hospital D	Hospital
0.001	0.62632*	0.17556	Hospital A	Hospital D
0.008	0.36878*	0.13457	Hospital C	
0.075	0.23977	0.13305	Hospital B	
0.004	0.74252*	0.25408	Hospital E	

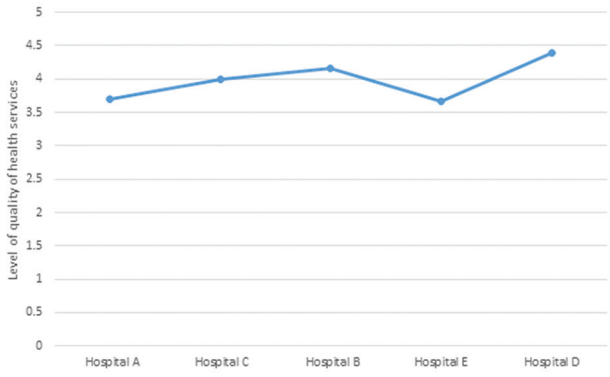

Figure 1. Differences in nurses' perceptions of health service quality across the hospitals under study

perceptions of and satisfaction with health-care services. These studies also underscore the significance of patient safety and reliability as essential components of health-care quality. However, the results of this study differ from those of (Canova-Barrios & Oviedo-Santamaría, 2021; Riordan *et al.,* 2020; and Verma *et al.,* 2020), which suggest that empathy and responsiveness are the most critical dimensions of health-care quality. In addition, these studies showed that demographic factors such as age, sex, and years of experience significantly impact health-care quality, contrasting with the findings of the present study.

Health-care service quality may vary significantly across different types of hospitals and geographical locations due to differences in resources, management practices, and patient demographics. Several limitations of the current study should be acknowledged. First, the study relied on self-reported data from nurses, which may be subject to social desirability bias. Nurses might have overestimated or underestimated the quality of services due to personal biases, fear of reprisal, or the desire to present their workplace in a positive light. Second, the study focused solely on the perceptions of the nursing staff. It is widely acknowledged that nurses play a crucial role in patient care, but the perceptions of other health-care professionals, such as doctors, pharmacists, and administrative staff, as well as patients themselves, were not considered in this study. Having different perspectives of non-nursing medical staff can provide a more comprehensive understanding of health-care service quality. Third, the study used a cross-sectional design, which captures a snapshot of the situation at a particular point in time. This design does not allow for the examination of changes in perceptions over time or the establishment of causal relationships between the SERVPERF dimensions and the perceived quality of health-care services. Hence, future research should aim to address these limitations by including a more diverse sample of hospitals, using multiple data collection methods to reduce bias, incorporating the perspectives of other health-care professionals and patients, and employing a longitudinal design to track changes over time.

5. Conclusion

This study offers valuable insights into measuring health-care service quality and nursing staff perceptions in Yemen. However, the findings are only generalizable to private hospitals. Future research could benefit from the application of the SERVPERF model in public hospitals to enable comparisons across different settings. The results provide empirical support for the development of targeted policies and interventions aimed at enhancing service quality in Yemeni hospitals.

Quality improvement strategies should prioritize addressing recognized challenges in infrastructure, staffing shortages, and medical supplies. Increasing investment in the health-care system could help improve the standard of care provided to patients. Nursing staff play a pivotal role in delivering high-quality services. Their views provide useful information for tailoring improvement efforts. Policies must acknowledge nurses' contributions and prioritize their training to bolster skills and competencies. Doing so could strengthen the reliability of care provision.

Theoretically, the findings offer insights corroborating dimensions of the SERVPERF framework. Service quality perceptions seem to be influenced most by safety, reliability, and tangibility. This finding lends support for focusing improvement work on these aspects to positively impact patient satisfaction. This study adds to the evidence emphasizing the importance of systematically measuring and enhancing health-care quality over time. Tools such as SERVPERF can be used to effectively monitor standards and pinpoint areas for targeted reform. With refinement, such strategic approaches offer pathways for strengthening Yemen's health-care system and outcomes. Overall, regular evaluation of quality from multiple perspectives seems integral for sustainable improvement. Further research applying these lessons more broadly could generate valuable knowledge for policymaking.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: All authors
Investigation: Ammar Ali Alraimi
Writing–original draft: Ammar Ali Alraimi
Writing–review & editing: Abhijeet Shelke

Ethics approval and consent to participate

We confirm that all the experiments conducted in this study were performed in accordance with the Declaration

of Helsinki. Ethical approval for this study was obtained from the Ethical Hospitals Association Committee with reference number 64 – 2023 for the study involving nursing staff samples. Written informed consent was obtained from all study participants before they participated in this study, and all the collected data were kept strictly confidential and used solely for research purposes.

Consent for publication

None.

Availability of data

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Further disclosure

The paper has been uploaded to and deposited in a preprint server (Research Square, https://doi.org/10.21203/rs.3.rs-3610003/v1).

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ACCSCIENCE PUBLISHING

Global Health Economics and Sustainability

ORIGINAL RESEARCH ARTICLE

Building sustainable local training capacity for maternal and newborn health within the public health system: A training intervention in Palghar District, India

Shilpa Karvande[1], Vidula Purohit[1], Subha Sri Balakrishnan[2], Helen Allott[3], Elisabeth Serle[4], Reeta Jha[5], Shubhro Mullick[6], Milind Chavan[7], Prashant Kulkarni[1], Matthews Mathai[8], and Nerges Mistry[1]*

[1]Department of Community Health, Foundation for Medical Research, Pune/Mumbai, India

[2]Independent researcher, Thiruvananthapuram, Kerala, India

[3]Department of Maternal and Newborn Health, Liverpool School of Tropical Medicine, Liverpool, United Kingdom

[4]Department of Women's and Child Health, Shetland NHS Health Board, Shetland, Scotland

Abstract

Continuing professional development for the health workforce is of paramount importance and can be implemented using locally available, competent trainers. However, guidelines for the selection, development, and mentorship of such trainers are lacking. Training intervention research conducted in Western Maharashtra, India, aimed to address these gaps by focusing on skills for maternal and newborn health (MNH). In this study, selected trainers from a pilot project in the Pune district received advanced training to become core trainers (CTs) for a scale-up project in Palghar district (2019 – 2022). The CTs trained master trainers (MTs) in Palghar ($n = 32$) with support from the United Kingdom-based technical partners, following a six-step approach: selection of trainers, training of trainers (ToT) (including knowledge and skills assessment), staggered induction as trainers, continuous support, regular quality assessment, and virtual refresher training. The process and outcomes of this six-step approach were evaluated using mixed-methods research. The skills of local trainers were augmented through hands-on training and further supported by long-term mentorship to develop training excellence. The CTs' competency as mentors improved due to appreciative feedback. Regular assessments conducted by the expert team also contributed to maintaining quality control. Online learning has emerged as an effective method for refresher training. There was considerable improvement in the clinical knowledge and skills of the health providers from Palghar ($n = 505$), which attests to the quality of the training delivered by the Palghar MTs. This intervention enhanced both clinical competency and confidence. The approach demonstrated the importance of recruiting suitable participants who could consciously shift their teaching style to become more adult-learner-centric facilitators. However, there is a need for a systematic, long-term evaluation of this model, its application to MNH care, and its institutionalization within the public health system.

Keywords: Sustainable trainers; Adult-learner-centric; Training of trainers approach; Raining process

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***Corresponding author:**
Nerges Mistry
(fmr@fmrindia.org)

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[5]Department of Obstetrics and Gynaecology, Royal Free London Hospitals Foundation Trust, London, United Kingdom
[6]Department of Paediatrics, Western Isle Hospital, Western Isles NHS Trust, Scotland, United Kingdom
[7]Department of District Health, Palghar, Maharashtra, India
[8]Independent Consultant, St John's, Newfoundland and Labrador, Canada

1. Introduction

A competent public health workforce is an important pillar of the health system and is necessary to improve population health (Barbazza *et al.*, 2015; Beaglehole & Dal Poz, 2003). However, maintaining health worker competencies requires continued, intensive efforts. While pre-service training lays the foundational skills, it must be supplemented with regular refresher training and updates to sustain these skills and competencies. Therefore, the need to invest in in-service training and continuous professional development of the health workforce is of paramount importance. To be effective, training programs must focus on evidence-based training techniques provided by competent faculty possessing appropriate clinical and pedagogical skills (Zhao *et al.*, 2013; Nicol *et al.*, 2019; Laskaratos *et al.*, 2014). Moreover, an urgent need for transformation in training approaches is evident, as traditional didactic techniques with passive instructions have minimal impact on learning outcomes (Bluestone *et al.*, 2013). Case-based learning, clinical simulations, and skills practice with feedback are highly effective in engaging participants and achieving positive learning outcomes, including increased knowledge, skills, and confidence in health-care delivery (Bluestone *et al.*, 2013; Harris & Bacon, 2019; Karvande *et al.*, 2020).

Workforce capacity can be strengthened at multiple levels by utilizing a training cascade. The training of trainers (ToT) model is based on selecting trainers who have the ability to acquire, understand, and transfer knowledge and skills to trainees or peers while also ensuring the sustainability of these skills over the long term (Understanding the Training of Trainers Model [CDC], 2019; Mormina & Pinder, 2018). Various studies have shown the benefits of the ToT model in implementing evidence-based public health practices (Olayo *et al.*, 2019.; Hiner *et al.*, 2009; Yarber *et al.*, 2015; Nitturi *et al.*, 2021; Rowe *et al.*, 2021). This model is considered strongly predictive of sustainability due to its ability to rapidly, cost-effectively, continuously, and exponentially upskill the workforce (Mormina & Pinder, 2018). Furthermore, qualified trainers can act as health facility-based mentors to continually reinforce the lessons learned during clinical practice.

In addition to essential clinical knowledge and skills, non-technical attributes for ToT trainers include good communication skills, time management, teamwork, and respectful behavior (Skills and interests [health trainer], National Health Services, 2015). However, evidence-based guidelines for the selection and recruitment of trainers for public health training programs are limited in India and require further research. Similarly, evidence for pedagogies and processes of training in the public health system using a ToT model are lacking.

In this context, training intervention research was undertaken in Western Maharashtra. The intervention employed a ToT model and was implemented as a pilot project in Pune District (2017 – 2019) and later scaled up to Palghar District (2019 – 2022). The present paper describes the pedagogy, process, and effects of implementing the ToT model in the Palghar district, aiming at developing a sustainable resource of competent trainers for in-service training within the local public health system. Although India has achieved significant declines in maternal (Meh *et al.*, 2022) and under-five (Bango & Ghosh, 2023; Patel and Olickal, 2021) mortality rates over the years, maintaining this progress requires building a skilled workforce capable of providing quality obstetric and newborn care and is considered one of the urgent necessities (Exemplars in Maternal and Newborn Health India Study, 2023). Studies conducted in Asian countries (Ariff *et al.*, 2010; Khan *et al.*, 2019), including India (Iyengar & Iyengar, 2009; Rao *et al.*, 2019), have pointed toward the maternal newborn health (MNH)-related skill deficits among health providers. Hence, MNH care was considered for undertaking this intervention research to build the capacities of frontline health providers working in the rural public health system of Western Maharashtra, India.

2. Methods

2.1. Setting

The study was conducted in Palghar District, in Western Maharashtra. This district has a population of 2,990,116 (About District, n.d.), with a majority of tribal communities in six of its eight rural blocks. Low birthweight babies, teenage pregnancies, and anemia are some of the high-risk factors related to adverse outcomes in MNH in Palghar (End Malnutrition, MLD Community Care, n.d.; Project Spotlight Palghar, End of Project Evaluation, n.d.). Due to these reasons, the Government of Maharashtra

recommended this district for the scale-up phase of the project.

The primary health-care system of the district consists of 46 primary health centers (PHCs) and 311 health subcenters (HSCs). A PHC, the first port of call to see a qualified doctor in the public sector, typically covers a population of 30,000 in plain areas and 20,000 in hilly, tribal, or difficult areas. It acts as a referral unit for HSCs. An HSC is the first point of contact between the primary health-care system and the community, covering a population of 5000 in the plains and 3,000 in tribal and hilly areas for the provision of essential preventive and promotional services and a few curative and referral services (Indian Public Health Standards, National Health Mission, n.d.).

2.2. Project design

This project was implemented in Pune (13 rural blocks) during 2016 – 2019 (Karvande *et al.*, 2020) as a pilot and scaled up in the Palghar district during 2019 – 2022 (at a time when India experienced three waves of the COVID-19 pandemic). Both of these projects were implemented with on-site (for Pune) and virtual (for Palghar) support from the technical partners – a team of obstetricians and a pediatrician – from the United Kingdom (UK). The Palghar project design involved two phases: (i) preparing for the scale-up and (ii) developing a local cadre of skilled MTs.

2.2.1. Phase 1: Preparing for the scale-up in Palghar

A group of eight clinically competent trainers, including seven general nurse midwives (GNMs) and one medical doctor (out of 38) from the Pune pilot project, were selected as the "core" trainers (CTs). These trainers were selected for their ability to imbibe and repeatedly demonstrate the expected training pedagogy. They expressed willingness and commitment to work in the Palghar scale-up phase. They had received sustained feedback concerning clinical and teaching skills from the UK team during the pilot phase. Acknowledging the seriousness of the prevalent health issues in the Palghar district, the scale-up included two major adaptations in the training content. First, the training content was adapted to include or emphasize local context-specific subjects related to MNH, for example, the management of low-birth-weight babies, anemia, and malnutrition. Second, it targeted additional cadres of health providers. While the Pune pilot project focused on auxiliary nurse midwives (ANM), the Palghar scale-up opted to train an entire team of multidisciplinary health providers – including medical officers, staff nurses, community health officers, GNMs, and ANMs – since MNH case management is typically handled by such teams at PHC/HSC. The Pune pilot project's training materials and content adapted for Palghar were reviewed and endorsed by experts from the State Family Welfare Bureau, the Government of Maharashtra, and the District Health Office of Palghar.

The Pune CTs were oriented regarding their roles in the Palghar scale-up phase, and a 4-day refresher learning session was delivered, followed by a series of virtual continuous learning sessions, each focusing on one key subject related to MNH, over 3 months. These sessions included lecture practice using PowerPoint presentations, followed by clinical skill demonstrations with feedback provided by the UK team experts to enhance their clinical knowledge, practical skills, and teaching skills as CTs. A specific session was conducted by the UK experts about "*How to become an effective trainer?*" with practical tips and guidance for the Pune CTs.

2.2.2. Phase 2: Developing a local cadre of skilled master trainers in Palghar

The approach of developing a local cadre of skilled MTs for the Palghar district involved six steps:

(i) Step 1: Pre-ToT screening of identified candidates by Pune CTs and project researchers.

A group of 48 candidates (medical officers, staff nurses, community health officers, obstetricians, and pediatricians working as clinicians and/or administrators at various levels of health facilities across all the blocks of the district) were identified as potential trainers. The initial exploratory and baseline study aided both understanding of diverse geographies and identification of health facilities with relatively poor access to referral hospitals and a higher number of childbirths. The potential trainers represented such facilities, which was a step toward increasing the outreach of skilled human resources across the district. The potential trainers were identified through field-based interactions with Palghar district health officials and health providers and observations by the project researchers during initial exploratory visits and baseline assessments. A pre-ToT screening of these identified potential ToT candidates over 4 days focused primarily on the assessment of their work profile, previous experience as trainers, if any, interest and commitment to work as trainers, and demonstration of baseline teaching skills. The teaching skill demonstration was assessed for session preparations, clarity in conveying messages, ability to engage participants, and respectful behavior during teaching sessions. They were scored using a three-point grade scale: excellent, fair, and unsatisfactory. The candidates who received "excellent" or "fair" grades were considered potential ToT participants (n = 32), including 25 medical doctors and seven GNMs.

(ii) Step 2: Training of potential master trainers with pre- and post-ToT assessment.

The 32 selected candidates participated in the ToT to become Palghar MTs, with pre- and post-ToT assessments of clinical knowledge and skills as well as teaching skills. Adult learning principles, including exhibiting a participatory, interactive, and respectful learning approach, providing opportunities for participants to think and learn, and ensuring active engagement and hands-on practice for participants with explanations of step-wise management, were applied during the ToT and all subsequent training. A simulation of various high-risk cases with complications was used for discussing step-wise case management. The pre- and post-ToT assessments included written examinations, structured observations of teaching skills, and clinical demonstrations with mannequins using checklists. A total of 18 participants achieved a composite score of more than 85%, and the remaining 14 scored in the range of 70 – 84% in the post-ToT assessment out of the 32 Palghar MTs.

(iii) Step 3: Staggered induction of selected candidates as MTs.

A strategic process of staggered and structured induction was adopted for 32 Palghar MTs for conducting training for health providers from the public health system in Palghar. Master trainers with "intermediate" scores (70 – 84%; $n = 14$) were paired up with those with the "highest" scores (85% and above) ($n = 18$). After working with the highest-scoring trainers for at least two training batches, they were inducted as independent trainers. The Palghar MTs then conducted training for 505 health providers over a period of 18 months (Table 1).

(iv) Step 4: Continuous support and guidance to Palghar MTs by Pune CTs.

Each training batch of Palghar health providers ($n = 20 – 25$) was conducted by a mix of highest- and intermediate-scoring Palghar MTs (altogether 4 – 5) supported by one Pune CT. In addition to providing clinical guidance and feedback, this supportive supervision included teaching the new trainers the pedagogy for adhering to adult learning principles and ensuring adequate time for a reverse demonstration of the relevant skill by each participant. The MT demonstrated a clinical skill to a group of 5 – 6 participants using a mannequin in a stepwise manner and asked each participant to observe. Subsequently, each of them was requested to demonstrate the skill to the MT, engaging the rest of the participants in the process. The MT observed and provided feedback to each participant. This step provided a longer time frame for the MTs to work as trainers with the mentorship of the Pune CTs.

Table 1. Cadre-wise profile of health providers (n=505) trained by Palghar MTs

Cadre	No. of trained health providers
Auxiliary nurse midwife (ANM)	304
Community health officer (CHO)	73
Medical officer	66
General nurse midwife (GNM)	38
Lady health visitor (LHV)	18
Staff nurse	6
Total	505

Note: LHV is an ANM who is trained for a period of 6 months to function as a female health supervisor and provides supportive supervision and technical guidance to ANMs (Mavalankar and Vora, 2008).

(v) Step 5: Regular quality assessment by the UK experts.

Due to travel constraints during the COVID-19 pandemic, structured quality assessment and feedback sessions ($n = 3$) were conducted remotely by the UK experts. These sessions aided in ensuring the correct demonstration of clinical skills and standardized delivery of training content by the Palghar MTs. While the Palghar MTs had the essential clinical knowledge, they initially found it challenging to conduct case-based sessions, providing trainees with practice opportunities and allowing time for reflection and learning. They were provided with feedback and tips during the initial rounds of teaching demonstrations to help them adapt to this more inclusive pedagogy. Most MTs implemented the corrective steps as suggested by the UK experts and showed improvements in the subsequent rounds of skill demonstrations. Examples of improvements included encouraging participants to consider the next steps in case management, exercising respectful communication throughout the case-based discussions, and accurately demonstrating skills such as abdominal palpation during pregnancy.

(vi) Step 6: Virtual refresher training for MTs.

Although an intense single face-to-face training intervention can lead to increased knowledge and clinical skills, there is a risk of attrition over time. Moreover, face-to-face training is both resource- and time-intensive. Repeating this was not feasible, especially during the COVID-19 pandemic. Acknowledging this reality, a series of refresher sessions on essential MNH skills were organized by the project team for the Palghar MTs with support from the Pune CTs. These sessions were conducted over a period of 10 months (starting 6 months after the ToT) using ECHO – Extended Community Health Outcomes India – a virtual knowledge-sharing platform for building capacity and sharing best practices through case-based learning using a hub and spoke model (ECHO India, n.d.). These refresher sessions were planned on the principle of learning through

discussions of real-life clinical situations presented by the Palghar MTs. The essential skills included plotting and interpretation of partographs for monitoring the progress of labor, management of eclampsia, newborn resuscitation, and abdominal palpation of pregnant women.

2.3. Data collection and analysis

To assess the process and outcomes of this six-step approach used to generate a cadre of local MTs in Palghar, a mixed-methods research design was adopted. Quantitative data from pre- and post-training assessments included scores assigned for clinical knowledge and skills. These pre- and post-training assessment scores were analyzed using Microsoft Excel 2016 and compared with the Wilcoxon signed-rank test.

The qualitative data were collected through process documentation, structured observations, and in-depth interviews with UK clinical experts (n = 3), Pune CTs (n = 5), and Palghar MTs (n = 12). These data were coded and analyzed thematically to identify key themes such as experience with the training pedagogy, effects of training on building confidence and competencies, and application of training in clinical practice.

2.4. Ethics statement

This training intervention research project received approval from the Institutional Research and Ethics Committee of the Foundation for Medical Research (FMR/IREC/CH/01/2019).

3. Results

The results of this training intervention research are presented as (i) the importance of the methodical six-step approach to developing Palghar MTs; (ii) evidence of increased competency of Palghar MTs with support from Pune MTs; and (iii) personal and professional gains of the Palghar MTs.

3.1. Importance of the methodical six-step approach to developing Palghar MTs

A group of eight Pune CTs contributed to building a cadre of 32 Palghar MTs (25 medical doctors and seven GNMs) during the scale-up phase. Each of the six steps adopted in the approach to building the cadre of Palghar MTs was found to have its own advantages (Table 2).

3.2. Evidence of increased competency of Palghar MTs with support from Pune MTs

In-person training received from the Palghar MTs and Pune CTs with periodic virtual inputs from UK experts resulted in considerable improvement in the clinical knowledge and skills (abdominal palpation, newborn resuscitation, and eclampsia management) of the trainee health providers from Palghar (Figure 1).

The post-training assessment scores were significantly higher than those of the pre-training assessment scores for clinical knowledge ($p < 0.001$), as well as for the three skills, namely abdominal palpation ($p < 0.001$), newborn resuscitation ($p < 0.001$), and eclampsia management ($p < 0.001$). This improvement in the post-training assessment scores of the trainee health providers was evidence of the quality of the training delivered to them by the Palghar MTs with support from the Pune CTs.

3.3. Personal and professional gains of the Palghar MTs

The effect of the current training intervention on the Palghar MTs had three aspects: (i) increased clinical competency; (ii) confidence as a trainer; and (iii) career growth – recognition and motivation.

3.3.1. Increased clinical competency and its application

The Palghar MTs were practicing clinicians, staff nurses, and non-specialist or specialist medical doctors. They reported internalizing the clinical protocols thoroughly on account of repeated demonstrations of essential MNH skills during the training. They acquired leadership skills and used the same for monitoring and mentoring their staff for appropriate case management and referrals.

> *"When we demonstrated the skills in several training batches, it got fixed in our heads. Now, we have become more effective in managing any crucial case."* (Palghar MT [senior specialist, Sub District Hospital {SDH}])
>
> *"I check all the data for my PHC, especially all the high-risks cases and the referred-out data, to*

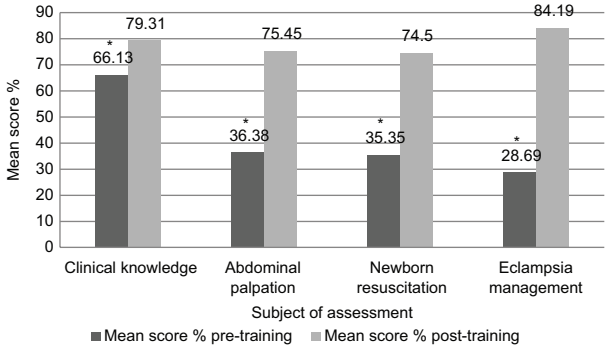

Figure 1. Pre and post-training assessment scores for clinical knowledge and skills of trainee health providers from Palghar (n = 463). Notes: Although 505 health providers were trained during the training intervention, pre- and post-training scores for all the assessments were available only for 463 providers. *Indicates $p < 0.001$.

Table 2. Methodical six-step approach to building master trainers (MT) cadre and lessons learned

Serial number	Name of the step	Details	Lessons
Step 1	Pre-ToT screening of identified candidates (*n*=48)	(i) Teaching skills, work profile, and previous experience as a trainer (ii) Expected commitment to the project (iii) Scoring above the threshold and willingness as potential trainers	(i) Helped in optimal utilization of resources for conducting the ToT with selected candidates
Step 2	Training of potential trainers (*n*=32) with pre- and post-ToT assessment	**(i)** Imparting clinical knowledge, skills, teaching skills using adult learner principles, and simulation-based learning **(ii)** Written examination, structured observation of clinical demonstration, and teaching skills with check-list (iii) Composite score of post-ToT assessment: 18 MTs with highest scores and 14 MTs with intermediate scores	(i) Led to objective assessment of trainers and identification of gaps for improvement
Step 3	Staggered induction of selected candidates as trainers	(i) Master trainers with intermediate scores paired up with the highest scoring ones for conducting training and inducted as independent trainers after substantial experience working in these pairs	(ii) Provided more time and support to trainers with intermediate scores to excel through peer learning. (iii) Helped in ultimately achieving a larger group of competent trainers at the local level
Step 4	Continuous support and guidance of Palghar MTs by Pune core trainers (CTs)	(i) A mix of 4 – 5 MTs with the highest and intermediate scores conducted training courses for batches of health providers (ii) Presence of one Pune CT in every training batch, offering supportive supervision, clinical guidance, training pedagogy, and ensuring adherence to adult-leaner-centric principles	(i) Generated training opportunities for Pune CTs to become competent and confident trainers and mentors (ii) Longer time frame for Palghat MTs to receive supportive supervision, critical feedback, and appreciation
Step 5	Regular quality assessment by the UK experts (*n*=3)	**(i)** Structured quality assessment and critical feedback sessions (virtual) to ensure clinical acumen and standardized delivery of training content **(i)** Palghar MTs possessed essential clinical knowledge but initially faced challenges in adapting to the expected training pedagogy (ii) Immediate corrective steps were taken based on feedback	(i) Proved necessary for ensuring consistency of standardized training with expected quality throughout the intervention, highlighting an essential quality control step
Step 6	Virtual refresher training for master trainers	(i) Series of refresher sessions on essential maternal and newborn health skills over a period of 10 months (starting 6 months after the ToT) using a virtual platform (ii) Through case-based discussion	(i) Demonstrated an effective and resource-efficient method for delivering training content and reinforcing knowledge and skills without interruptions, even during COVID-19

> *see whether the required primary management was undertaken here before referring the cases.*" (Palghar MT [MO-PHC])
>
> "*I taught partograph plotting to all our staff nurses. It helped everyone, including myself, to understand obstructed labor.*" (Palghar MT [MO-Rural Hospital {RH}])

The Palghar MTs appreciated learning new concepts, for example, the danger response-airway breathing circulation (DR-ABC) approach to case assessment, which helped them to be more organized and efficient in systematic patient management. The training emphasized appropriate referral practices and the use of a standardized referral tool-situation background assessment recommendation (SBAR) (Shahid & Thomas, 2018). The Palghar MTs' preparedness to manage referred in cases increased when appropriate referral notes were sent with the patients and because of appropriate primary-level management undertaken before referral. This reduced delays in the secondary management of patients at the referral facility and increased the chances of their recovery and survival. They also mentioned adapting to evidence-based practices

and avoiding harmful practices that were previously followed without assessing their clinical relevance or checking if the practice had an evidence base.

> *"Due to this training, not only me but also my ANMs started following the DR-ABC approach very diligently and not missing out on important investigations such as measuring respiratory rate."* (Palghar MT [CHO])
>
> *"We were copying our seniors and giving fundal pressure when the baby would be stuck; or rupture the membrane artificially. I learned about the consequences of such practices and have stopped doing them. I have even told the same to my colleagues."* (Palghar MT [staff nurse, RH])
>
> *"Recently, I have received one referral from a PHC. The child had pneumonia and was in respiratory distress. The case was not manageable by the PHC staff. They referred the child to our facility but with oxygen. So we could start higher treatment immediately."* (Palghar MT [MO, SDH])
>
> *"Even when I want to refer a case to a higher hospital, I don't hesitate to call the specialist and describe the case as per the SBAR taught to us during this training."* (Palghar MT [MO, RH])

3.3.2. Confidence as a trainer

Building the confidence of trainers was another focus area of this intervention. Palghar MTs were involved in repeated training sessions for health providers. This resulted in more opportunities for peer interactions, encouragement from Pune CTs and UK experts, and increased confidence. With experience working as MTs in the project, they started applying the newly learned adult learner training pedagogy in their own health facilities, as well as in other settings and training programs. The following quotes explain the nuances of increased confidence mentioned by the Palghar MTs:

> *"I wanted to overcome my stage fright; hence, so I participated as a trainer in a number of batches during this project. I learned many new things, such as how to present a topic or how to organize a training program. I now feel very confident."* (Palghar MT [MO-PHC])
>
> *"I am sharing my knowledge on case management with my colleagues who could not attend this training. That's a wonderful feeling, which also increases our own knowledge."* (Palghar MT [staff nurse, SDH])
>
> *"Earlier, my 'teaching pattern' was just to talk and talk and give information to students who would come and learn nutrition here. I now make their groups, ask them to interact with mothers of admitted children here, conduct a diet audit, and make them think about possible reasons for malnutrition among children. I understood how I could involve the students and engage them in learning."* (Palghar MT [MO, Nutrition Rehabilitation Center, SDH], who manages medical college students interning at their hospital)

3.3.3. Career growth- recognition and motivation

Apart from the direct benefits to the Palghar MTs in terms of increased clinical competency and confidence as trainers, the training intervention additionally benefitted them in receiving recognition or appreciation from colleagues and superiors and added value to their leadership roles in their health facilities. They expressed their willingness to continue working as trainers in the future and even get promoted to CT. Receiving critical feedback as well as appreciation from the UK experts during the live virtual quality assessment sessions was a motivating moment for the Palghar MTs.

> *"My image as a medical officer has changed. Even other PHC doctors call me or discuss with me any clinical problem because they all know that I work as this project's trainer. The problem gets solved by sharing, so it benefits."* (Palghar MT [MO-PHC])
>
> *"The enthusiasm of the trainers (Palghar MTs) is worth noting, especially moving forward as a group in these challenging years (of the COVID pandemic)."* (UK expert)
>
> *"After receiving this training, even my senior sir asked for my clinical opinion. I feel good that my knowledge is being useful."* (Palghar MT [MO-RH])
>
> *"I feel so motivated. Even I would like to work like Pune CT and travel to other places to train more trainers."* (Palghar MT [MO-PHC])

4. Discussion

The MNH-related skill deficits and the urgent need to strengthen the health workforce are evident in several studies (Iyengar & Iyengar, 2009; Nandan & Agarwal, 2012; Rao *et al*., 2019; Karvande *et al*., 2020; Privitera 2021; Karan *et al*., 2021). The low pre-training assessment scores of health providers from Palghar confirmed these deficits. Recent initiatives in India, such as skills laboratories, Dakshata training (Chhugani, 2015), and India's National Training Strategy (National Training Strategy for the Ministry of Health and Family Welfare, Government of India, 2008), have shifted focus to skills-based training strategies. However, the benefits of these strategies have yet to reach frontline health workers

in the primary health system. India is projected to face a shortfall of approximately 0.7 million skilled health workers required to achieve the 25:10000 ratio of skilled health workers to the population by 2030 (Karan *et al*., 2021). In this context, the current training intervention, which includes a training cascade involving Pune CTs, Palghar MTs, and Palghar health providers, demonstrates a model for upskilling existing human resources within the public health system.

This training intervention adopted a TOT model and demonstrated its effects on developing sustainable, competent trainers within the public health system. The content and criteria for assessment of TOT are documented (Esau *et al.,* 2020); however, little evidence is available about the approach, implementation steps, or prerequisites of TOT for achieving expected gains (Mormina & Pinder, 2018). The TOT planning and evaluation require capturing outcomes as well as process measures, demonstrating both the ultimate aim and the steps required to achieve it (Kelly *et al*., 2015). This paper has attempted to describe the necessary elements of the methodical approach and the outcomes of the TOT intervention.

An appropriate initial choice of trainers is a prerequisite for a successful TOT intervention. Key attributes of an effective trainer include enthusiasm, willingness to teach, patience, insight, confidence, communication skills, leadership, capacity for self-reflection, ability to be constructively critical, and above all, motivation to help others (Mormina & Pinder, 2018; Baron, 2006). The Pune pilot project demonstrated the importance of systemic investments in creating and sustaining competent, motivated, and updated trainers and conducive environments for the absorption of learning among ANMs (Karvande *et al*., 2020). The Palghar scale-up phase deliberately invested efforts to identify and recruit appropriate candidates with essential attributes, which is known to minimize the attrition of skilled resources (Mormina & Pinder, 2018).

Appropriate training pedagogy is the next essential for effective training interventions. The adult learning process can be transformative and transformational (Esau *et al*., 2020; Merriam, 2008; English & Irving, 2000). Hence, a conscious shift in the teaching style of the trainers was achieved by developing them as adult learner-centric facilitators and effectively using a simulation-based learning approach, which has been shown to be of proven benefit in training intervention research (Mun *et al*., 2022; Tavares *et al*., 2014; Mash *et al*., 2018). The positive outcomes of the current training intervention in terms of increased confidence among Palghar MTs and enhancement in clinical knowledge and skills of health providers endorsed the appropriateness of this approach. This training intervention, built on a hybrid platform with an appropriate blend of virtual and in-person training activities, proved to be effective for the delivery of the training content and for reinforcing knowledge and skills even during the COVID-19 pandemic. Other studies have validated the usefulness of a virtual platform for conducting training during the COVID-19 pandemic (Mun *et al*., 2022).

Training of trainers is generally a short-term program with few opportunities for MTs to conduct supervised training (Fernandes *et al*., 2007). Longer time frames are needed for trainers to learn, assimilate, and then teach others (Mormina & Pinder, 2018), and newly trained trainers need to be supported beyond the initial training event (Understanding the Training of Trainers Model | Healthy Schools [CDC], 2019). The opportunity to do this may be missed at a typical one-time TOT event. Gradual and staggered involvement of Palghar MTs and continued support by Pune CTs with periodic guidance from UK experts provided an extended opportunity for the newly trained Palghar MTs to unlearn and learn, assimilate, accept, and act on constructive criticism, and then conduct training of health providers under continued mentorship. This scale-up intervention proved to be an important step in strengthening Pune CTs as competent mentors. Under their mentorship, the newly trained Palghar MTs were empowered to implement the training intervention seamlessly and effectively.

The Palghar MTs reported increased capacity and motivation in performing their clinical tasks. This concept of perceived increased ability to perform tasks successfully is termed "self-efficacy," and self-efficacy following continuous education is known to increase knowledge and motivation to implement the new knowledge for patient care (Fusco & Ohtake, 2019). However, self-reporting of gains or positive effects of intervention could be overestimated (Mash *et al*., 2018). In the present research, the qualitative data from in-depth interviews with and observations of the Pune CTs, UK experts, and project researchers endorsed this increased ability of Palghar MTs, thus minimizing the possibility of overestimation.

Studies have recommended that to avoid attrition of trainers, becoming a trainer should be recognized as a career path and not just an adjunct duty (Mormina & Pinder, 2018). Reluctance to releasing staff for training and perceiving it as an unnecessary burden imposed on a system with limited human resources has been reported in other studies (Mormina & Pinder, 2018; Hague *et al*., 2015). There was no such reluctance to release Palghar MTs for participating in the training. However, at times,

it was challenging for them to commit the necessary time against their competing clinical and/or administrative priorities. Hence, a realistic and wider strategy needs to be developed to create space for clinicians to work as trainers while making continuous use of their skills. An efficient training intervention using the TOT model should result in self-sustaining exponential growth and continue to generate an ever-widening pool of skilled human resources. However, this swift progression demands continued investment in human resources for health and enablers in health facilities, including embedded refresher training, an uninterrupted supply of drugs, materials, and essential infrastructure. There needs to be a systematic commitment to nurturing the talent of trainers through accreditation and the provision of opportunities for teaching as well as learning.

This paper is based on the lessons from the training intervention research projects in two rural set-ups in western Maharashtra. However, the findings regarding the value of the selection of appropriate candidates and the demonstrated approach of long-term and structured investment in building the skills of human resources could be generalizable across regions and populations with a scarcity of skilled human resources within public health systems.

5. Conclusion

The availability and skill level of human resources directly influence the quality of MNH care, impacting the health of women and newborns. This paper provides a strategic approach to building and nurturing skills through targeted teaching and learning opportunities. It presents the lessons learned from a pilot project and the subsequent scale-up of a skill-building intervention across two rural areas in Maharashtra. The study demonstrates the increased competency of trained human resources in the Palghar district as a consequence of the intervention. However, a systematic evaluation is needed to assess the long-term effects of this training on the retention of clinical and teaching competencies among trainers and their application in MNH care. Essential components for a robust training intervention include longer time frames, an adult learner-centric approach, a hybrid platform, and investment in an enabling ecosystem for applying the learned skills.

To ensure the sustainability and scalability of the intervention beyond the project period, it is crucial to adopt the demonstrated training pedagogy and provide continuous learning opportunities within the public health system. This pedagogy can be extended from in-service training for maternal and newborn health care to include pre-service training and comprehensive primary health-care training. Future research should focus on the cost implications of this training intervention to evaluate its potential for scaling up and institutionalization.

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Conflict of interest

The authors declare that they have no conflict of interest.

Author contributions

Conceptualization: Shilpa Karvande, Vidula Purohit, Matthews Mathai, Nerges Mistry

Formal analysis: Shilpa Karvande, Vidula Purohit, Nerges Mistry

Investigation: Shilpa Karvande, Vidula Purohit, Prashant Kulkarni

Methodology: Shilpa Karvande, Vidula Purohit, Prashant

Kulkarni, Milind Chavan, Nerges Mistry
Writing – original draft: Shilpa Karvande
Writing – review & editing: Vidula Purohit, Subha Sri Balakrishnan, Helen Allott,
Elisabeth Serle, Reeta Jha, Shubhro Mullick, Milind Chavan, Prashant Kulkarni, Matthews Mathai, Nerges Mistry

Ethics approval and consent to participate

This intervention research project received approval from the Institutional Research and Ethics Committee (FMR/IREC/CH/01/2019). The research did not involve interacting with any human subject other than the implementers of the intervention.

Consent for publication

The respondents who were part of the implementation team consented to publish the data generated as part of this intervention research.

Availability of data

Data used in this work are available from the corresponding author upon reasonable request.

Further disclosure

(i) The findings have been presented at the International Maternal Newborn Health Conference in May 2023, Cape Town, South Africa.
(ii) This paper has been uploaded to a preprint server in January 2024 (MedArchive: https://doi.org/10.1101/2024.01.01.24300686).

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ACCSCIENCE PUBLISHING

Global Health Economics and Sustainability

ORIGINAL RESEARCH ARTICLE

Short-term cost-effectiveness of oral semaglutide versus empagliflozin, sitagliptin, and liraglutide in the treatment of Type 2 diabetes in Greece

Panagiotis Papantoniou[1]* and Anastasia Papageorgiou[2]

[1]Department of Public Health Policy, Faculty of Public Health, University of West Attica, Athens, Greece

[2]Department of Plant Pathology, Faculty of Crop Science, Agricultural University of Athens, Athens, Greece

Abstract

Diabetes is a significant global health concern, affecting more than 540 million people worldwide and imposing a substantial financial burden on health systems and societies. This study evaluates the cost per patient of achieving treatment targets with oral semaglutide compared to empagliflozin, sitagliptin, and liraglutide in patients with Type 2 diabetes in Greece. The analysis focuses on seven outcomes, including hemoglobin A1C levels, avoidance of hypoglycemia, and weight loss, with costs calculated in 2024 EUR, excluding patient copayments. The annual treatment costs were EUR 1,210.04 for oral semaglutide, EUR 528.04 for empagliflozin, EUR 260.51 for sitagliptin, and EUR 1,542.87 for liraglutide. Although a higher proportion of patients achieved treatment goals with oral semaglutide, it was associated with a higher cost of control across most outcomes compared to empagliflozin (mean probabilistic sensitivity analysis [PSA] difference: EUR 839.45) and sitagliptin (mean PSA difference: EUR 1,041.50). In contrast, oral semaglutide demonstrated a consistently lower cost of control compared to liraglutide across all treatment targets (mean PSA difference: EUR −3,779.23). This analysis confirms that the cost of control of oral semaglutide varies significantly depending on the treatment target, suggesting that, without changes in its list or net price, it may not be the most cost-effective option compared to empagliflozin and sitagliptin in Greece.

Keywords: Cost of control; Short-term cost-effectiveness; Type-2 diabetes; Glucagon-like peptide-1 receptor agonists; Greece

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***Corresponding author:**
Panagiotis Papantoniou
(ppapantoniou@uniwa.gr)

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1. Introduction

Diabetes is a complex and multifactorial metabolic syndrome characterized by elevated blood glucose levels, representing a global pandemic that affects more than 540 million people (10.5%) worldwide (International Diabetes Federation [IDF], 2021). This figure is predicted to exceed 643 million in 2030 (IDF, 2021). Type 2 diabetes accounts for 90 – 95% of all diabetes cases and is driven by a combination of socioeconomic, environmental, behavioral, and genetic factors. Although Type 2 diabetes primarily

manifests in adulthood, its prevalence among younger populations has risen significantly in recent years, placing a substantial burden on health systems globally. Diabetes is particularly prevalent in Greece, with a reported prevalence of 11.9% (Makrilakis *et al*., 2021), which is higher than the average prevalence among adults in Europe (IDF, 2021). According to data from the Greek e-prescription system, there were 1.17 million diabetes patients in Greece in 2022, with 91.84% of these cases being Type 2 diabetes.

If not controlled in its early stages, Type 2 diabetes can lead to numerous complications, including macrovascular and microvascular issues. Cardiovascular diseases are the most common diabetes-related complications, severely affecting approximately 32% of patients (Einarson *et al*., 2018). These complications are the primary causes of death among patients with Type 2 diabetes, with cardiovascular diseases responsible for half of these deaths (Morrish *et al*., 2001). Patients with Type 2 diabetes are more likely to succumb to cardiovascular diseases than those without Type 2 diabetes (Huxley *et al*., 2006). Unsurprisingly, diabetes-related complications negatively impact patients' health-related quality of life (HRQoL), with uncontrolled patients experiencing significant deteriorations in their quality of life compared to those who are well-managed (Rubin & Peyrot, 1999; UKPDS, 1999).

Diabetes imposes a substantial financial burden on health systems and societies, with the IDF estimating that approximately USD 850 billion was spent globally on treating diabetes and its related complications in 2017. This figure is predicted to exceed USD 1 trillion by 2030 (IDF, 2021). The majority of diabetes-related costs are attributed to complications, which can be avoided through access to innovative treatments that ensure effective disease control. A report by Kanavos *et al*. (2012) showed that in the EU5, the cost of pharmacotherapies used to treat diabetes-related complications was 3 times higher than the drug acquisition costs for treating diabetes.

The primary aim of diabetes therapy is to prevent the manifestation of diabetes-related complications and to improve patients' HRQoL, which requires adequate glycemic control (Hemoglobin A1C [HbA1c] <7%). Current therapeutic options for Type 2 diabetes include biguanides, sulfonylureas, thiazolidinediones, dipeptidyl peptidase-4 inhibitors, sodium-glucose co-transporter-2 inhibitors, meglitinides, glucagon-like peptide-1 (GLP-1) receptor agonists, and insulin. Metformin, along with lifestyle modifications, is the most commonly employed first-line treatment. However, due to the progressive and chronic nature of the disease, most patients require therapy intensification with the coadministration of injectable or oral therapies, along with insulin, to achieve glycemic control (Davies *et al*., 2018; Buse *et al*., 2020).

The American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD) highlight the importance of managing cardiovascular risk in diabetic patients as early as possible, recommending the use of medications that reduce this risk. The ADA Standards of Care (2022) specifically recommend GLP-1 receptor agonists or sodium-glucose cotransporter-2 (SGLT-2) inhibitors for diabetic patients with established cardiovascular disease.

In April 2020, the European Medicines Agency (EMA) granted marketing authorization for the first GLP-1 analog that is orally administered daily. According to the EMA, oral semaglutide is indicated for the treatment of Type 2 diabetes patients who are inadequately controlled, either as monotherapy when metformin is not appropriate or in combination with other medications. The efficacy and safety of oral semaglutide were evaluated in the PIONEER clinical trial program, specifically in PIONEER 2, 3, and 4, which were 52-week, double-blind, double-dummy, active- and placebo-controlled, parallel-group, multicenter, multinational trials. These trials compared oral semaglutide 14 mg with empagliflozin 25 mg, sitagliptin 100 mg, and liraglutide 1.8 mg (Pratley *et al*., 2019; Rodbard *et al*., 2019; Rosenstock *et al*., 2019). The treatment policy estimand was used to consider clinical efficacies for all patients, regardless of treatment discontinuation. The PIONEER trials examined a range of single and composite outcomes over 52 weeks, providing a clinically meaningful assessment of the effectiveness of these different treatments (Pratley *et al*., 2019).

The present analysis investigated the cost per patient of achieving seven treatment goals with oral semaglutide 14 mg versus empagliflozin 25 mg, sitagliptin 100 mg, and liraglutide 1.8 mg from the perspective of the Greek third-party payer (EOPYY). The treatment targets examined were: (i) HbA1c ≤6.5%, (ii) HbA1c <7%, (iii) ≥1%-point HbA1c reduction, (iv) HbA1c <7% without hypoglycemia and no weight gain, (v) weight loss ≥5%, (vi) weight loss ≥10%, and (vii) ≥1%-point HbA1c reduction and weight loss ≥3%.

2. Data and methods

2.1. Clinical effectiveness

Clinical effectiveness data on the percentage of patients achieving the seven examined treatment targets were retrieved from the PIONEER 2, 3, and 4 clinical trials, where oral semaglutide 14 mg was compared with empagliflozin 25 mg, sitagliptin 100 mg, and liraglutide 1.8 mg (Rodbard *et al*., 2019; Rosenstock *et al*., 2019; Pratley *et al*., 2019). This study utilized data on the percentage of patients achieving treatment goals at 52 weeks (Table 1).

Table 1. Percentage of patients achieving clinical targets

Treatment targets	Oral semaglutide 14 mg (%)	Empagliflozin 25 mg (%)
Achieved in PIONEER 2		
HbA1c ≤6.5%	47.40 (2.55)	21.73 (2.11)
HbA1c ≤7%	66.15 (2.41)	43.19 (2.53)
≥1%-point HbA1c reduction	63.28 (2.46)	42.67 (2.53)
HbA1c <7% without hypoglycemia and no weight gain	55.73 (2.53)	39.0 (2.50)
Weight loss ≥5%	40.41 (2.50)	39.16 (2.49)
Weight loss ≥10%	15.03 (1.82)	7.83 (1.37)
≥1.0%-point HbA1c reduction and weight loss ≥3%	42.71 (2.52)	26.44 (2.26)
Achieved in PIONEER 3		
HbA1c ≤6.5%	33.64 (2.27)	13.53 (1.64)
HbA1c ≤7%	54.84 (2.39)	31.65 (2.23)
≥1%-point HbA1c reduction	58.06 (2.37)	37.61 (2.32)
HbA1c<7% without hypoglycemia and no weight gain	44.93 (2.39)	19.95 (1.91)
Weight loss ≥5%	33.79 (2.27)	11.44 (1.52)
Weight loss ≥10%	11.03 (1.50)	2.52 (0.75)
≥1%-point HbA1c reduction and weight loss ≥3%	37.79 (2.33)	11.70 (1.54)
Achieved in PIONEER 4		
HbA1c ≤6.5%	43.27 (2.99)	32.71 (2.86)
HbA1c ≤7%	60.73 (2.94)	55.02 (3.03)
≥1%-point HbA1c reduction	58.55 (2.97)	51.30 (3.05)
HbA1c <7% without hypoglycemia and no weight gain	56.36 (2.99)	48.33 (3.05)
Weight loss ≥5%	44.73 (3.00)	24.54 (2.62)
Weight loss ≥10%	16.36 (2.23)	7.43 (1.60)
≥1%-point HbA1c reduction and weight loss ≥3%	43.64 (2.99)	28.62 (2.76)

Note: The data are expressed as % (*SD*).
Abbreviations: HbA1c: Hemoglobin A1C; SD: Standard deviation.

2.2. Cost data

The present study adopted a third-party payer perspective (using EOPYY); thus, only direct medical costs were considered (Tables 2 and 3). Costs for oral semaglutide 14 mg, empagliflozin 25 mg, and liraglutide 1.8 mg were calculated over 52 weeks, based on the retail prices of the examined medicines, excluding the patients' copayments. Following the PIONEER protocol, treatments were administered at the maximum daily doses, with a daily injection of 1.8 mg of liraglutide requiring one needle per day. The costs associated with lancets and blood glucose test strips were not considered, as it was assumed that resource usage was similar across the examined treatments.

2.3. Examination of the short-term cost-effectiveness

A cost-of-control model was developed in Microsoft Excel (version 2021, Microsoft Corporation, United States of America [USA]) to examine the cost per patient achieving seven treatment goals with oral semaglutide 14 mg compared to empagliflozin 25 mg, sitagliptin 100 mg, and liraglutide 1.8 mg (Table 1). To calculate the cost of control for each medication for each target, the annual treatment cost was divided by the percentage of patients achieving each treatment goal at 52 weeks. This method provides a clinically meaningful and easy-to-understand examination of the cost of control and has been widely utilized in similar studies published across various therapeutic categories and diseases (Hunt *et al.*, 2019; Hansen *et al.*, 2020). In addition, no discounting was applied due to the short-term nature of the present analysis.

2.4. Sensitivity analysis

To account for the uncertainty in clinical outcomes, a probabilistic sensitivity analysis (PSA) was performed utilizing a Monte Carlo simulation based on the standard errors of the proportion of patients achieving the treatment targets. By sampling the percentage of patients achieving

Table 2. Drug acquisition costs

Cost of interventions	Pharmacy selling price (EUR)	Copayment (%)	Payer cost (EUR)	Payer cost per day (EUR)	Reference
Oral semaglutide 14 mg	110.43	10	99.39	3.31	Ministerial decree (67328/December 29, 2023)
Empagliflozin 25 mg	48.19	10	43.37	1.45	
Sitagliptin 100 mg	22.19	10	19.97	0.71	
Liraglutide 1.8 mg	93.87	10	84.48	4.22	

Table 3. Consumables cost

Consumable costs	Reimbursed price	Co-payment	EOPYY cost	EOPYY cost/needle	Reference
NOVOFINE 32G 0.23/0.25×6 mm×100 units	9.18	0%	9.19	0.09	Government Gazzete (FEK B' 4045/November 17, 2017)

Note: EOPYY: Greek third-party payer.

treatment targets, the cost of control for each medication was calculated and repeated 10,000 times. From these iterations, the average cost of control for each medication was determined, along with the 95% confidence interval, using the percentile method.

3. Results

3.1. Annual treatment costs

The annual treatment costs for oral semaglutide 14 mg, empagliflozin 25 mg, and sitagliptin 100 mg were estimated to be EUR 1,210.04, EUR 528.04, and EUR 260.51, respectively. The annual treatment cost of liraglutide 1.8 mg was EUR 1,542.87, of which EUR 33.53 (2.17%) was attributed to needles (Figure 1). Oral semaglutide had a higher annual treatment cost than empagliflozin 25 mg and sitagliptin 100 mg by EUR 681.99 (129.16%) and EUR 949.52 (364.48%), respectively. Liraglutide 1.8 mg had the highest annual treatment costs among all examined treatments, driven by the use of the highest daily dose (as compared to 1.2 mg or 1.5 mg) as specified in the summary of product characteristics of the product.

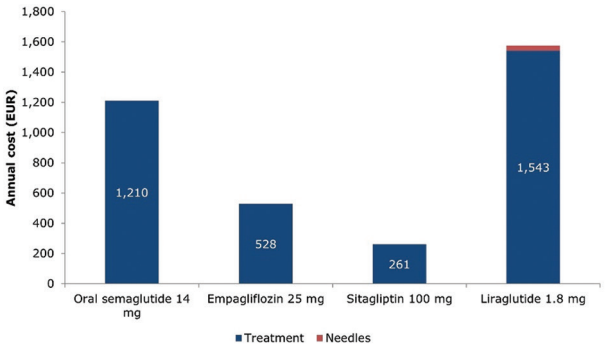

Figure 1. Annual treatment cost (EUR 2024). Figure created using Microsoft Excel

3.2. Number of patients needed to treat for one patient to achieve a treatment target

Across all PIONEER trials, the number of patients needed to treat for one patient to achieve a treatment target was lower with oral semaglutide compared to the other medications. Specifically, in PIONEER 2, the number needed to treat (NNT) with oral semaglutide was 2.11 for achieving HbA1c ≤6.5%, 1.51 for HbA1c ≤7%, and 1.58 for a ≥1%-point HbA1c reduction. In contrast, the NNT for empagliflozin 25 mg was 3.60, 2.32, and 2.34, respectively (Figure 2). For weight loss targets, the NNT with oral semaglutide was 2.47 and 6.66 to achieve ≥5% and ≥10% weight loss, respectively, compared to 2.55 and 12.77 with empagliflozin 25 mg (Figure 2).

In the PIONEER 3 trial, the NNT with oral semaglutide 14 mg was 2.97 for achieving HbA1c ≤6.5%, 1.82 for HbA1c ≤7%, and 1.72 for a ≥1%-point HbA1c reduction, while the NNT with sitagliptin 100 mg was 7.39, 3.16, and 2.66, respectively (Figure 3). For weight loss targets, the NNT with oral semaglutide was 2.96 and 9.06 to achieve ≥5% and ≥10% weight loss, respectively, compared to 8.74 and 39.73 with sitagliptin 100 mg (Figure 3).

Similarly, in PIONEER 4, the NNT with oral semaglutide 14 mg was 2.31 for achieving HbA1c ≤6.5%, 1.65 for HbA1c ≤7%, and 1.71 for a ≥1%-point HbA1c reduction, while the NNT for liraglutide 1.8 mg was 3.06, 1.82, and 1.95, respectively (Figure 4). For weight loss targets, the NNT with oral semaglutide was 2.24 and 6.11 to achieve ≥5% and ≥10% weight loss, respectively, compared to 4.08 and 13.45 with liraglutide 1.8 mg (Figure 4).

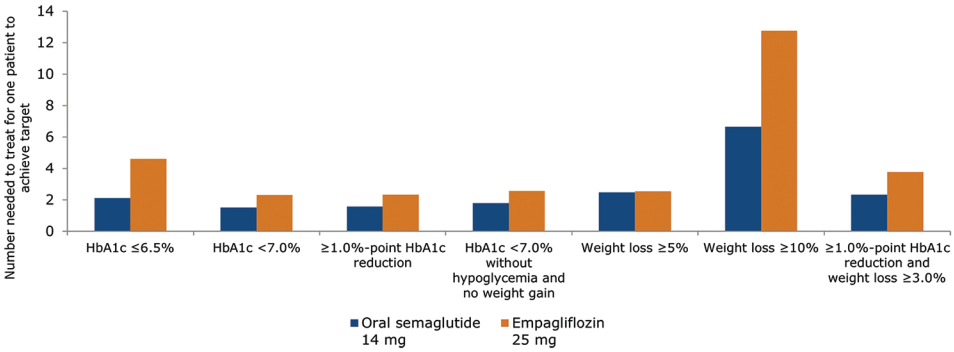

Figure 2. Number needed to treat (PIONEER 2). Figure created using Microsoft Excel

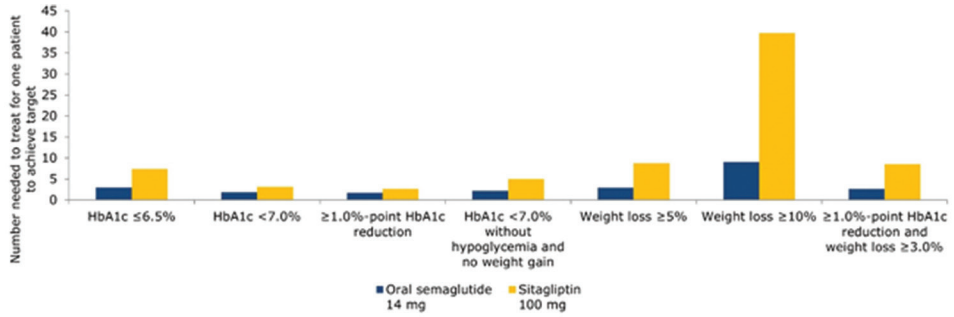

Figure 3. Number needed to treat (PIONEER 3). Figure created using Microsoft Excel

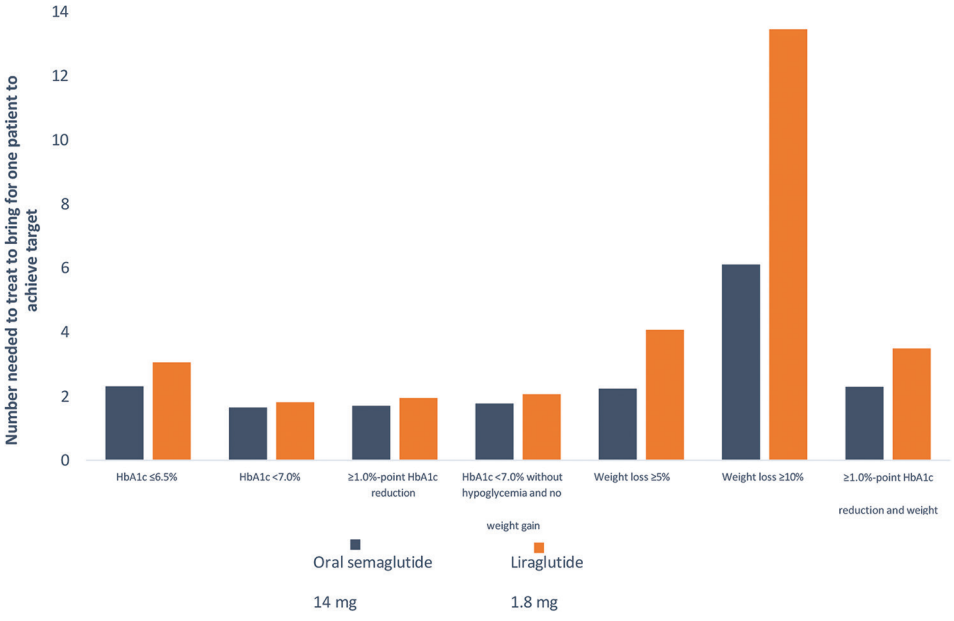

Figure 4. Number needed to treat (PIONEER 4). Figure created using Microsoft Excel

3.3. Cost per patient achieving treatment targets

Based on PIONEER 2, the cost per patient achieving treatment targets with oral semaglutide 14 mg was higher than that of empagliflozin 25 mg across all assessed outcomes (Figure 5). Specifically, for the targets of HbA1c ≤6.5% and HbA1c <7%, the cost difference

in favor of empagliflozin was EUR 122.78 and 606.85, respectively. The cost difference in favor of empagliflozin increased significantly to EUR 1,645.80 and 1,311.67 when examining the targets of weight loss ≥5% and weight loss ≥10%, respectively (Table 4).

Based on PIONEER 3, the cost per patient achieving treatment targets with oral semaglutide 14 mg was higher than that of sitagliptin 100 mg across all assessed outcomes (Figure 6). Specifically, for the targets of HbA1c ≤6.5% and HbA1c <7%, the cost difference in favor of sitagliptin was EUR 1,671.80 and 1,383.46, respectively. The cost difference in favor of sitagliptin remained relatively high at EUR 1,303.82 and 616.42 when examining the targets of weight loss ≥5% and weight loss ≥10%, respectively (Table 5).

On the contrary, based on PIONEER 4, the cost per patient achieving control was lower with oral semaglutide 14 mg compared to liraglutide 1.8 mg across all seven treatment targets (Figure 7). Specifically, for the targets of HbA1c ≤6.5% and HbA1c <7%, the cost difference in favor of oral semaglutide 14 mg was EUR 2,022.47 and 872.64, respectively. The cost difference in favor of oral semaglutide 14 mg remained significantly high at EUR 3,719.66 and 13,807.92 when examining the targets of weight loss ≥5% and weight loss ≥10%, respectively (Table 6).

3.4. Sensitivity analysis

The PSA demonstrated that the base case results were stable when sampling around the mean values of the efficacy model inputs (Table 7). The PSA results were

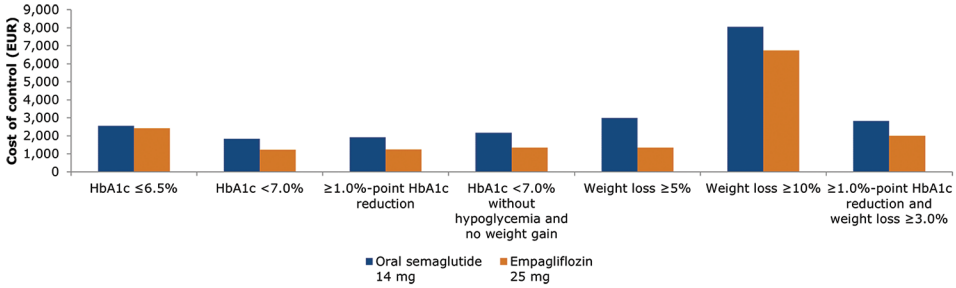

Figure 5. Cost per patient achieving treatment targets (PIONEER 2). Figure created using Microsoft Excel

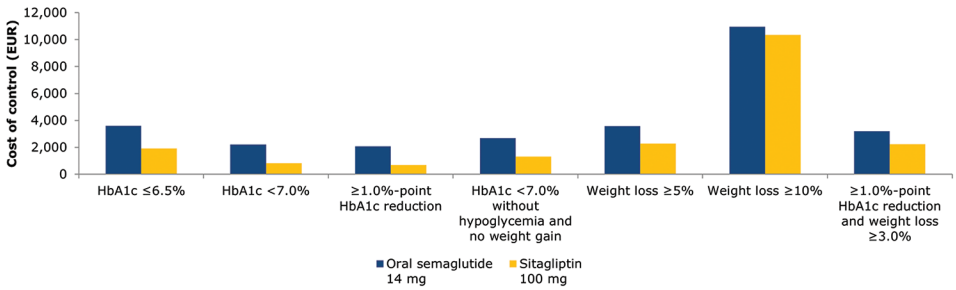

Figure 6. Cost per patient achieving treatment targets (PIONEER 3). Figure created using Microsoft Excel

Table 4. Base case deterministic cost of control comparisons between oral semaglutide and empagliflozin

Treatment targets	Oral semaglutide 14 mg (EUR)	Empagliflozin 25 mg (EUR)	Difference (oral semaglutide – empagliflozin) (EUR)
HbA1c ≤6.5%	2,553.04	2,430.27	122.78
HbA1c ≤7%	1,829.35	1,222.50	606.85
≥1%-point HbA1c reduction	1,912.16	1,237.50	674.66
HbA1c <7% without hypoglycemia and no weight gain	2,171.28	1,353.77	817.51
Weight loss ≥5%	2,994.07	1,348.27	1,645.80
Weight loss ≥10%	8,053.00	6,741.34	1,311.67
≥1%-point HbA1c reduction and weight loss ≥3%	2,833.26	1,997.15	836.11

Abbreviation: HbA1c: Hemoglobin A1C.

Table 5. Base case deterministic cost of control comparisons between oral semaglutide and sitagliptin

Treatment targets	Oral semaglutide 14 mg (EUR)	Sitagliptin 100 mg (EUR)	Difference (oral semaglutide -sitagliptin) (EUR)
HbA1c≤6.5%	3,596.96	1,925.16	1,671.80
HbA1c≤7%	2,206.54	823.07	1,383.46
≥1%-point HbA1c reduction	2,083.95	692.59	1,391.36
HbA1c<7% without hypoglycemia and no weight gain	2,693.11	1,305.57	1,387.54
Weight loss≥5%	3,580.72	2,276.90	1,303.82
Weight loss≥10%	10,965.96	10,349.53	616.42
≥1%-point HbA1c reduction and weight loss≥3%	3,202.17	2,227.14	975.03

Table 6. Base case deterministic cost of control comparisons between oral semaglutide and liraglutide

Treatment targets	Oral semaglutide 14 mg (EUR)	Liraglutide 1.8 mg (EUR)	Difference (oral semaglutide – liraglutide) (EUR)
HbA1c ≤6.5%	2,796.30	4,818.77	−2,022.47
HbA1c ≤7%	1,992.58	2,865.21	−872.64
≥1%-point HbA1c reduction	2,066.83	3,072.84	−1,006.01
HbA1c <7% without hypoglycemia and no weight gain	2,146.84	3,261.94	−1,115.10
Weight loss ≥5%	2,705.37	6,425.03	−3,719.66
Weight loss ≥10%	7,394.67	21,202.59	−13,807.92
≥1%-point HbA1c reduction and weight loss≥3%	2,773.00	5,507.17	−2,734.17

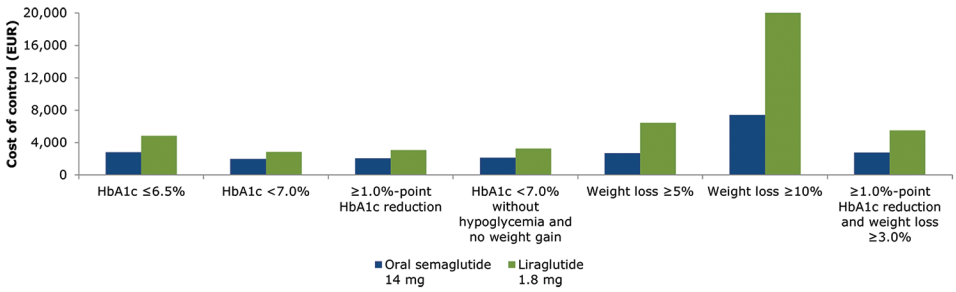

Figure 7. Cost per patient achieving treatment targets (PIONEER 4). Figure created using Microsoft Excel

consistent with the deterministic results, indicating that oral semaglutide 14 mg had a higher cost of control compared to empagliflozin 25 mg and sitagliptin 100 mg, but a lower cost of control compared to liraglutide 1.8 mg (Table 7).

The cost-effectiveness acceptability curves for oral semaglutide 14 mg versus empagliflozin 25 mg and sitagliptin 100 mg are shown in Figures 8 and 9. Although there is no official willingness-to-pay (WTP) threshold in Greece for assessing the cost of control for patients achieving various treatment targets over 52 weeks with different pharmacotherapies, at a WTP of EUR 1000, oral semaglutide 14 mg was cost-effective compared to empagliflozin 25 mg in almost 90% of the PSA iterations, except for the weight loss targets (Figure 8). When compared to sitagliptin 100 mg, at a WTP of EUR 1000, oral semaglutide was cost-effective in <5% of the PSA iterations, except for the weight loss targets of ≥5% and ≥10%, where oral semaglutide 14 mg was cost-effective in 23.49% and 54.39% of the PSA iterations, respectively (Figure 9). Compared to liraglutide 1.8 mg, oral semaglutide 14 mg demonstrated a lower cost of control in all PSA iterations (with a negative difference in cost of control) across all examined treatment targets (figure not presented).

4. Discussion

This study provides detailed insights into the cost of control for oral semaglutide compared to three alternative treatments in achieving various clinically relevant goals for Type 2 diabetes patients in Greece. Based on clinical

Table 7. Probabilistic sensitivity analysis results

Treatment targets	Oral semaglutide 14 mg (mean cost of control [CI 95%]) (EUR)	Empagliflozin 25 mg (mean cost of control [CI 95%]) (EUR)	Difference (Mean cost of control [CI 95%]) (EUR)
Achieved in PIONEER 2			
HbA1c ≤6,5%	2,558.47 (2,313.36 – 2,850.67)	2,454.98 (2,047.4 – 2,997.39)	103.49 (−495.62 – 606.67)
HbA1c ≤7%	1,831.20 (1,707.12 – 1,967.55)	1,225.85 (1,095.43 – 1,384.94)	605.35 (410.22 – 794.31)
≥1%-point HbA1c reduction	1,914.62 (1,776.85 – 2,067.12)	1,242.45 (1,109.10 – 1,398.39)	672.17 (465.14 – 874.57)
HbA1c <7% without hypoglycemia and no weight gain	2,174.04 (1,992.41 – 2,380.76)	1,359.27 (1,202.53 – 1,545.66)	814.77 (557.55 – 1,074.42)
Weight loss ≥5%	3,004.16 (2,669.60 – 3,400.19)	1,353.62 (1,200.22 – 1,537.25)	1,650.54 (1,270.70 – 2,086.01)
Weight loss ≥10%	8,174.05 (6,501.18 – 10,529.62)	6,973.94 (5,014.36 – 10,303.43)	1,200.11 (−2,564.61 – 4,338.69)
≥1%-point HbA1c reduction and weight loss ≥3%	2,844.78 (2,540.64 – 3,215.34)	2,015.04 (1,712.19 – 2,406.99)	829.73 (323.97 – 1,313.93)
Achieved in PIONEER 3			
HbA1c ≤6.5%	3,613.00 (3,173.43 – 4,151.45)	1,952.22 (1,549.32 – 2,526.48)	1,660.78 (939.35 – 2,356.74)
HbA1c ≤7%	2,213.42 (2,036.72 – 2,415.21)	828.07 (723.96 – 957.48)	1,385.35 (1,167.52 – 1,611.25)
≥1%-point HbA1c reduction	2,085.84 (1,932.53 – 2,261.11)	694.87 (618.00 – 790.32)	1,390.96 (1,209.35 – 1,582.54)
HbA1c <7% without hypoglycemia and no weight gain	2,699.76 (2,442.03 – 2,997.96)	1,319.82 (1,097.98 – 1,608.06)	1,379.94 (992.33 – 1,755.92)
Weight loss ≥5%	3,594.87 (3,168.27 – 4,118.14)	2,324.69 (1,801.89 – 3,105.47)	1,270.17 (373.22 – 2,024.59)
Weight loss ≥10%	11,183.28 (8,661.38 – 14,973.42)	11.925.84 (6,597.16 – 24,481.59)	−742.56 (−13,783.15 – 6,117.98)
≥1%-point HbA1c reduction and weight loss ≥3%	3,217.72 (2,861.34 – 3,644.12)	2,271.87 (1,783.89 – 2,983.11)	945.85 (150.48 – 1.608.65)
Achieved in PIONEER 4			
HbA1c ≤6.5%	2,807.89 (2,463.68 – 3,225.66)	4,858.40 (4,125.04 – 5,844.40)	2,050.51 (3,088.36 – 1,203.21)
HbA1c ≤7%	1,998.55 (1,818.28 – 2,206.44)	2,873.78 (2,582.82 – 2,224.35)	875.24 (1,265.36 – 518.05)
≥1%-point HbA1c reduction	2,071.91 (1,877.91 – 2,300.32)	3,082.29 (2,753.74 – 3,472.38)	1,010.38 (1,458.79 – 608.40)
HbA1c <7% without hypoglycemia and no weight gain	2,152.31 (1,941.63 – 2,390.42)	3,273.27 (2,904.20 – 3,715.13)	1,120.95 (1,616.56 – 681.94)
Weight loss ≥5%	2,715.15 (2,384.81 – 3,107.44)	6,501.66 (5,316.08 – 8,120.02)	3,786.51 (5,442.34 – 2,557.33)
Weight loss ≥10%	7,545.44 (5,799.37 – 10,110.13)	22,388.14 (14,916.07 – 36,736.22)	14,842.71 (29,228.28 – 7,042.28)
≥1%-point HbA1c reduction and weight loss ≥3%	2,786.81 (2,447.73 – 3,214.02)	5,555.85 (4,633.53 – 6,809.92)	2,769.04 (4,046.21 – 1,766.97)

Abbreviation: HbA1c: Hemoglobin A1C.

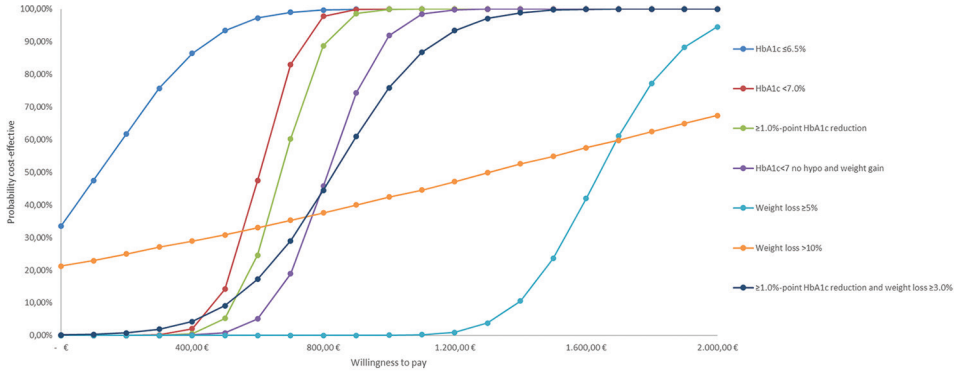

Figure 8. Cost-effectiveness acceptability curve of oral semaglutide 14 mg versus empagliflozin based on PIONEER 2. Figure created using Microsoft Excel

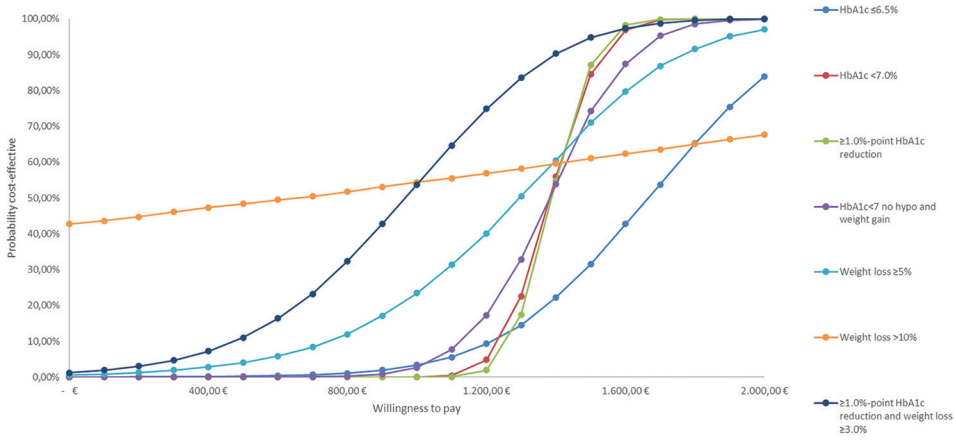

Figure 9. Cost-effectiveness acceptability curve of oral semaglutide 14 mg versus sitagliptin based on PIONEER 3. Figure created using Microsoft Excel

effectiveness results from the PIONEER 2, 3, and 4 trials over a 52-week period, the analysis revealed that while oral semaglutide is cost-effective compared to liraglutide, it may not be as cost-effective as empagliflozin and sitagliptin in achieving the seven treatment targets at its current price.

The treatment targets examined in this study align with modern clinical guidelines for diabetes treatment, which emphasize a comprehensive approach that includes elements beyond glycemic control, such as HbA1c reduction, to improve patients' well-being (Kim *et al.*, 2022; Curry *et al.*, 2018). A significant advantage of this study is its focus on treatment targets outlined in the most recent ADA and EASD clinical guidelines and recommendations, ensuring that the analysis is both applicable and relevant in clinical practice. Another key strength of this study is the use of a straightforward and transparent methodology, which facilitates easy assessment and replication by other interested parties. The model provides clear clinical and cost inputs that can be readily assessed and modified as new clinical evidence becomes available. Specifically, the model allows for the consideration of voluntary discounts when examining the cost of control of medications. This is particularly relevant for payers, as it enables them to calculate the discount applied to the ex-factory price of products to achieve an average cost of control below the WTP threshold.

A crucial consideration in this study is the reliability of its results, given the short-term horizon. Traditional long-term cost-effectiveness models rely on data reported in clinical trials and extrapolate outcomes using risk equations, which are inherently subject to increased uncertainty due to the complexity of Type 2 diabetes. This study aims to complement long-term cost-effectiveness analysis by exploring the cost-effectiveness of these interventions in natural units. Long-term cost-effectiveness analyses provide crucial information regarding the quality-adjusted life years gained by new medications and the total costs associated with achieving these outcomes. Such figures can be compared across different interventions by payers, health technology assessment bodies, and budget holders who seek to maximize value for money.

This study represents the first cost-of-control analysis based on the PIONEER 2, 3, and 4 trials, specifically considering clinical effectiveness after 52 weeks of treatment. Previous short-term cost-effectiveness studies conducted in the USA focused on the percentage of patients achieving treatment targets at 26 weeks. The extended analysis period in this study offers a more reliable assessment of the sustained efficacy and cost-effectiveness of anti-diabetic medications, as the benefits of diabetes treatments can change over time, potentially altering the long-term value of treatments that initially appear cost-effective (Hunt *et al.*, 2021; Hansen *et al.*, 2020). A 52-week timeframe aligns more closely with real-world practices, as most patients with diabetes require lifelong treatment to manage this complex, multifactorial condition. Therefore, exploring the cost-effectiveness of treatments over an extended period allows for more informed and relevant decision-making.

The present study differentiates itself from previous studies by examining the risk of hypoglycemia and weight loss targets (5% and 10%) at 52 weeks. Previous studies have focused almost exclusively on achieving HbA1c targets (Hunt *et al.*, 2021; Hansen *et al.*, 2020). However, focusing solely on glycemic control targets overlooks current treatment guidelines that advocate for a patient-centric perspective, addressing risk factors such as hypoglycemia and body weight, which increase the risk of diabetes-related complications (Handelsman *et al.*, 2015). While most GLP-1 agonists and SGLT-2 inhibitors are

associated with a low risk of hypoglycemia, their efficacy in promoting weight loss varies. Therefore, considering multiple composite outcomes that include glycemic control, hypoglycemia, and weight loss is highly relevant and essential when comparing antidiabetic treatments.

The findings of this study align with previously published short-term cost-effectiveness studies examining oral semaglutide and liraglutide. Specifically, oral semaglutide has been reported to have a lower cost of control for all examined treatment goals compared to liraglutide 1.8 mg in the USA (Hunt *et al.*, 2021; Hansen *et al.*, 2020). Although these findings cannot be directly compared due to differences in the list prices of medicinal products across various regions, oral semaglutide consistently demonstrates a lower cost of control than liraglutide.

However, this study contradicts previous research that indicated a lower cost of control for oral semaglutide compared to sitagliptin (Hunt *et al.*, 2021). Specifically, due to the substantial difference in annual treatment costs – oral semaglutide had a 364% higher annual cost than sitagliptin – it was not cost-effective compared to sitagliptin at a WTP of EUR 1,000. Nevertheless, at the same WTP level, oral semaglutide was cost-effective compared to empagliflozin for all examined treatment targets in over 75% of the PSA iterations. This is primarily due to the smaller difference in annual treatment costs between the two medications, with oral semaglutide having a 129% higher annual cost than empagliflozin.

This study has several limitations. First, it examines treatment target outcomes using a binary classification (patients achieving and not achieving targets), which excludes HbA1c and bone mass index reductions that patients might have experienced despite not achieving the examined thresholds. This means that health improvements that did not achieve specific targets were not captured due to the reporting methods of clinical efficacy used in the PIONEER trials. In addition, this study did not consider safety data, including gastrointestinal issues, which are the most commonly, reported adverse events associated with GLP-1 receptor agonists. For example, a composite treatment target that includes achieving glycemic and weight loss targets without gastrointestinal adverse events could provide valuable information regarding the benefit-risk profile of the examined products. Incorporating such data into the analysis could also allow for the calculation of total costs (including drug acquisition and adverse events) per patient needed to achieve various treatment targets from the third-party payer perspective. However, it is essential to note that PIONEER 2, 3, and 4 reported no statistically significant differences in the risk of Grade 3 and above adverse events, so the contribution of such costs to the overall analysis would likely be minor.

Furthermore, this study does not encompass adherence data or HRQoL data. Previous studies have demonstrated that Type 2 diabetes patients often prefer oral treatments due to the burden of frequent injections (Boye *et al.*, 2011; Ridderstrale *et al.*, 2016). The fear of injectable treatments is a significant factor contributing to therapeutic inertia (Fu & Sheehan, 2016; Khunti *et al.*, 2018; Pantalone *et al.*, 2018). From this perspective, oral semaglutide might offer clinical and non-clinical benefits that are not fully captured in the present analysis. However, given that both sitagliptin and empagliflozin are also orally administered, incorporating adherence data would not likely change the main findings and conclusions of this study dramatically.

A limitation of this study is that it considers only list prices without incorporating confidential paybacks in the form of voluntary discounts or volume-based rebates. Given that such data are not readily available, using the pharmacy selling price and subtracting the patients' contributions is the most reliable approach for determining the medication costs borne by the third-party payer in Greece. Moreover, the third-party payer in Greece has not published a WTP threshold for achieving treatment targets over 52 weeks. While cost-effectiveness acceptability curves can help examine the likelihood of new therapies being cost-effective at various WTP levels, the absence of published guidance on WTP for these treatment targets presents a significant challenge in demonstrating value for money. This implies that the third-party payer in Greece may be reluctant to spend EUR 1,000 for a patient to achieve a treatment target with oral semaglutide over 52 weeks compared to other treatments. Such reluctance is often linked to budget impact concerns that third-party payers consider when making reimbursement decisions. Even if an antidiabetic product is deemed cost-effective, it might still pose an "unaffordable" budget impact burden.

Importantly, this analysis does not include incremental cost-effectiveness ratios, quality-adjusted life years, averted disability-adjusted life years, or cost savings from reduced diabetes-related complications. A long-term cost-effectiveness analysis is essential to fully substantiate the value of oral semaglutide compared to various comparators. Nonetheless, a short-term cost-effectiveness analysis offers a preliminary comparative measure of value for money for payers. In addition, the results are based on a single randomized clinical trial; therefore, more data, especially real-world evidence, is needed to confirm and complement the trial findings with information on adverse events, quality of life, and adherence.

5. Conclusion

This study provides a comprehensive analysis of the short-term cost-effectiveness of oral semaglutide compared to empagliflozin, sitagliptin, and liraglutide for the treatment of Type 2 diabetes in Greece. The findings offer a detailed perspective on the economic implications of reimbursing oral semaglutide in this context. Despite demonstrating superior efficacy over 52 weeks, the substantially higher annual treatment cost of oral semaglutide results in an unfavorable cost of control compared to empagliflozin and sitagliptin. Conversely, oral semaglutide exhibited a significantly lower cost of control when compared to liraglutide.

These results indicate that at its current list price, oral semaglutide is not cost-effective compared to empagliflozin and sitagliptin, despite its high efficacy in achieving treatment targets. The higher cost of control for most outcomes highlights the need for the Greek health technology assessment body to negotiate a net price that ensures the economic viability of the product in Greece.

Stakeholders, including policymakers and decision-makers, should carefully consider these findings, weighing both clinical and economic factors when comparing therapeutic options. The implications of this study extend beyond individual treatment decisions, potentially influencing broader strategies for diabetes management in Greece. As the prevalence and incidence of diabetes continue to rise, reaching the levels of a "silent pandemic" and driving up antidiabetic expenditures, it is crucial for decision-makers to ensure that new medications are cost-effective and have a minimal budget impact. Healthcare professionals can leverage these findings to tailor treatment decisions based on clinical efficacy and cost considerations, thereby maximizing health outcomes while efficiently managing scarce resources.

While oral semaglutide has shown promising clinical results in achieving relevant treatment targets, its high cost presents a challenge in demonstrating its cost-effectiveness compared to specific therapeutic alternatives.

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Conflict of interest

The authors declare they have no conflicts of interest.

Author contributions

Conceptualization: Papantoniou Panagiotis
Investigation: Papantoniou Panagiotis
Methodology: Anastasia Papageorgiou
Writing – original draft: Papantoniou Panagiotis
Writing – review & editing: All authors

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

All the data used are in the manuscript.

Further disclosure

The clinical effectiveness data have been retrieved from the PIONEER 2, 3, and 4 original publications (Rodbard *et al*., 2019; Rosenstock *et al*., 2019; Pratley *et al*., 2019). The price data of the examined medications have been extracted from the official price bulletin published by the Greek Ministry of Health (Ministerial Decree 67328, 2023).

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Global Health Economics and Sustainability

ORIGINAL RESEARCH ARTICLE

Impact of fiscal policy shocks on health outcomes in Sub-Saharan Africa: A panel structural VAR approach

Chukwunonso Gerald Iheoma*

Department of Statistics, Central Bank of Nigeria, Abuja, Nigeria

Abstract

This study investigates the impact of fiscal policy shocks on health outcomes in Sub-Saharan Africa (SSA). It is motivated by health systems' increasing reliance on public funding despite growing macroeconomic uncertainties. This study adopts a regional analysis, sampling five countries with the highest per capita public health expenditure from the Central, Eastern, Southern, and Western African regions. The study employs the panel structural vector autoregression technique and expresses health outcomes as a function of fiscal policy and private health expenditure shocks. The results suggest that fiscal policy shock significantly and positively affects health outcomes in Central and Western Africa. However, health outcomes are resilient to fiscal policy shock in Eastern and Southern regions and to private health expenditure shock in all regions. The study indicates that achieving sustainable improvement in health outcomes in SSA would require policies designed to expand health financing options beyond the traditional public and private funding arrangements.

Keywords: Health outcome; Life expectancy; Fiscal policy; Private expenditure; Shocks

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Mihajlo Jakovljevic M.D. Ph.D. MAE

***Corresponding author:**
Chukwunonso Gerald Iheoma
(iheomanonso@gmail.com)

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1. Introduction

Achieving universal health coverage (UHC) has been a major development priority for sub-Saharan African (SSA) countries because it presents huge opportunities for improving health outcomes. Ensuring health and well-being for all is the third Sustainable Development Goal (SDGs). As a healthy population is required to provide the workforce needed to drive the economic development process, this goal becomes critical for achieving other SDGs and for promoting economic growth and development. In developing countries, there is evidence that a USD1 investment in health could provide households with economic benefits of USD2 – 4, which could translate to 7 – 11% growth in the gross domestic product (GDP; Remes *et al.*, 2020). In SSA, economic benefits arising from investment in health outweigh those of foreign direct investment (Byaro *et al.*, 2022).

Low employment and income levels in the region have resulted in growing reliance on government expenditure for financing the health system. The dependence of health systems on public funding is supported by the evidence that increasing public health expenditure leads to an increase in life expectancy and a decrease in infant and under-five mortality rates in middle- and high-income countries, and these outcomes

increase as health expenditure improves (Rezapour *et al*., 2019; Onofrei, 2021). However, despite public budgetary allocation to the health system in SSA, health outcomes in the region have only responded marginally, raising concerns about the adequacy and sustainability of health expenditure in improving health outcomes in the region.

In recent times, there have been growing concerns among policymakers in SSA about the sustainability of public financing for health systems. These concerns arise from the cost implications of providing health care to a growing population and the vulnerability of SSA fiscal operations to economic uncertainties. Economic uncertainties limit the government's ability to generate and allocate revenue by reducing the tax base or taxable income, a condition known as fiscal shocks. The occurrence of fiscal shocks could force the adoption of austerity measures, which could produce adverse effects on the health system. For example, the financial crisis of 2009 in Greece forced the government to adopt austerity measures, causing a reduction in public expenditure. Ifanti *et al*. (2013) found that this reduction affected the structure and functioning of public hospitals, leading to a shortage of drugs and medical supplies and understaffing. Health promotion initiatives targeted toward disease prevention were curtailed.

Fiscal shocks can have a profound impact on health outcomes. Schakel *et al*. (2018) found a 3% reduction in health expenditure arising from fiscal shocks in 32 Organization for Economic Cooperation and Development countries and that the likelihood of health expenditure reduction increased in the years following the shock. This finding is supported by those of Karanikolos *et al*. (2013), confirming that the strict fiscal austerity measures adopted by Greece, Spain, and Portugal as a response to the fiscal shocks caused by the 2008 financial crisis led to recession in those economies and that its adverse effect on the healthcare systems continues to grow. There have been increasing incidences of suicides and outbreaks of infectious diseases in these countries, and budget cuts have resulted in restricted access to health care. By contrast, the crisis has had no significant effect on health outcomes in Iceland because of its expansionary fiscal policy.

The effects of fiscal shocks on health outcomes appear to be homogeneous, irrespective of their form of manifestation or source. The effects of fiscal shocks manifesting in the form of the International Monetary Fund's fiscal conditionalities have been studied in 16 Western African countries. Evidence suggests that such shock induces reduction in government health expenditure per capita by 0.248% and impedes the achievement of universal health care (Stubbs *et al*., 2017). Fiscal shock manifesting in the form of an unexpected fiscal rule (a rule that restrains government spending above a pre-determined threshold) could have an adverse effect on health expenditure and outcomes (Schakel *et al*., 2018). The fiscal shock emanating from the financial crisis in Greece forced the government to adopt austerity measures, causing a reduction in public spending with adverse effects on the structure and functioning of the public health system in the country (Ifanti *et al*., 2013).

The adverse effect of fiscal shocks on health outcomes could be better appreciated by understanding how fiscal actions affect health outcomes; therefore, various studies have investigated this effect. A study on the impact of public health expenditure on health outcomes in SSA found that health expenditure has a significant but inelastic effect on reducing mortality rates (Arthur & Oaikhenan, 2017). In a related study on developing countries in the European Union, Onofrei (2021) found the existence of a long-run equilibrium relationship between public health expenditure and health outcomes. Evidence from country-level studies in Nigeria suggests that an increase in public health expenditure improves life expectancy and reduces infant mortality rates in the long run (Edeme *et al*., 2017; Oluwatoyin *et al*., 2015). In a similar study in Ghana, Boachie *et al*. (2018) found that public health expenditure contributed to improvements in health outcomes. A 10% increase in public health expenditure prevents 0.102 – 4.4 infant and under-five deaths per 1000 live births while increasing life expectancy at birth by 0.77 – 47 days per year.

This study's objective is to empirically determine the effect of fiscal policy shocks on health outcomes in SSA. From the policy perspective, understanding the reaction of health outcomes to fiscal shocks provides evidence for developing policies that can guarantee sustained improvement of health outcomes in the event of such shocks. The study is timely and policy-relevant in view of the COVID-19 pandemic, which has exposed the vulnerabilities of health systems in the region, and because SSA economies rely mainly on commodity export for revenue, which makes them susceptible to global economic uncertainties. The study contributes to the existing literature by highlighting the effects of fiscal policy shocks on health outcomes, allowing policymakers to appreciate the imperatives of building resilient health systems. To the best of our knowledge, no study on the subject has been conducted in the region, creating a gap in an evidence base for sustainable health outcome improvement policies.

2. Data and methods

2.1. Data

The data for the study variables were obtained from the World Bank's World Development Indicators database.

Annual data are used, covering a period of 20 years (2000 – 2019) from 20 countries in SSA (Appendix A1). Our variables of interest are life expectancy, government per capita health expenditure, and private per capita health expenditure. Life expectancy refers to the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth remain unchanged throughout its life. Government per capita health expenditure is the average amount of money spent by the government to provide healthcare services per citizen. Private per capita health expenditure is the average household health expenditure for each household member; it is introduced as a control variable to determine if it moderates the potential negative impact of fiscal policy shock. Public and private health expenditures per capita are measured in US dollars.

2.2. Method

The study adopts the panel structural vector autoregression (SVAR) model developed by Pedroni (2013). The model addresses the challenge of insufficient time series data for an economic unit and accounts for two major features that characterize panel data. First, it accounts for substantial heterogeneity that is likely to be present across the individual members of the panel. Second, it accounts for possible cross-sectional dependence that may be present in the panel as economic units respond not only to their own idiosyncratic shocks but also to common shocks that affect all units in the panel.

The model requires a minimum set of restrictions and produces two features – impulse response function (IRF) and forecast error variance decomposition, respectively, reflecting the size of the impact and transmission mechanism of policy shocks (Cazacu, 2015). We specify a panel SVAR model in the following form:

$$B_i Y_{it} = A_i Y_{it-p} + Z_i \varepsilon_{it} \quad \text{(I)}$$

Where B_i is a 3 × 3 matrix of contemporaneous effects, Y_{it} is a 3 × 1 vector matrix of estimable endogenous variables (fiscal shock [v], private health expenditure shock [z], and health outcomes [x]). A_i is a 3 × 3 matrix of coefficients of endogenous variables, representing the IRFs of the shocks to the elements of $Y_{it\text{-}p}$. $Y_{it\text{-}p}$ is a matrix of lagged endogenous variables. Z_i is a 3 × 3 matrix that captures the linear relations between structural shocks and those of the reduced-form model. ε_{it} is a 3 × 1 vector matrix of composite structural shocks. These composite shocks are distributed independently over time but may be cross-sectional dependent. i, t, and p represent the individual unit in the panel, time, and optimal lag length, respectively.

We consider a common representation of the composite shocks, such that $\varepsilon_{it} = \lambda_i \pi_t + \bar{\pi}_{it}$, where the two categories of mutually orthogonal structural shocks π_t and $\bar{\pi}_{it}$ represent, respectively, the common structural shocks shared by all panel members and member-specific idiosyncratic structural shocks. λ_i is the member-specific loading coefficients for the common shocks. Following Boiciuc (2015), to estimate a SVAR model, the reduced form is determined by multiplying Equation (1) by an inverse matrix B_0^{-1}, which produces the following:

$$B_i^{-1} B_i Y_{it} = B_i^{-1} A_i Y_{it-p} + B_i^{-1} Z_i \varepsilon_{it} \quad \text{(II)}$$

Arranging Equation (2) in a more compact form yields the following:

$$Y_{it} = \phi Y_{it-p} + \psi_{it} \quad \text{(III)}$$

where $\phi = B_i^{-1} A_i$ and $\psi_{it} = B_i^{-1} Z_i \varepsilon_{it}$. ψ_{it} is a 3 × 1 vector of structural shocks in a reduced form that is orthogonal and normally distributed. The relation between structural shocks and reduced-form shocks is expressed as follows:

$$B_i \psi_{it} = Z_i \varepsilon_{it} \quad \text{(IV)}$$

Estimating Equation (1) may pose some difficulties because of parameter proliferation, that is, the number of estimable parameters exceeding the number of equations. To overcome this challenge and resolve the problem of identification, we impose restrictions[1] on some parameters of the matrix of contemporaneous effects, assuming that the shock to fiscal policy affects health outcomes and private per capita health expenditure contemporaneously. Shocks to private per capita health expenditure may not impact fiscal operations contemporaneously, and shocks to health outcomes affect neither fiscal operations nor private per capital health expenditure contemporaneously. This assumption informs the ordering of the variables.

We use the recursive approach for identification restriction, which allows us to set the upper triangular section of the matrix of contemporaneous effects to zero and restrict Z_i to an identity matrix (Caldara & Kamps, 2008), such that the diagonal elements are the loading coefficients λ_i. After the initial period, the variables in the system are allowed to interact freely. For example, private health expenditure shock can affect health outcomes in all periods after the one in which the shock occurs. This operation produces the following:

[1] We use the formula $(n_2\text{-}n)/2$ to determine the number of restrictions to be imposed, where n is the number of endogenous variables.

$$\begin{pmatrix} 1 & 0 & 0 \\ \lambda_{21} & 1 & 0 \\ \lambda_{31} & \lambda_{32} & 1 \end{pmatrix} \begin{pmatrix} \psi_{itv_{it}} \\ \psi_{itz_{it}} \\ \psi_{itx_{it}} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_{itv_{it}} \\ \varepsilon_{itz_{it}} \\ \varepsilon_{itx_{it}} \end{pmatrix} \quad \text{(V)}$$

Before estimating the model, we conducted a unit root test on the variables using the Im–Pesaran–Shin (IPS; Im *et al*., 2003) and the Levin–Lin–Chu (Levin *et al*., 2002) techniques. Both techniques assume cross-sectional independence and that all series are non-stationary under the null hypothesis. Further, we conducted a regional analysis. In each of the four regions in SSA,[2] Central, Eastern, Southern, and Western (Appendix A2), we selected five countries with the highest per capita public health expenditure. The aim was to achieve relative regional homogeneity and ensure that results are appropriate for region-specific policies. All variables were demeaned at the country level to eliminate time-invariant fixed effects and then first differentiated to guarantee stationarity (Pedroni, 2013).

3. Results

3.1. Preliminary analysis

Table 1 shows the regional summary statistics of the study variables. Average per capita public health expenditure in SSA differs markedly across the regions. The Southern African region has the largest average per capita public health expenditure (USD159.8), followed by Eastern Africa (USD122.5), and the Central African region records the least (USD17.5). A similar distribution is observed for private per capita health expenditure; its largest averages are recorded in the Southern African (USD113.4) and Eastern African (USD88.5) regions, while the lowest average expenditure is seen in Central Africa (USD19.7). Life expectancy averages 65.2 years in the Eastern and 60.4 years in the Western regions, while it is 54 years in the central and Southern regions.

Figure 1 highlights the regional stylized facts in public and private per capita health expenditures and life expectancy over the study period. While life expectancy in Central Africa maintained a steady and moderate increase over the period, from 47.8 years in 2000 to 60.5 years in 2019, public and private per capita expenditures exhibited a rather unstable movement. Both commenced a steady increase from about USD4 in 2000. While public per capita health expenditure peaked at USD31.2 in 2013, its private counterpart was highest at USD25.3 in 2014. Thereafter, both maintained a steady decline, reaching USD15.5 and USD19.9 in 2019, respectively. A steady increase is observed in life expectancy in the Eastern African sub-region from 60.9 years in 2000 to 69.1 years in 2019. Public and private per capita health expenditures in the sub-region maintained a stable rise from USD73 and USD29 in 2000 to USD199.8 and USD135.2 in 2019, respectively.

Life expectancy exhibited similar patterns in Southern and Western Africa, growing moderately from 50.8 years in 2000 to 62.4 years in 2019 in the former and from 57.4 years to 64 years over the same period for the latter. In the Southern sub-region, public per capita health expenditure recorded an unstable growth from USD72.7 in 2000 and reached its highest value of USD226.2 in 2018, before declining to USD217.5 in 2019. Private per capita health expenditure rose from USD70.3 in 2000, peaked at USD164.6 in 2011, and thereafter maintained a steady decline, reaching USD115.8 in 2019. In Western Africa, public per capita health expenditure recorded its highest value of USD86.5 in 2013. It declined to USD63.8 in 2015 and grew moderately afterward, reaching USD70.6 in 2019. Similarly, private per capita health expenditure was at its peak at USD126.9 in 2008. Thereafter, it declined and maintained a rather unstable pattern, reaching USD81.9 in 2019.

Table 1. Summary statistics

Region	Variable	Mean	Std. Dev.	Min.	Max.	Obs.
Central Africa	Public expenditure	17.52	20.52	1.67	89.08	100
	Private expenditure	19.66	12.60	2.96	57.86	100
	Life expectancy	54.53	6.73	44.06	69.02	100
Eastern Africa	Public expenditure	122.51	163.41	2.75	620.39	100
	Private expenditure	88.52	92.57	5.11	364.83	100
	Life expectancy	65.23	7.43	50.80	74.51	100
Southern Africa	Public expenditure	159.84	97.17	12.39	388.23	100
	Private expenditure	113.38	80.69	8.63	287.24	100
	Life expectancy	54.07	7.34	42.52	69.59	100
Western Africa	Public expenditure	57.77	45.54	4.61	176.53	100
	Private expenditure	81.02	72.83	10.00	342.12	100
	Life expectancy	60.37	6.65	49.48	72.98	100

[2] Western Africa: Cabo Verde, Equatorial Guinea, Gabon, Ghana, and Cote d'Ivoire. Central Africa: Angola, Rwanda, Congo, Republic of, Central African Republic, and Chad. Eastern Africa: Seychelles, Mauritius, Kenya, Sudan, and Tanzania. Southern Africa: South Africa, Botswana, Namibia, Eswatini, and Lesotho.

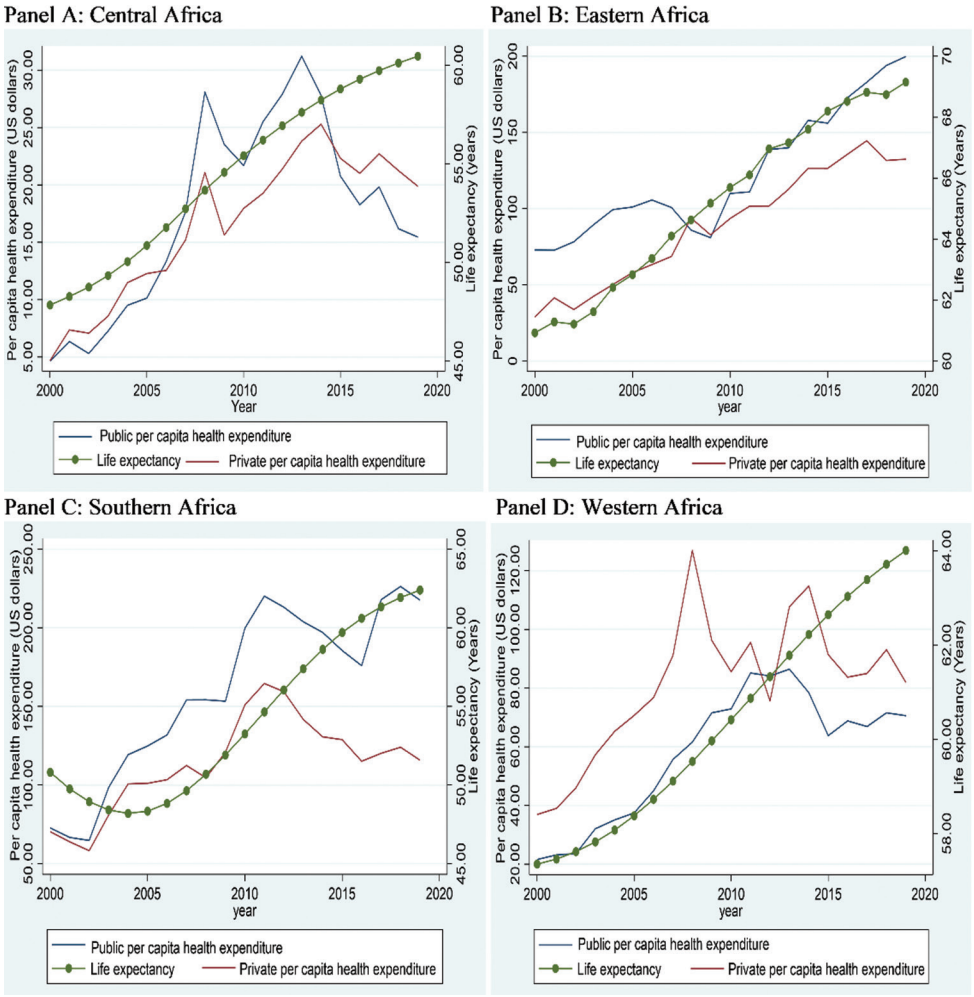

Figure 1. Trends in regional public and private per capita health expenditures and life expectancy. Image created with Stata

From the foregoing, divergent movement is observed among the variables in the Central, Southern, and Western sub-regions, while a relative co-movement is observed in the Eastern sub-region. This suggests that while changes in life expectancy may be uncorrelated with the public and private per capita health expenditures in the Central, Southern, and Western sub-regions, the reverse may be the case in the Eastern region.

Table 2 presents the unit root results of the variables. Only life expectancy is stationary at level and first differences for the two test techniques. Public and private per capita health expenditures are not stationary at level but stationary at first difference for both techniques.

3.2. Estimation results

The impulse response graphs are those of the composite shocks. The choice of the composite shocks is informed by its incorporation of idiosyncratic and common shocks, presenting a more compact and comprehensive overview of the responses of endogenous variables to exogenous shocks.

Figure 2 shows the impulse response of health outcomes to fiscal policy and private health expenditure per capita shocks in Central Africa. There is a positive instantaneous impact of fiscal policy shock on health outcomes (Panel 3). The shock causes a consistent annual improvement in life expectancy, cumulating to about 1.5 years by the 8th year. Private health expenditure shocks have a neutral impact (Panel 6).

As shown in Figure 3, an insignificant impact of fiscal policy and private health expenditure per capita shocks to health outcomes is observed for Eastern Africa (Panels 3 and 6, respectively). Similar results are observed for Southern Africa (Panels 3 and 6 in Figure 4).

The results for the Western African region are slightly similar to those for Central Africa (Figure 5). While shock

Table 2. Unit root test results

Region	Variable	IPS		LLC	
		Level	1st Diff.	Level	1st Diff.
Central Africa	Public expenditure	−0.08	−7.15***	−0.68	−8.62***
	Private expenditure	0.12	−4.82***	−1.67	−6.01***
	Life expectancy	−17.59***	−6.72***	−24.36***	−9.20***
Eastern Africa	Public expenditure	3.36	−7.43***	2.47	−8.80***
	Private expenditure	0.71	−9.90***	−0.73	−11.65***
	Life expectancy	−10.87***	−6.78***	−13.71***	−6.16***
Southern Africa	Public expenditure	0.13	−7.15***	−1.88	−6.59***
	Private expenditure	−1.10	−5.12***	−2.26	−6.16***
	Life expectancy	−30.92***	−15.32***	−34.17***	−16.13***
Western Africa	Public expenditure	1.02	−6.87***	−0.36	−8.43***
	Private expenditure	−0.31	−7.67***	−1.65	−9.06***
	Life expectancy	−12.70***	−18.85***	−18.26***	−13.55***

Notes: *, **, *** stand for 10%, 5%, and 1% level of significance, respectively. IPS: Im–Pesaran–Shin technique; LLC: Levin–Lin–Chu technique.

to fiscal policy produces significant impact on health outcomes (Panel 3), shock to private health expenditure per capita produces insignificant impact (Panel 6). Fiscal policy shock results in a steady annual increment in health outcomes, starting from the 2nd year and cumulating to about 12 months gained by the 8th year.

3.3. Variance decomposition

Table 3 shows the degree of the contribution of fiscal and private per capita health expenditure shocks to changes in health outcomes. In Central Africa, a greater proportion of the variations in health outcomes is attributed to fiscal policy shocks. There is an incremental impact of fiscal shocks over the 8-year horizon, starting from 0.02% in the 1st year to 0.12% in the 8th year. A similar pattern is observed in Western Africa, from almost zero in the year, the shock occurs to 0.10% in year 8.

However, in Eastern and Southern Africa, the converse appears to be the case; private health expenditure shock incrementally accounts for the observed variations in health outcomes, starting from <0.01% effect in both sub-regions to 0.03% and 0.05% in Eastern and Southern Africa, respectively.

4. Discussion

The significant positive effects of fiscal policy shocks in Central and Western Africa may be explained by the existence of well-functioning mechanisms through which positive changes in fiscal operations of the central government get cascaded to the health system and health outcomes. These mechanisms may involve the efficient allocation and utilization of funds, as well as transparent accountability processes. Investing in education, healthcare, and social welfare programs can have long-term positive effects on human outcomes. Improved investments in these sectors can mitigate the adverse effect of fiscal shock and ensure sustained positive health outcomes. Further, the health systems in these sub-regions are resilient to negative fiscal shocks. Health system resilience can be bolstered by investments in emergency preparedness, health workforce training, and health information systems. Moreover, expanded health insurance coverage can reduce out-of-pocket expenses, ensure equitable access to healthcare services, and enhance health outcomes. Thus, by relying on alternative funding sources to provide services to people during periods of fiscal shocks, fiscal shocks can have a positive effect.

The neutral effect of private health expenditure shocks on health outcomes may be explained by its abysmal levels in the regions, which implies that it is not a major determinant of health outcomes. For example, private health expenditure per capita averaged USD19.7 in Central and Western Africa within the study period, compared to over USD80 in other regions. Low private health expenditure may be due to high dependence on publicly funded healthcare, low income, and poor disposition for preventive healthcare services among citizens. These findings contradict sharply those of Schakel *et al.* (2018) and Ifanti *et al.* (2013), who found that fiscal shocks could exert negative consequences on public health expenditure and outcomes.

The results from Central and Western Africa differ slightly from those of Eastern and Southern Africa, where fiscal and private health expenditure shocks show a neutral effect. This result suggests that public and private health expenditures do not translate to health outcomes, implying that shocks to fiscal operations and private health spending may not be transmitted to health outcomes. In both sub-regions, corruption, administrative bottlenecks, and human capacity constraints in the health system may explain why the positive effects of public budgetary allocations to the health system and private health expenditure do not sufficiently get relayed to health outcomes. However,

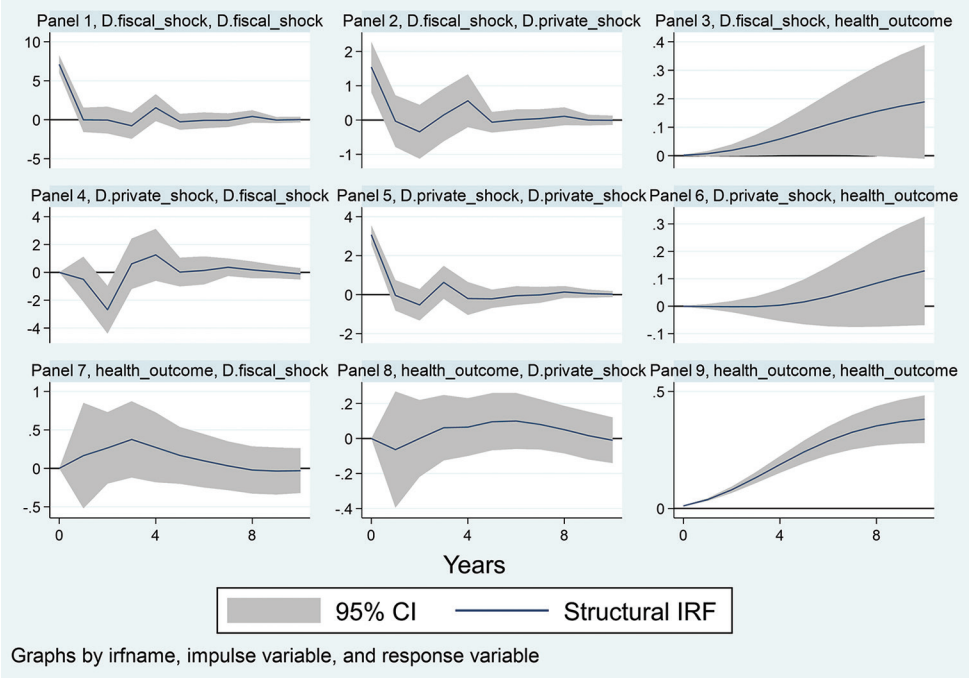

Figure 2. Impulse response of life expectancy to composite shocks to public and private per capita health expenditure in Central Africa. Image created with Stata

Abbreviations: CI: Confidence interval; IRF: Impulse response function.

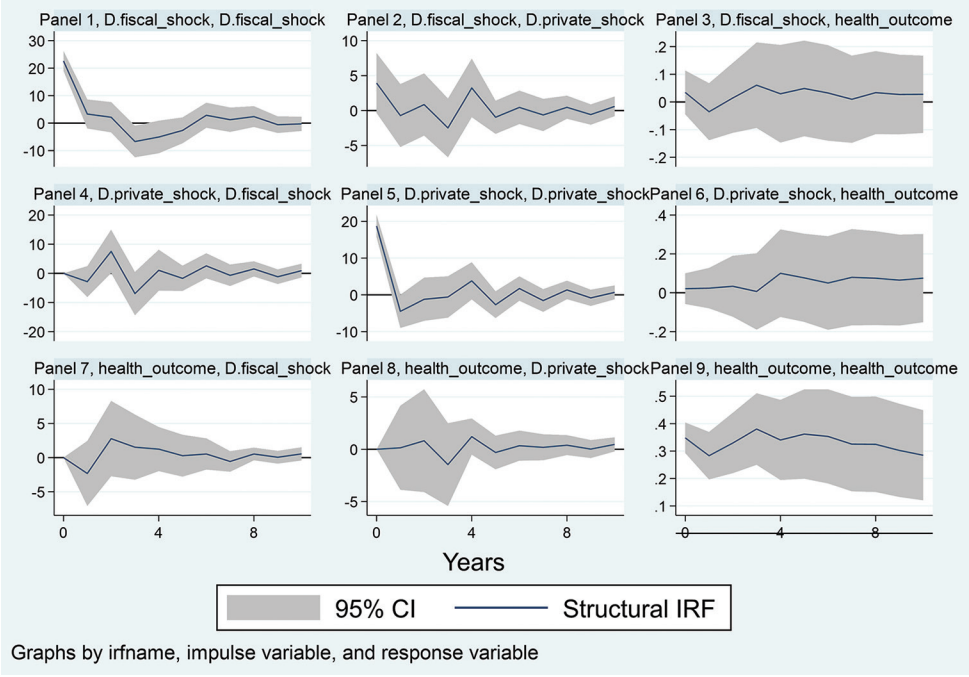

Figure 3. Impulse response of life expectancy to composite shocks to public and private per capita health expenditure in Eastern Africa. Image created with Stata

Abbreviations: CI: Confidence interval; IRF: Impulse response function.

the results could highlight the system's resilience to shocks; service provision may be unaffected by shocks, as alternative financing mechanisms may be available, which may imply that health outcomes are unaffected, as well.

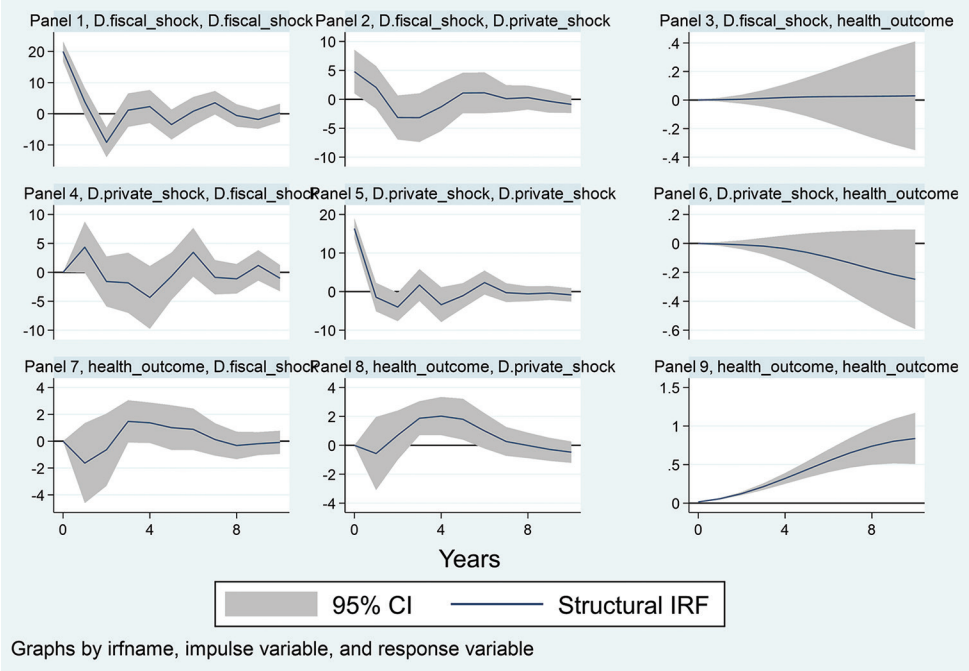

Figure 4. Impulse response of life expectancy to composite shocks to public and private per capita health expenditure in Southern Africa. Image created with Stata
Abbreviations: CI: Confidence interval; IRF: Impulse response function.

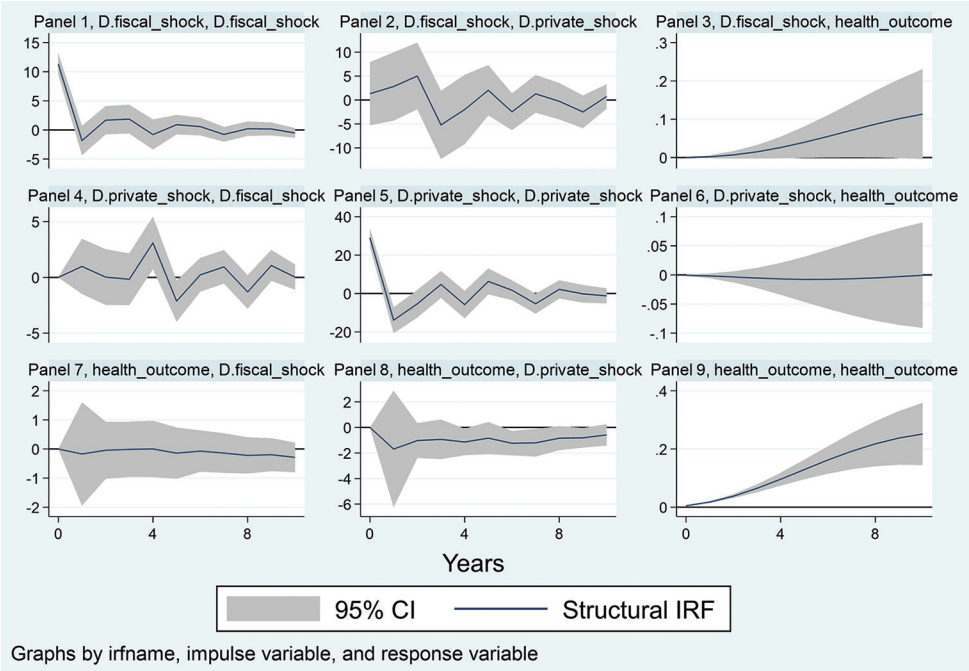

Figure 5. Impulse response of life expectancy to composite shocks to public and private per capita health expenditure in Western Africa. Image created with Stata
Abbreviations: CI: Confidence interval; IRF: Impulse response function.

Although most studies (Arthur & Oaikhenan, 2017; Edeme *et al.*, 2017; Oluwatoyin *et al.*, 2015; Boachie *et al.*, 2018) show a positive and significant effect of public and private health expenditures on health outcomes, these

Table 3. Forecast error variance decomposition of health outcomes

Step	Central Africa		Eastern Africa		Southern Africa		Western Africa	
	Fiscal shock	Private shock	Fiscal shock	Private shock	Fiscal shock	Private shock	Fiscal shock	Private shock
1	0.019	0.001	0.010	0.004	0.002	0.001	0.002	0.011
2	0.032	0.001	0.012	0.005	0.002	0.004	0.012	0.009
3	0.050	0.001	0.008	0.007	0.002	0.006	0.028	0.008
4	0.065	0.000	0.014	0.005	0.003	0.007	0.043	0.007
5	0.079	0.000	0.012	0.021	0.003	0.010	0.059	0.006
6	0.093	0.002	0.013	0.025	0.003	0.015	0.073	0.004
7	0.107	0.006	0.012	0.024	0.002	0.022	0.087	0.003
8	0.119	0.014	0.011	0.028	0.002	0.030	0.101	0.002
9	0.130	0.023	0.011	0.030	0.002	0.038	0.113	0.002
10	0.140	0.034	0.011	0.031	0.002	0.046	0.125	0.001

effects are rather minute. This may explain why shocks to these expenditure types do not necessarily translate to a significant impact on health outcomes in some regions. In 2001, African governments committed to spending at least 15% of their annual national budget on the health sector. However, this target is yet to be met. At present, SSA countries spend about USD129 per capita on health, a sharp contrast to the over USD4,000 spent by high-income countries (Gatome-Munyua & Olalere, 2020). Various factors could explain this gap, the most significant among them being low GDP and low revenue mobilization capacity among African countries, compounded by other competing development priorities.

5. Conclusion

Improved health outcomes, an SDG, is critical for achieving other SDGs and for boosting economic growth and development because a healthy population is needed for a workforce that drives the economic development process. This study examines the reaction of health outcomes to fiscal policy and private per capita health expenditure shocks in SSA. A regional analysis was conducted by sampling five countries from the Central, Eastern, Southern, and Western African sub-regions. A panel SVAR model was used to address the challenge of insufficient time series data for a single economic unit and accounting for substantial heterogeneity and cross-dependence. Evidence from the study is expected to guide policymakers in developing shock-mitigating health system financing models.

This study's results indicate that while health outcomes are affected by shocks to fiscal policy and private health expenditures in some sub-regions, they appear to be unaffected by those shocks in other sub-regions. Achieving sustainable improvement in health outcomes would require policies designed to expand health financing options beyond the traditional public and private funding mechanisms. The study is limited by several factors. First, the data are used in an aggregated form. This may obscure some salient features of individual countries and, second, the study is restricted to the period when data are available. The period may be expanded as data become available.

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Conflict of interest

The author declares no competing interests.

Author contributions

This is a single-authored article.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

The data used for the research are available in the World Bank's online database.

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Appendix

Appendix A1. List of Countries

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
1	2000	Cabo Verde	West	44.94	16.47	68.58
2	2001	Cabo Verde	West	49.02	16.22	69.10
3	2002	Cabo Verde	West	53.06	17.74	69.56
4	2003	Cabo Verde	West	65.34	22.29	69.93
5	2004	Cabo Verde	West	69.99	24.24	70.22
6	2005	Cabo Verde	West	69.57	25.65	70.42
7	2006	Cabo Verde	West	78.40	29.16	70.57
8	2007	Cabo Verde	West	94.81	31.67	70.68
9	2008	Cabo Verde	West	91.19	33.82	70.79
10	2009	Cabo Verde	West	96.87	34.26	70.91
11	2010	Cabo Verde	West	95.62	46.41	71.06
12	2011	Cabo Verde	West	107.16	46.27	71.24
13	2012	Cabo Verde	West	106.01	47.97	71.45
14	2013	Cabo Verde	West	110.50	51.57	71.66
15	2014	Cabo Verde	West	109.22	53.16	71.89
16	2015	Cabo Verde	West	96.59	44.06	72.12
17	2016	Cabo Verde	West	96.45	47.54	72.35
18	2017	Cabo Verde	West	108.03	51.88	72.57
19	2018	Cabo Verde	West	116.06	56.50	72.78
20	2019	Cabo Verde	West	116.99	48.73	72.98
21	2000	Equatorial Guinea	West	6.10	33.62	53.28
22	2001	Equatorial Guinea	West	5.03	47.77	53.58
23	2002	Equatorial Guinea	West	4.99	64.73	53.84
24	2003	Equatorial Guinea	West	10.96	94.11	54.06
25	2004	Equatorial Guinea	West	13.32	120.48	54.26
26	2005	Equatorial Guinea	West	22.58	136.15	54.45
27	2006	Equatorial Guinea	West	33.62	151.00	54.64
28	2007	Equatorial Guinea	West	46.16	190.20	54.84
29	2008	Equatorial Guinea	West	68.60	342.12	55.07
30	2009	Equatorial Guinea	West	98.40	191.95	55.33
31	2010	Equatorial Guinea	West	78.44	222.28	55.62
32	2011	Equatorial Guinea	West	87.64	234.05	55.95
33	2012	Equatorial Guinea	West	113.82	151.26	56.29
34	2013	Equatorial Guinea	West	87.11	290.79	56.64
35	2014	Equatorial Guinea	West	91.33	332.44	57.00
36	2015	Equatorial Guinea	West	62.56	262.30	57.36
37	2016	Equatorial Guinea	West	64.24	223.16	57.71

(Cont'd...)

Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
38	2017	Equatorial Guinea	West	57.12	223.01	58.06
39	2018	Equatorial Guinea	West	62.47	240.81	58.40
40	2019	Equatorial Guinea	West	54.18	198.39	58.74
41	2000	Gabon	West	46.85	78.39	58.26
42	2001	Gabon	West	50.43	73.78	57.97
43	2002	Gabon	West	49.68	86.01	57.79
44	2003	Gabon	West	70.81	100.81	57.76
45	2004	Gabon	West	78.03	110.15	57.89
46	2005	Gabon	West	71.75	120.03	58.18
47	2006	Gabon	West	86.51	131.79	58.64
48	2007	Gabon	West	104.33	155.83	59.23
49	2008	Gabon	West	108.95	171.65	59.90
50	2009	Gabon	West	119.81	174.26	60.64
51	2010	Gabon	West	139.22	77.35	61.40
52	2011	Gabon	West	171.40	102.08	62.17
53	2012	Gabon	West	145.52	90.92	62.92
54	2013	Gabon	West	176.53	97.55	63.65
55	2014	Gabon	West	146.56	95.75	64.32
56	2015	Gabon	West	115.61	79.03	64.91
57	2016	Gabon	West	140.43	75.14	65.42
58	2017	Gabon	West	127.24	72.60	65.84
59	2018	Gabon	West	128.02	87.78	66.19
60	2019	Gabon	West	129.68	84.12	66.47
61	2000	Ghana	West	4.61	10.00	57.00
62	2001	Ghana	West	6.58	10.52	57.16
63	2002	Ghana	West	4.89	12.42	57.43
64	2003	Ghana	West	6.95	13.93	57.79
65	2004	Ghana	West	6.90	14.66	58.23
66	2005	Ghana	West	16.54	18.24	58.72
67	2006	Ghana	West	19.00	21.42	59.23
68	2007	Ghana	West	24.43	25.28	59.74
69	2008	Ghana	West	28.85	27.92	60.22
70	2009	Ghana	West	31.48	24.67	60.65
71	2010	Ghana	West	41.45	25.39	61.03
72	2011	Ghana	West	49.72	40.03	61.38
73	2012	Ghana	West	42.44	36.55	61.72
74	2013	Ghana	West	43.87	46.60	62.06
75	2014	Ghana	West	28.35	39.79	62.42
76	2015	Ghana	West	28.27	32.23	62.77

(Cont'd...)

Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
77	2016	Ghana	West	25.64	32.66	63.12
78	2017	Ghana	West	22.03	36.81	63.46
79	2018	Ghana	West	30.31	38.05	63.78
80	2019	Ghana	West	30.29	36.50	64.07
81	2000	Cote d'Ivoire	West	5.30	46.05	49.64
82	2001	Cote d'Ivoire	West	4.68	46.76	49.50
83	2002	Cote d'Ivoire	West	5.41	49.01	49.48
84	2003	Cote d'Ivoire	West	6.21	55.16	49.57
85	2004	Cote d'Ivoire	West	7.14	56.88	49.79
86	2005	Cote d'Ivoire	West	6.81	53.33	50.12
87	2006	Cote d'Ivoire	West	7.32	50.43	50.56
88	2007	Cote d'Ivoire	West	8.64	52.50	51.09
89	2008	Cote d'Ivoire	West	10.35	58.94	51.68
90	2009	Cote d'Ivoire	West	11.22	56.11	52.31
91	2010	Cote d'Ivoire	West	9.85	56.37	52.96
92	2011	Cote d'Ivoire	West	9.80	55.44	53.62
93	2012	Cote d'Ivoire	West	12.82	51.36	54.27
94	2013	Cote d'Ivoire	West	14.24	52.18	54.91
95	2014	Cote d'Ivoire	West	16.78	52.90	55.51
96	2015	Cote d'Ivoire	West	15.87	39.34	56.07
97	2016	Cote d'Ivoire	West	17.33	40.07	56.57
98	2017	Cote d'Ivoire	West	20.04	40.64	57.02
99	2018	Cote d'Ivoire	West	20.98	42.33	57.42
100	2019	Cote d'Ivoire	West	21.84	41.81	57.78
101	2000	Angola	Central	7.57	5.37	46.52
102	2001	Angola	Central	13.20	15.31	47.06
103	2002	Angola	Central	11.42	17.26	47.70
104	2003	Angola	Central	14.41	20.11	48.44
105	2004	Angola	Central	21.18	27.67	49.26
106	2005	Angola	Central	24.33	28.29	50.17
107	2006	Angola	Central	37.54	28.18	51.14
108	2007	Angola	Central	53.76	36.59	52.18
109	2008	Angola	Central	87.27	44.96	53.24
110	2009	Angola	Central	81.21	34.20	54.31
111	2010	Angola	Central	60.06	33.49	55.35
112	2011	Angola	Central	79.07	39.54	56.33
113	2012	Angola	Central	79.73	39.80	57.24
114	2013	Angola	Central	89.08	50.84	58.05
115	2014	Angola	Central	71.29	56.18	58.78

(Cont'd...)

Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
116	2015	Angola	Central	51.43	54.25	59.40
117	2016	Angola	Central	41.99	49.67	59.93
118	2017	Angola	Central	52.91	57.86	60.38
119	2018	Angola	Central	36.74	47.66	60.78
120	2019	Angola	Central	29.40	39.66	61.15
121	2000	Rwanda	Central	1.68	3.30	48.65
122	2001	Rwanda	Central	1.67	3.02	49.94
123	2002	Rwanda	Central	1.77	2.96	50.99
124	2003	Rwanda	Central	5.76	4.21	52.18
125	2004	Rwanda	Central	5.28	5.57	53.60
126	2005	Rwanda	Central	5.36	7.39	55.25
127	2006	Rwanda	Central	5.44	6.55	57.08
128	2007	Rwanda	Central	7.66	7.75	58.92
129	2008	Rwanda	Central	9.87	9.46	60.61
130	2009	Rwanda	Central	10.91	10.40	62.13
131	2010	Rwanda	Central	12.44	11.27	63.43
132	2011	Rwanda	Central	14.70	12.15	64.52
133	2012	Rwanda	Central	14.91	12.53	65.44
134	2013	Rwanda	Central	15.71	11.60	66.22
135	2014	Rwanda	Central	16.30	11.17	66.88
136	2015	Rwanda	Central	15.82	13.08	67.45
137	2016	Rwanda	Central	16.64	12.78	67.93
138	2017	Rwanda	Central	17.21	12.72	68.34
139	2018	Rwanda	Central	18.35	13.38	68.70
140	2019	Rwanda	Central	20.53	13.50	69.02
141	2000	Congo, Republic of	Central	5.98	9.49	52.12
142	2001	Congo, Republic of	Central	9.12	9.72	52.52
143	2002	Congo, Republic of	Central	4.37	10.83	53.09
144	2003	Congo, Republic of	Central	5.68	13.65	53.82
145	2004	Congo, Republic of	Central	6.33	15.95	54.67
146	2005	Congo, Republic of	Central	7.93	16.88	55.60
147	2006	Congo, Republic of	Central	11.96	18.51	56.57
148	2007	Congo, Republic of	Central	13.29	21.88	57.54
149	2008	Congo, Republic of	Central	31.92	25.63	58.47
150	2009	Congo, Republic of	Central	14.49	26.13	59.32
151	2010	Congo, Republic of	Central	25.49	24.80	60.09
152	2011	Congo, Republic of	Central	23.20	26.14	60.79
153	2012	Congo, Republic of	Central	32.13	23.04	61.42
154	2013	Congo, Republic of	Central	36.39	24.13	62.02

(Cont'd...)

Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
155	2014	Congo, Republic of	Central	35.81	25.24	62.58
156	2015	Congo, Republic of	Central	27.39	21.38	63.10
157	2016	Congo, Republic of	Central	24.57	29.45	63.56
158	2017	Congo, Republic of	Central	21.01	29.78	63.95
159	2018	Congo, Republic of	Central	17.47	29.28	64.29
160	2019	Congo, Republic of	Central	18.26	26.25	64.57
161	2000	Central African Republic	Central	4.10	4.90	44.19
162	2001	Central African Republic	Central	3.67	5.23	44.06
163	2002	Central African Republic	Central	3.73	5.56	44.06
164	2003	Central African Republic	Central	4.73	7.10	44.18
165	2004	Central African Republic	Central	4.89	7.99	44.41
166	2005	Central African Republic	Central	3.62	8.31	44.74
167	2006	Central African Republic	Central	4.59	8.98	45.16
168	2007	Central African Republic	Central	5.32	10.21	45.64
169	2008	Central African Republic	Central	4.06	11.68	46.16
170	2009	Central African Republic	Central	3.54	11.59	46.72
171	2010	Central African Republic	Central	2.86	11.88	47.31
172	2011	Central African Republic	Central	2.29	13.23	47.95
173	2012	Central African Republic	Central	3.52	13.23	48.64
174	2013	Central African Republic	Central	3.74	9.09	49.37
175	2014	Central African Republic	Central	3.02	10.67	50.13
176	2015	Central African Republic	Central	1.72	9.41	50.88
177	2016	Central African Republic	Central	2.41	12.30	51.59
178	2017	Central African Republic	Central	3.29	17.31	52.24
179	2018	Central African Republic	Central	3.36	22.74	52.81
180	2019	Central African Republic	Central	3.93	22.81	53.28
181	2000	Chad	Central	3.90	6.01	47.71
182	2001	Chad	Central	4.12	7.27	47.79
183	2002	Chad	Central	5.25	12.41	47.90
184	2003	Chad	Central	5.75	9.42	48.06
185	2004	Chad	Central	9.86	15.47	48.27
186	2005	Chad	Central	9.45	19.33	48.55
187	2006	Chad	Central	7.09	23.72	48.91
188	2007	Chad	Central	8.21	24.47	49.34
189	2008	Chad	Central	7.42	28.23	49.82
190	2009	Chad	Central	7.47	25.45	50.35
191	2010	Chad	Central	7.62	26.54	50.89
192	2011	Chad	Central	8.26	25.50	51.42
193	2012	Chad	Central	9.27	24.18	51.93

(Cont'd...)

Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
194	2013	Chad	Central	11.17	25.49	52.39
195	2014	Chad	Central	12.65	26.54	52.79
196	2015	Chad	Central	7.47	21.66	53.14
197	2016	Chad	Central	5.76	21.81	53.44
198	2017	Chad	Central	4.67	19.71	53.71
199	2018	Chad	Central	4.97	20.15	53.98
200	2019	Chad	Central	5.17	18.58	54.24
201	2000	Seychelles	Eastern	287.38	62.61	72.78
202	2001	Seychelles	Eastern	283.79	122.78	73.25
203	2002	Seychelles	Eastern	301.69	73.70	71.09
204	2003	Seychelles	Eastern	340.93	95.74	71.03
205	2004	Seychelles	Eastern	366.16	121.09	72.66
206	2005	Seychelles	Eastern	375.34	137.54	72.13
207	2006	Seychelles	Eastern	390.92	136.90	72.22
208	2007	Seychelles	Eastern	349.12	117.85	73.14
209	2008	Seychelles	Eastern	256.94	167.09	73.16
210	2009	Seychelles	Eastern	222.77	138.46	73.08
211	2010	Seychelles	Eastern	330.10	172.34	73.20
212	2011	Seychelles	Eastern	334.03	161.48	72.72
213	2012	Seychelles	Eastern	459.95	185.19	74.28
214	2013	Seychelles	Eastern	455.80	166.61	73.12
215	2014	Seychelles	Eastern	468.92	203.52	73.23
216	2015	Seychelles	Eastern	470.68	192.70	74.30
217	2016	Seychelles	Eastern	534.14	208.05	74.31
218	2017	Seychelles	Eastern	568.18	205.10	74.30
219	2018	Seychelles	Eastern	620.39	216.70	72.84
220	2019	Seychelles	Eastern	610.80	228.98	74.05
221	2000	Mauritius	Eastern	63.69	54.93	71.66
222	2001	Mauritius	Eastern	64.25	54.54	71.77
223	2002	Mauritius	Eastern	71.91	63.61	71.97
224	2003	Mauritius	Eastern	84.96	76.86	72.12
225	2004	Mauritius	Eastern	103.25	86.62	72.27
226	2005	Mauritius	Eastern	95.25	102.35	72.43
227	2006	Mauritius	Eastern	93.87	115.11	72.43
228	2007	Mauritius	Eastern	98.61	136.85	72.57
229	2008	Mauritius	Eastern	113.54	205.33	72.57
230	2009	Mauritius	Eastern	117.50	187.24	72.88
231	2010	Mauritius	Eastern	162.06	198.15	72.97
232	2011	Mauritius	Eastern	163.12	217.91	73.27

(Cont'd...)

Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
233	2012	Mauritius	Eastern	176.94	212.57	73.86
234	2013	Mauritius	Eastern	189.14	256.89	74.02
235	2014	Mauritius	Eastern	252.16	304.73	74.19
236	2015	Mauritius	Eastern	220.53	294.88	74.35
237	2016	Mauritius	Eastern	244.04	307.93	74.39
238	2017	Mauritius	Eastern	268.34	337.82	74.51
239	2018	Mauritius	Eastern	288.51	364.83	74.42
240	2019	Mauritius	Eastern	322.68	361.26	74.24
241	2000	Kenya	Eastern	5.87	12.10	50.92
242	2001	Kenya	Eastern	6.19	12.36	51.10
243	2002	Kenya	Eastern	6.57	12.04	51.61
244	2003	Kenya	Eastern	7.21	13.92	52.41
245	2004	Kenya	Eastern	7.18	14.68	53.48
246	2005	Kenya	Eastern	8.50	16.70	54.73
247	2006	Kenya	Eastern	10.00	18.83	56.09
248	2007	Kenya	Eastern	12.85	22.52	57.46
249	2008	Kenya	Eastern	14.78	24.11	58.76
250	2009	Kenya	Eastern	15.21	23.44	59.93
251	2010	Kenya	Eastern	16.86	24.58	60.96
252	2011	Kenya	Eastern	17.43	24.18	61.85
253	2012	Kenya	Eastern	20.68	27.62	62.66
254	2013	Kenya	Eastern	22.50	29.17	63.42
255	2014	Kenya	Eastern	26.87	30.58	64.14
256	2015	Kenya	Eastern	28.18	29.10	64.80
257	2016	Kenya	Eastern	31.04	29.72	65.39
258	2017	Kenya	Eastern	27.96	23.42	65.91
259	2018	Kenya	Eastern	31.70	25.54	66.34
260	2019	Kenya	Eastern	38.35	29.62	66.70
261	2000	Sudan	Eastern	5.15	10.08	58.47
262	2001	Sudan	Eastern	5.53	11.05	58.86
263	2002	Sudan	Eastern	6.26	12.04	59.26
264	2003	Sudan	Eastern	8.03	16.34	59.67
265	2004	Sudan	Eastern	12.16	19.51	60.09
266	2005	Sudan	Eastern	15.94	23.77	60.53
267	2006	Sudan	Eastern	22.21	36.07	60.97
268	2007	Sudan	Eastern	32.78	55.37	61.42
269	2008	Sudan	Eastern	29.45	60.48	61.88
270	2009	Sudan	Eastern	39.20	52.65	62.33
271	2010	Sudan	Eastern	30.42	60.22	62.76

(Cont'd...)

Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
272	2011	Sudan	Eastern	30.79	93.34	63.17
273	2012	Sudan	Eastern	26.92	71.22	63.54
274	2013	Sudan	Eastern	21.03	99.76	63.88
275	2014	Sudan	Eastern	29.55	83.06	64.17
276	2015	Sudan	Eastern	49.48	106.33	64.43
277	2016	Sudan	Eastern	39.01	123.47	64.66
278	2017	Sudan	Eastern	34.68	147.57	64.88
279	2018	Sudan	Eastern	13.09	41.84	65.10
280	2019	Sudan	Eastern	10.65	33.20	65.31
281	2000	Tanzania	Eastern	2.75	5.11	50.80
282	2001	Tanzania	Eastern	3.99	6.63	51.44
283	2002	Tanzania	Eastern	4.95	7.69	52.14
284	2003	Tanzania	Eastern	5.81	9.37	52.87
285	2004	Tanzania	Eastern	8.20	9.25	53.60
286	2005	Tanzania	Eastern	10.32	9.85	54.35
287	2006	Tanzania	Eastern	11.36	9.67	55.12
288	2007	Tanzania	Eastern	10.41	10.85	55.93
289	2008	Tanzania	Eastern	14.99	12.39	56.78
290	2009	Tanzania	Eastern	9.99	12.16	57.67
291	2010	Tanzania	Eastern	10.42	12.32	58.58
292	2011	Tanzania	Eastern	9.68	11.27	59.53
293	2012	Tanzania	Eastern	9.91	11.94	60.47
294	2013	Tanzania	Eastern	11.17	11.39	61.40
295	2014	Tanzania	Eastern	12.00	10.66	62.29
296	2015	Tanzania	Eastern	11.57	9.31	63.11
297	2016	Tanzania	Eastern	15.11	8.54	63.84
298	2017	Tanzania	Eastern	15.38	8.81	64.48
299	2018	Tanzania	Eastern	15.82	9.10	65.02
300	2019	Tanzania	Eastern	16.49	9.27	65.46
301	2000	South Africa	Southern	90.60	155.39	56.05
302	2001	South Africa	Southern	71.41	138.93	55.09
303	2002	South Africa	Southern	64.49	121.09	54.31
304	2003	South Africa	Southern	117.69	162.77	53.75
305	2004	South Africa	Southern	147.75	207.10	53.44
306	2005	South Africa	Southern	165.61	199.60	53.45
307	2006	South Africa	Southern	202.41	200.80	53.80
308	2007	South Africa	Southern	223.78	210.28	54.45
309	2008	South Africa	Southern	214.96	202.39	55.36
310	2009	South Africa	Southern	248.56	210.72	56.46

(Cont'd...)

Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
311	2010	South Africa	Southern	325.98	260.57	57.67
312	2011	South Africa	Southern	363.05	287.24	58.90
313	2012	South Africa	Southern	340.43	274.04	60.06
314	2013	South Africa	Southern	309.36	254.64	61.10
315	2014	South Africa	Southern	305.43	234.75	61.97
316	2015	South Africa	Southern	287.54	207.79	62.65
317	2016	South Africa	Southern	263.25	192.33	63.15
318	2017	South Africa	Southern	305.23	223.37	63.54
319	2018	South Africa	Southern	323.44	234.67	63.86
320	2019	South Africa	Southern	321.23	219.42	64.13
321	2000	Botswana	Southern	112.52	58.79	50.63
322	2001	Botswana	Southern	114.29	58.42	50.28
323	2002	Botswana	Southern	119.11	57.74	50.23
324	2003	Botswana	Southern	155.06	77.41	50.52
325	2004	Botswana	Southern	171.55	88.01	51.15
326	2005	Botswana	Southern	156.65	87.30	52.13
327	2006	Botswana	Southern	150.80	84.63	53.44
328	2007	Botswana	Southern	176.31	88.08	54.98
329	2008	Botswana	Southern	205.47	83.50	56.68
330	2009	Botswana	Southern	176.64	141.07	58.45
331	2010	Botswana	Southern	229.40	148.84	60.21
332	2011	Botswana	Southern	270.25	148.51	61.91
333	2012	Botswana	Southern	279.30	133.74	63.51
334	2013	Botswana	Southern	287.49	122.47	64.98
335	2014	Botswana	Southern	295.56	105.36	66.27
336	2015	Botswana	Southern	263.84	98.17	67.34
337	2016	Botswana	Southern	267.95	112.03	68.18
338	2017	Botswana	Southern	366.36	71.32	68.81
339	2018	Botswana	Southern	388.23	75.05	69.28
340	2019	Botswana	Southern	378.12	73.81	69.59
341	2000	Namibia	Southern	105.65	93.42	52.19
342	2001	Namibia	Southern	96.26	78.28	51.40
343	2002	Namibia	Southern	93.82	72.52	50.86
344	2003	Namibia	Southern	138.44	104.82	50.59
345	2004	Namibia	Southern	172.47	131.05	50.60
346	2005	Namibia	Southern	169.85	132.13	50.93
347	2006	Namibia	Southern	168.69	142.81	51.61
348	2007	Namibia	Southern	204.00	170.47	52.59
349	2008	Namibia	Southern	171.78	151.34	53.82

(Cont'd...)

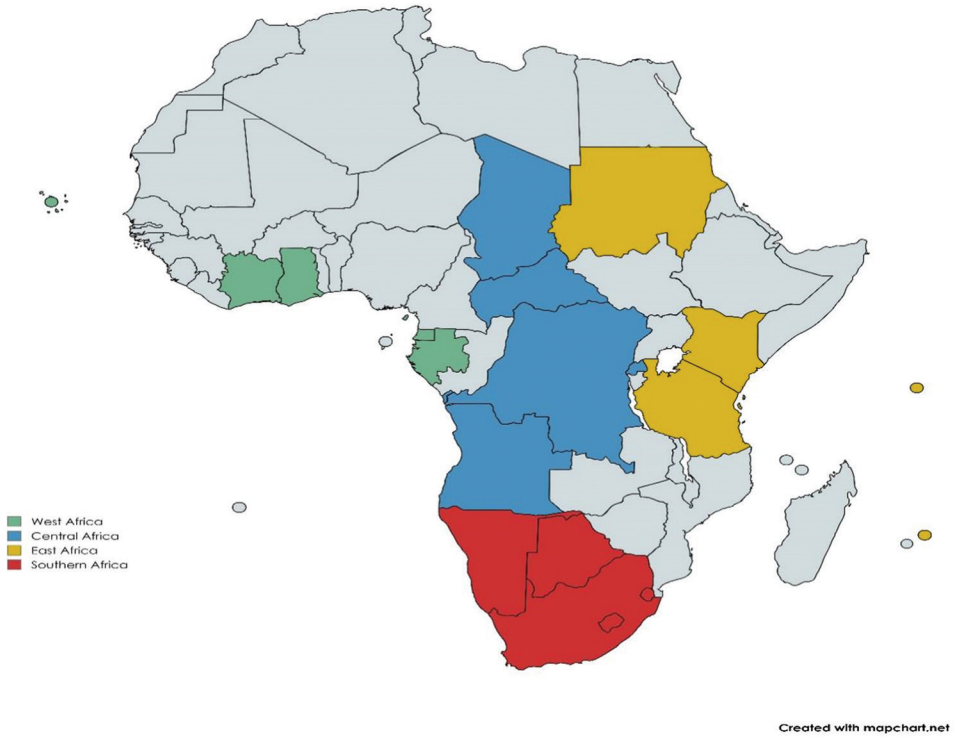
Appendix A1. ***(Continued)***

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
350	2009	Namibia	Southern	146.63	162.41	55.21
351	2010	Namibia	Southern	212.06	231.51	56.67
352	2011	Namibia	Southern	234.20	267.18	58.09
353	2012	Namibia	Southern	230.00	276.97	59.39
354	2013	Namibia	Southern	225.46	231.84	60.51
355	2014	Namibia	Southern	212.43	219.82	61.43
356	2015	Namibia	Southern	206.28	254.54	62.12
357	2016	Namibia	Southern	198.78	195.55	62.63
358	2017	Namibia	Southern	217.66	218.68	63.02
359	2018	Namibia	Southern	216.27	226.52	63.37
360	2019	Namibia	Southern	200.38	206.99	63.71
361	2000	Eswatini	Southern	41.68	34.71	47.49
362	2001	Eswatini	Southern	36.28	33.24	45.80
363	2002	Eswatini	Southern	34.05	31.29	44.41
364	2003	Eswatini	Southern	62.67	49.40	43.37
365	2004	Eswatini	Southern	81.62	64.60	42.73
366	2005	Eswatini	Southern	112.27	72.37	42.52
367	2006	Eswatini	Southern	109.89	74.17	42.73
368	2007	Eswatini	Southern	124.92	77.11	43.31
369	2008	Eswatini	Southern	139.74	70.62	44.17
370	2009	Eswatini	Southern	151.06	73.50	45.28
371	2010	Eswatini	Southern	176.25	90.39	46.60
372	2011	Eswatini	Southern	162.40	96.44	48.14
373	2012	Eswatini	Southern	154.54	89.92	49.86
374	2013	Eswatini	Southern	140.65	80.32	51.70
375	2014	Eswatini	Southern	110.66	74.80	53.57
376	2015	Eswatini	Southern	108.37	66.37	55.36
377	2016	Eswatini	Southern	97.49	59.87	56.96
378	2017	Eswatini	Southern	138.73	69.74	58.32
379	2018	Eswatini	Southern	144.31	65.81	59.40
380	2019	Eswatini	Southern	133.97	61.12	60.19
381	2000	Lesotho	Southern	13.18	9.29	47.69
382	2001	Lesotho	Southern	15.18	10.68	46.20
383	2002	Lesotho	Southern	12.39	8.63	44.90
384	2003	Lesotho	Southern	18.54	10.22	43.85
385	2004	Lesotho	Southern	23.10	12.75	43.08
386	2005	Lesotho	Southern	19.68	14.02	42.66
387	2006	Lesotho	Southern	27.39	14.58	42.60
388	2007	Lesotho	Southern	41.55	16.08	42.85

(Cont'd...)

Appendix A1. *(Continued)*

S/N	Year	Country	Region	Public health expenditure	Private health expenditure	Life expectancy
389	2008	Lesotho	Southern	38.96	15.36	43.38
390	2009	Lesotho	Southern	43.72	16.26	44.15
391	2010	Lesotho	Southern	54.73	23.39	45.10
392	2011	Lesotho	Southern	70.62	23.44	46.21
393	2012	Lesotho	Southern	61.15	22.17	47.42
394	2013	Lesotho	Southern	56.08	19.35	48.66
395	2014	Lesotho	Southern	60.94	18.41	49.89
396	2015	Lesotho	Southern	61.51	17.36	51.04
397	2016	Lesotho	Southern	51.89	15.82	52.06
398	2017	Lesotho	Southern	61.13	17.75	52.95
399	2018	Lesotho	Southern	58.82	18.12	53.71
400	2019	Lesotho	Southern	54.07	17.61	54.33



Appendix A2. Map of Countries included in the study

ACCSCIENCE PUBLISHING

Global Health Economics and Sustainability

ORIGINAL RESEARCH ARTICLE

Evaluation of long-term care expenditures from the silver economy perspective

Gülay Ekinci*

Department of Health Management, Faculty of Health Sciences, Istanbul Sabahattin Zaim University, Istanbul, Turkey

Abstract

Silver economics is a field of science that evaluates the long-term care needs that develop because of aging from the economics perspective within the supply and demand framework. The expenditures and investments made to meet long-term care needs constitute the main subject of long-term care expenditures. This study empirically tested the relationship between long-term care expenditures and life expectancy. Expenditures on long-term care facilities (LTCFE) were taken as the dependent variable, and life expectancy at birth (LEAB) and life expectancy at 65 years and over (LEO65) were taken as independent variables. The analysis included data from 25 countries with regular LTCFE from 2004 to 2020. The variables were analyzed using the econometric model established within the framework of panel data analysis. According to the least squares analysis results, a 1% increase in LEAB increased LTCFE by 2.1%, while a 1% increase in LEO65 decreased LTCFE by 0.54%. Moreover, a unidirectional causality relationship was found between LTCFE and LEAB and LEO65. The empirical evidence suggests that life expectancy impacted LTCFE. According to the findings, they emphasize the importance of aligning policy frameworks with demographic changes to ensure sustainable long-term care systems in aging societies.

Keywords: Econometric evaluation; Silver economy; Expenditures on long-term care facilities; Life expectancy; Aging population

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***Corresponding author:**
Gülay Ekinci
(gulay.ekinci@izu.edu.tr)

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1. Introduction

The "silver economy" is defined as the economic opportunities arising from increased public and consumer spending of the aging population and the unique needs of people aged over 50 years (EC, 2015). Silver economies prioritize the quality of life of older persons from a holistic perspective, addressing issues such as employment of persons aged over 50 years, policies, such as lifelong learning for older persons, preventive health services, and creating a sustainable society (EC, 2015). Silver economics is a field of science that evaluates the long-term care needs that develop because of aging within a supply and demand framework from an economic perspective. The silver economy has significant socioeconomic and health impacts. From a socioeconomic perspective, the aging population may cause employment difficulties for younger generations as the retirement age increases or the aging population may face employment loss due to retirement, illness, etc. In addition, it may cause difficulties in the financial sustainability

of social security systems due to the decrease in the contribution to social system revenues and the increase in payments for retirement and social services due to various reasons, such as unemployment, informal employment, low wages, aging population, early retirement, economic instability, and migration.

With regard to social services, an aging population can cause significant changes in economies with the increased demand for health services, nursing homes, and other social services. This situation may require governments to rethink social and health service budgets and policies. The consumption habits of older individuals often differ. Difficulties in adapting to new technology and changing daily habits may also result in negative impacts on the quality of life of elderly individuals. The health effects of the silver economy include the risk of aging and chronic diseases, which may require healthcare systems to cope with chronic diseases. Increased demand for health services and healthcare costs may impose significant burdens on health systems. Nonetheless, the aging population's demand for health and social services may create new opportunities in these sectors, and economies may be positively affected by this demographic change (Streicher *et al*., 2022; Costa-Font & Vilaplana-Prieto, 2023; Spitzer & Reiter, 2024.). Therefore, governments must evaluate their economies from a sustainability perspective within the aging framework and the needs that will develop due to aging and make investments in this field. The most decisive feature of the silver economy is the needs arising from aging because of prolonged life expectancy. Aging and the accompanying chronic diseases create the need for long-term care, bringing healthcare to the forefront in this respect. In fact literature stated that long-term care services are considered as an important sector in the care economy after child care/education (Ilkkaracan & Kim, 2019; Norouzi & Angel, 2023).

The increase in life expectancy at birth (LEAB); the slowdown in the fertility rate; social, cultural, economic, and technological transformations; and developments in the field of health have led to an increase in the elderly population. Furthermore, health services provided to elderly individuals are more expensive than those provided to younger individuals (Demirci *et al*., 2019). Due to the high incidence of chronic diseases in elderly adults, they benefit more from long-term care services. According to the World Health Organization data, 1 out of every 6 people in the world will be 60 years of age or older in 2030, and the number of individuals aged 60 years and older is expected to double in 2050 (2.1 billion). Furthermore, individuals aged 80 years and older are expected to triple between 2020 and 2050, reaching 426 million (WHO, 2021). Changes in the age distribution of populations are observed in high-income countries (for example, in Japan, the number of people over the age of 60 years comprises 30% of the population); however, significant changes will also occur in low- and middle-income countries in the coming years. By 2050, many Organization for Economic Co-operation and Development (OECD) countries are expected to be aging, increasing the demand for long-term care services. Even Turkey, which has the youngest population among OECD countries, is projected to have 17.6% of its population aged 65 years and over in 2050 (Bal, 2016). Therefore, a sustainable method for financing long-term care services must be established.

Long-term care services are provided to people with reduced physical or cognitive capacity, including health and social care activities, and people dependent on external assistance to perform basic daily activities for an extended period (Bal, 2016). In general, long-term care services are provided by professional caregivers, paid caregivers, or family members (usually women) in the home of the person receiving the service, in an institution providing daytime services to elderly adults, or in living spaces such as supervised nursing homes. The need for long-term care arises due to illness, disability, chronic diseases, or problems arising from old age, and the duration of the need for long-term care varies depending on the cause for the same. As a natural consequence of aging, the demand for long-term services is increasing, and expenditures in this area are steadily rising, threatening the financial sustainability of society as the number of elderly individuals who need professional medical care or support in activities of daily living because of illness increases. Long-term care is labor-intensive, expensive under all circumstances, and requires more dedication and professionalism than other care services with unique emotional aspects (Bal, 2016). In 2021, approximately $467.4 billion was spent on long-term services and supports, representing 13.2% of the $3.6 trillion spent on personal healthcare in U.S.(Congressional Research Service, 2023).

Regarding financial sustainability, long-term care expenditures have become a priority policy issue in many countries with aging populations, such as the OECD nations. Studies emphasize that the aging population will put pressure on the healthcare system and the social security system (Aina *et al*., 2021; Cristea *et al*., 2020; Vlad & Mădălina, 2012). Moreover, solutions to be implemented through high premium taxes will put pressure on the economy. Research shows different and contradictory results on this relationship, and how and why long-term care expenditures affect life expectancy remains unclear (Spielauer, 2001). The ambiguity of the relationship

between long-term care expenditures and life expectancy is expressed in the fact that the causal link between them remains unproven. Without such evidence, the effects of an increase/decrease in long-term care expenditures on life expectancy may not be accurately estimated. There is no detailed study on this issue using one-to-one parametric methods; therefore, this study empirically analyzes the relationship between long-term care expenditures and life expectancy. Econometric analyses allow us to empirically reveal the causal relationship between two or more variables. Econometric forecasting models are one method to investigate future trends in spending and demand for long-term care based on demographic data (Spielauer, 2001; Spielauer, 2011; Schneider & Buchinger, 2009; Olivares-Tirado *et al*., 2011). To empirically test the relationship between long-term care expenditures and life expectancy, this study's research question was determined as follows:

Q_1: Is there a relationship between life expectancy and long-term care expenditures? If so, to what extent and in what direction does life expectancy affect long-term care expenditures?

2. Methods

This study used panel data analysis to investigate the relationship between life expectancy and long-term care expenditures. LEAB and life expectancy at 65 years and over (LEO65) were considered independent variables representing the silver economy. Expenditures on long-term care facilities (LTCFE) were considered the dependent variable for long-term care expenditures. The panel data method allows us to test many countries and multi-temporal data together. In this context, the analysis was conducted in three stages. In the first stage, descriptive information about the variables subject to the research was given, and the significance tests of the econometric model were carried out using the least squares method. In the second stage, unit root tests were performed to determine the degree of stationarity of the variables. In the third stage, the lag length of the model was determined, and the causality relationship between the variables was analyzed with the Dumitrescu Hurlin (DH) panel causality test.

2.1. Variables

In this study, LEAB and LEO65 were determined as independent variables, and LTCFE (per capita, current prices, and current public-private partnerships [PPPs]) was determined as the dependent variable within the scope of long-term care expenditures in health. Data on health expenditures were generally recorded as total health expenditures at the country level. A few countries follow classifications by health expenditure functions, such as preventive, curative, and long-term care expenditures; these countries are in the high-income group. The year range was 2004 – 2020, and 25 countries with regular data on long-term care facility expenditures were identified: Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Japan, South Korea, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Switzerland, and the United States.

2.2. Statistical analysis

EViews 10 software (EViews 10, IHS Global Inc., 4521 Campus Drive, #336, Irvine, CA 92612) was used for statistical analysis.

3. Results

The average LEAB was 79.75 ± 2.94 years (min: 70.60; max: 84.60), LEO65 was 14.75 ± 2.94 (min: 19.60; max: 5.60), and LTCFE was 350.37 ± 325.96 per capita/PPP (min: 1.37; max: 1,669.19) (Figure 1).

LEAB increased by 2 – 9% over 16 years in the countries included in this study. In 16 years, the LEO65 increased from 10% to 20% in Austria, Belgium, Canada, France, Germany, Greece, Iceland, Japan, Netherlands, Poland, Portugal, Spain, and Switzerland. It increased by 21 – 50% in Czech Republic, Denmark, Finland, Hungary, South Korea, Lithuania, Luxembourg, Norway, and Slovenia and by 70 – 90% in Estonia and Latvia. In the United States, LEO65 decreased by 5%. LTCFE increased by 16 – 19 times in Czech Republic, Greece, and South Korea, whereas it decreased by 28% in Luxembourg. Table 1 shows the 16-year change in the variables subject to the research.

The equation to define the econometric model is as follows:

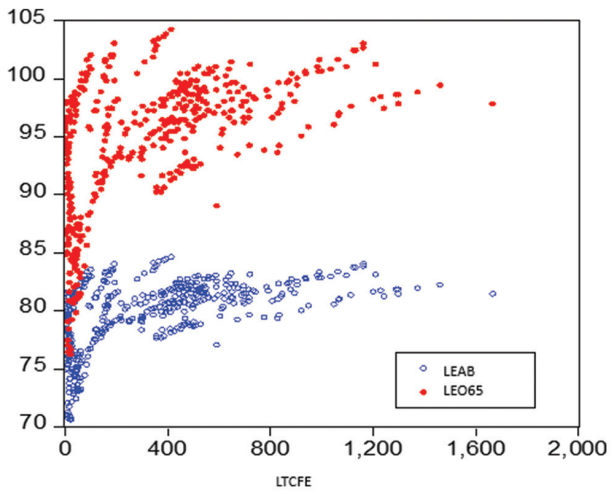

Figure 1. LTCFE, LEO65, and LEAB from 2004 to 2020

$$LTCFEit = \beta 0 + \beta 1LEABit + \beta 2LEO65it + uit.$$

Here, "β_0" represents the constant coefficient, "β_1" represents the LEAB, "β_2" represents LEO65, "u" represents the error term, "i" represents the countries in the cross-sectional dimension of the panel data, "t" represents the time dimension of 2004 – 2020, and "LTCFE" represents the dependent variable. Least squares analyses showed that the random effects (RE) model gave more consistent results in estimating the model established in the research according to the Hausman test result (*p*

Table 1. LTCFE, LEO65, and LEAB: Percentage change from 2004 to 2020

Countries	Year	LTCFE*	LEAB	LEO65	Countries	Year	LTCFE*	LEAB	LEO65
Austria	2004	214.12	79.30	14.30	S. Korea	2004	4.83	77.80	12.80
Austria	2020	474.84	81.30	16.30	S. Korea	2020	101.27	83.50	18.50
Austria	% change	1.22	0.03	0.14	S. Korea	% Change	19.96	0.07	0.45
Belgium	2004	303.52	79.00	14.00	Latvia	2004	21.00	70.90	5.90
Belgium	2020	642.44	80.80	15.80	Latvia	2020	61.44	75.50	10.50
Belgium	% change	1.12	0.,02	0.13	Latvia	% Change	1. 93	0.06	0.78
Canada	2004	342.51	80.10	15.10	Lithuania	2004	12.32	72.00	7.00
Canada	2020	736.05	81.70	16.70	Lithuania	2020	47.98	75.10	10.10
Canada	% change	1.15	0.02	0.11	Lithuania	% Change	2.89	0.04	0.44
Czech Republic	2004	16.92	75.90	10.90	Luxembourg	2004	674.59	79.20	14.20
Czech Republic	2020	300.69	78.0	13.30	Luxembourg	2020	486.13	82.20	17.20
Czech Republic	% change	16.77	0.03	0.22	Luxembourg	% Change	−0.28	0.04	0.21
Denmark	2004	358.83	77.80	12.80	Netherlands	2004	830.32	79.30	14.30
Denmark	2020	652.59	81.60	16.60	Netherlands	2020	1669.20	81.40	16.40
Denmark	% change	0.82	0.05	0.30	Netherlands	% Change	1.01	0.03	0.15
Estonia	2004	45.33	72.40	7.40	Norway	2004	613.78	80.10	15.10
Estonia	2020	184.66	78.90	13.90	Norway	2020	993.91	83.30	18.30
Estonia	% change	3.07	0.09	0.88	Norway	% Change	0.62	0.04	0.21
Finland	2004	251.76	79.00	14.00	Poland	2004	6.00	74.90	9.90
Finland	2020	534.90	82.00	17.00	Poland	2020	24.65	76.50	11.50
Finland	% change	1.12	0.04	0.21	Poland	% Change	3.11	0.02	0.16
France	2004	157.36	80.40	15.40	Portugal	2004	13.31	78.40	13.40
France	2020	650.78	82.30	17.30	Portugal	2020	44.55	81.10	16.10
France	% change	3.14	0.02	0.12	Portugal	% Change	2.35	0.03	0.20
Germany	2004	300.23	79.30	14.30	Slovenia	2004	110.27	77.20	12.20
Germany	2020	649.81	81.10	16.10	Slovenia	2020	221.40	80.60	15.60
Germany	% change	1.16	0.02	0.13	Slovenia	% Change	1.01	0.04	0.28
Greece	2004	1.37	79.40	14.40	Spain	2004	95.16	80.40	15.40
Greece	2020	28.55	81.40	16.40	Spain	2020	195.55	82.40	17.40
Greece	% change	19.81	0.03	0.14	Spain	% Change	1.05	0.02	0.13
Hungary	2004	38.17	73.00	8.00	Switzerland	2004	690.25	81.30	16.30
Hungary	2020	70.83	75.70	10.70	Switzerland	2020	1212.59	83.10	18.10
Hungary	% change	0.86	0.04	0.34	Switzerland	% Change	0.76	0.02	0.11
Iceland	2004	467.46	81.10	16.10	United States	2004	358.85	77.60	12.60
Iceland	2020	723.85	83.10	18.10	United States	2020	593.93	77.00	12.00
Iceland	% change	0.55	0.02	0.12	United States	% Change	0.66	−0.01	−0.05
Japan	2004	68.35	82.10	17.10					
Japan	2020	416.00	84.60	19.60					
Japan	% change	5.09	0.03	0.15					

*Per capita, current prices, current PPPs, long-term care (health), and residential long-term care facilities.
Abbreviations: LTCFE: Expenditures on long-term care facilities; LEAB: Life expectancy at birth; LEO65: Life expectancy at 65 years and over.

= 0.9613). According to these results, the econometric model was analyzed under the RE model, revealing that the independent variables had a good explanatory power on the dependent variable; however, multicollinearity, cross-sectional dependence, and autocorrelation problems persisted in the model. Therefore, the new model was re-estimated under the AR(1) model, and no multicollinearity, cross-sectional dependence, or autocorrelation problem (at a 1% significance level) were found. According to the least squares results in Table 2, a 1% increase in the LEAB increased LTCFE by 2.1%, while a 1% increase in the LEO65 decreased LTCFE by 0.54%. Furthermore, diagnostic tests showing the validity of least squares analyses confirm the suitability of the econometric model established in the research.

At this stage, the augmented Dickey-Fuller Fisher Chi-square test, which is a unit root test, was done to determine whether the variables were stationary (Levin *et al.*, 2002). In these tests, the null hypothesis indicates the presence of a unit root, and the alternative hypotheses indicate the absence of a unit root. Table 3 shows that all variables were stationary at the 1% significance level.

Causality analysis is a technique used to explain the causal relationship between two variables. It evaluates whether the lagged values of the other variable (for example, the X_t variable) in a relationship contribute to explaining the current value of one of the variables (for example, the Y_t variable) (Granger, 1969). This study used the DH causality method to determine the causal relationship between the variables. Panel causality analyses developed by Dumitrescu and Hurlin (2012) do not require testing the cointegration relationship between variables; they provide more effective and consistent results in cases of horizontal cross-section dependence and take heterogeneity and short time dimension into account (Tang *et al.*, 2009). The results obtained in the analysis revealed unidirectional causality relationships of LEAB and LEO65 with LTCFE. According to this result, changes in LEAB and LEO65 unilaterally affected LTCFE. Table 4 presents the results.

Table 2. Least squares test results

Dependent variable	Independent variable	Coefficient	Significance
LTCFE	LEAB	2.168702	0.0000
	LEO65	−0.543117	0.0338*
	AR (1)	0.978071	0.0000

Diagnostic test results: Breusch–Pagan LM=0.0265*; Pesaran scaled LM=0.0447*; Durbin Watson=1.926913; Skewness Value=0.508116; Kurtosis Value=5.658287; R^2=0.99; Adjusted R^2=0.99. * denotes a 5% significance level; variables are used in logarithmic form in the analysis.
Abbreviations: LTCFE: Expenditures on long-term care facilities; LEAB: Life expectancy at birth; LEO65: Life expectancy at 65 years and over.

Table 3. Unit root test results

Variables	Augmented Dickey-Fuller Fisher Chi-square test	Level
LTCFE	0.0000*	I (0)
LEAB	0.0002*	I (0)
LEO65	0.0000*	I (0)

*1% significance level.
Abbreviations: LTCFE: Expenditures on long-term care facilities; LEAB: Life expectancy at birth; LEO65: Life expectancy at 65 years and over.

Table 4. Dumitrescu Hurlin panel causality test results

Null hypothesis	W-Stat.	ZbarStat	Prob.	Decision
LEO65 ≠|> LTCFE	4.08902	2.45029	0.0143*	LEO65→LTCFE LEAB→LTCFE
LTCFE ≠|> LEO65	2.98160	0.73955	0.4596	
LEAB ≠|> LTCFE	4.02408	2.34998	0.0188*	
LTCFE ≠|> LEAB	2.94350	0.68071	0.4961	
LEAB ≠|> LEO65	2.14428	0.55108	0.5816	
LEO65 ≠|> LEAB	2.27707	0.34536	0.7298	

*5% significance level.
Abbreviations: LTCFE: Expenditures on long-term care facilities; LEAB: Life expectancy at birth; LEO65: Life expectancy at 65 years and over.

4. Discussion

Elderly populations in OECD countries are increasing because of high life expectancy and declining fertility rates. While the share of the population aged 65 years and over in these countries averaged <9% in 1960, it increased to 17% in 2015 and is expected to reach 28% by 2050 (OECD, 2017).

The aging of the population brings a significant increase in the number of individuals with diseases requiring long-term care, such as chronic and mental disorders. The demand for long-term care is considered age-related and mostly demanded by individuals aged 65 years and over (Colombo *et al.*, 2011). In addition, the global long-term care industry was projected to reach a market value of $1.6 trillion, with an annual growth rate of 8.5% between 2021 and 2027 (Ugalmugle & Swain 2021). The need for long-term care also means increased health expenditures. A study examining the expenditures per patient during the 60 months before death calculated total long-term care expenditure as USD48, 319, of which USD27, 217 belonged to institutional care services and USD21, 102 to home care services (Teraoka *et al.*, 2021). French *et al.* (2017) determined that health expenditure per capita in the past 12 months of life was USD80,000 in the United

States, USD60,000 in Denmark and the Netherlands, and USD50,000 in Germany. Brent (2022) reported that the value of years of life lost per person in nursing home adults was USD1.7 million that corresponding to in 2016 approximately 10% of national income as USD 18.7 trillion for the USA.

This study aimed to determine the economic evaluation of the relationship between long-term care expenditures and LEAB and those over 65 years of age in the silver economy, where long-term care investments are essential. The causality results revealed unidirectional relationships of LEAB and LEO65 to LTCFE. According to this result, changes in LEAB and LEO65 unilaterally affect LTCFE. Analyses using the econometric model revealed that a 1% increase in the LEAB increased LTCFE by 2.1%, while a 1% increase in the LEO65 decreased LTCFE by 0.54%. While this effect increased LTCFE because of extended life expectation at birth, LEO65 decreased LTCFE. Considering the increasing effect of LTCFE in LEAB and the extension of life expenses, it is necessary to build infrastructure and investments for LTCFE and increase these investments. In contrast, the increase of LEO65 decreased LTCFE because it can be interpreted that there is inherently a limit to the life expectancy of those aged 65 years and over. Therefore, this study's results confirmed the hypothesis that LEAB, LEO65, and LTCFE are related and were evaluated in line with the literature (Jaba *et al.*, 2014; Sey & Aydın, 2019; Şener & Yiğit, 2017; Şahbudak & Şahin, 2015).

5. Conclusion

When the needs that develop because of aging are considered from socioeconomic and health perspectives, increases in the incidence of chronic diseases (such as heart diseases, diabetes, hypertension, and cancer) that develop with old age, deterioration in joints and muscles, development of movement restrictions due to osteoporosis, mental health problems (such as dementia, Alzheimer's disease, and depression), and decreases in vision and hearing abilities require health services. Decreased income during retirement and decreased participation in social activities due to physical limitations or health problems may increase the feeling of social isolation in elderly individuals. For these reasons, the ability to perform daily living decreases with old age, which may increase the need for daily care. Furthermore, elderly individuals may have problems accessing health services because of mobility and economic factors. All these reasons can negatively affect the quality of life of elderly individuals. With the projected increase in the need for long-term care due to longer life expectancy, governments must design innovative health and social policies to implement services such as employment, health, infrastructure, and social protection in care services. In this context, we recommend the following:

- Design sports activity centers and culture-art centers specifically for the elderly
- Establish support teams to support daily activities in long-term care
- Define standards for long-term care processes
- Develop home healthcare services (home environment, palliative care, or integration into primary care services)
- Support/develop long-term care centers
- Design and support products suitable for the needs of elderly individuals[1]
- Increase public support to prevent economic inadequacy
- Expand/strengthen long-term care and support insurance.

This study provides policymakers with macroeconomic evidence to advance and regulate the future of long-term care needs in healthcare. Furthermore, this study's results provide evidence for resource allocation decisions in determining public expenditure policies.

The limitations of this study, considering the variables subject to the research, were the year range of these variables (between 2004 and 2020), and the countries included in the research. Moreover, the methods and variables used within the scope of the research were also considered research limitations.

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Conflict of interest

The author declares that she has no competing interests.

Author contributions

This is a single-authored article.

Ethics approval and consent to participate

Not applicable.

[1] I have worked in the field of nursing before. According to an incident I experienced in this field; "A 94-year-old patient of mine, who has a habit of regularly reading books using the bedside light before going to sleep, one day took the book printed on glossy paper in my hand and examined it, and told me that while reading these books at night, it tired her eyes because they reflected the light back. Because in their time, books were printed on straw paper."

Consent for publication

Not applicable.

Availability of data

OECD. Stat.report.

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ACCSCIENCE PUBLISHING

Global Health Economics and Sustainability

ORIGINAL RESEARCH ARTICLE

Dating violence, mental health symptoms, and life satisfaction in same-sex and opposite-sex relationships in Spain: A gender analysis

M. Pilar Matud[1]*, María-José del Pino[2], D. Estefanía Hernández-Lorenzo[1], Demelsa Fortes[1], and Ignacio Ibáñez[1]

[1]Department of Clinical Psychology, Psychobiology and Methodology, Universidad de La Laguna, La Laguna, Spain

[2]Department of Sociology, University Pablo de Olavide, Seville, Spain

Abstract

Intimate partner violence has become a major social and public health problem. Thus, this study examines dating violence perpetration and victimization in opposite-sex and same-sex couples in Spain. The sample was non-probabilistic and consisted of 240 men and 288 women, half of each gender group had a same-sex partner while the other half had an opposite-sex partner. Participants were assessed using six scales and questionnaires. The results showed that 60.8% of men and 59% of women in same-sex relationships and 67.5% of men and 48.6% of women in opposite-sex relationships reported experiencing some – mostly psychological – violence from their partner. 21.7% of men and 11.1% of women with a same-sex partner and 25.8% of men and 9.7% of women with an opposite-sex partner reported experiencing physical violence, and 10% of men and 9% of women with a same-sex partner and 7.5% men and 6.3% women with an opposite sex partner reported sexual violence. Perpetration and victimization were associated: 47.5% of men and 46.5% of women with a same-sex partner and 53.3% of men and 38.9% of women with an opposite-sex partner reported being both victims and perpetrators of dating violence. In all groups, being a victim of violence was linked to increased anxiety and insomnia symptoms, and in some groups, it was also linked to severe depressive symptoms and low self-esteem. Despite differences depending on gender and whether the relationship is between same-sex or opposite-sex partners, dating violence is common in all relationships and represents a serious threat to mental health and well-being.

Keywords: Dating violence; Same-sex partner; Opposite-sex partner; Gender; Mental health; Life satisfaction

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***Corresponding author:**
M. Pilar Matud
(pmatud@ull.edu.es)

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1. Introduction

Dating violence refers to the threatened or actual use of physical, verbal, or sexual abuse by one non-married partner against another in a dating relationship (Anderson & Danis, 2007). Although this term is generally applied to adolescent or young adult relationships, it can refer to violence or abuse that occurs in dating relationships regardless of age

(Lewis & Fremouw, 2001). Therefore, this term was used in the present study, which examines violence perpetrated by partners who are or have been in a dating relationship but are not married or cohabiting. Dating violence has traditionally been understudied, despite evidence that it is a serious and potentially destructive issue requiring both empirical and clinical attention (Shorey *et al*., 2008).

The Centers for Disease Control and Prevention (CDC; 2023) identifies dating violence as a type of intimate partner violence (IPV). IPV refers to aggression or abuse in romantic relationships with a current or former spouse or dating partner. IPV is a significant social and public health issue (CDC, 2023; Nicholls & Hamel, 2015; Ogbe *et al*., 2020) and a global phenomenon (Krug *et al*., 2002; Martínez-Heredia *et al*., 2021; Ogbe *et al*., 2020) that has many societal and individual costs (CDC, 2023). IPV has severe consequences for the mental and physical health of victims and survivors (Bates, 2020; Breiding *et al*., 2015; Spencer *et al*., 2019), as well as for families and society (Nicholls & Hamel, 2015). In addition, IPV perpetration has been linked to mental health problems (Spencer *et al*., 2019; Okuda *et al*., 2015; Yanez-Peñúñuri *et al*., 2023).

Although there is considerable variability in the severity, function, form, and manifestation of dating violence (CDC, 2023; Shorey *et al*., 2008), it encompasses three facets of abuse: physical, psychological, and sexual (Callan *et al*., 2021; Shorey *et al*., 2008; Spencer *et al*., 2019). Physical violence involves inflicting or attempting to inflict physical harm on a partner by punching, kicking, hitting, or otherwise using physical force; psychological aggression involves using verbal and non-verbal communication to cause psychological or emotional harm and/or to exert control over a partner; and sexual violence consists of forcing or attempting to force a partner to engage in any type of sexual activity against their will (CDC, 2023). Although many studies of IPV have been conducted worldwide, most have focused on married or cohabiting partners, heterosexual partners, and women as victims. While IPV against women is a serious public health issue (World Health Organization, 2021) and a violation of women's human rights with devastating long- and short-term effects on their physical and mental health (CDC, 2023; Klencakova *et al*., 2023; Sardinha *et al*., 2022), this study focuses on IPV among same-sex and opposite-sex dating partners.

Although not as extensively studied as IPV among heterosexual partners, there is evidence that violence occurs between same-sex partners (Frieze *et al*., 2020; McGregor, 2023; Townsend & Bailey, 2021). Rates of IPV among same-sex partners, while varying considerably across studies (Frieze *et al*., 2020), are comparable or even higher than those among opposite-sex partners (Callan *et al*., 2021; Cañete *et al*., 2022; Martin-Storey, 2015; Messinger, 2011; Rollè *et al*., 2018; Stephenson *et al*., 2022), making it a significant public health concern (Kar *et al*., 2023). It has been argued that addressing IPV requires considering women and men as potential perpetrators and victims of such violence (Costa *et al*., 2015), with evidence indicating that both genders can be victims and perpetrators (Costa *et al*., 2015; Nicholls & Hamel, 2015). Although research on men as survivors of IPV is limited, surveys have shown that men do experience IPV. Differences by sexual orientation have been noted, with bisexual men being more likely to report sexual and physical violence, and gay men more likely to report stalking (Dickerson-Amaya & Coston, 2019). IPV among female same-sex partners is also understudied. Garay-Villarroel *et al*. (2023) have noted the importance of examining this type of violence separately, as it cannot be directly equated with violence between heterosexual partners.

This study's purpose was to analyze both victimization and perpetration of violence among same-sex and opposite-sex partners who are not married or cohabiting, as well as among women and men. Further, it examines the association between victimization and perpetration of such violence. In addition, the study aims to determine the relationships between victimization and perpetration with psychological symptomatology, self-esteem, and life satisfaction among women and men. Finally, the study analyzes how perpetration and victimization of violence are associated with age, level of education, internalization of traits commonly associated with masculine/instrumental and feminine/expressive traits, and traditional attitudes toward gender roles.

2. Methods

2.1. Participants and procedure

This cross-sectional study was conducted with individuals from the general Spanish population. The sample was non-probabilistic and included 288 women (54.5%) and 240 men (45.5%), aged between 17 and 54 years. All participants were currently or previously in a partnership but were neither married nor cohabiting. If participants did not have a partner at the time of the study, they were asked to report on their most recent partner. Half of the women (n = 144) and men (n = 120) had same-sex partners, while the other half of the women (n = 144) and men (n = 120) had opposite-sex partners. We controlled for age, education level, occupation, and marital status of the same-sex partners to match those of opposite-sex partners (Table 1) and to ensure that these characteristics did not differ between women and men (Table 2). Although there was diversity in sociodemographic characteristics,

Table 1. Sociodemographic features of same-sex and opposite-sex partners

	Opposite-sex partner (*n*=264)		Same-sex partner (*n*=264)		χ^2-value	Sig.
	n	**%**	***n***	**%**		
Education level						
Elementary studies	20	7.8	16	7.5	0.07	0.96
High school diploma or vocational training	157	60.9	127	59.9		
University degree	81	31.4	69	32.5		
Missing data	6		52			
Occupation						
Employed	70	26.5	66	25.4	2.05	0.36
Unemployed	18	6.8	21	8.1		
Student	176	66.7	173	66.5		
Missing data	0		4			
Marital status						
Never married, unpartnered	81	32.4	69	31.5	0.04	0.84
Never married, with partner	169	67.6	150	68.5		
Missing data	14		45			
	M	***SD***	***M***	***SD***	***t*-value**	**Sig.**
Age	24.54	6.60	24.32	6.44	0.38	0.70

Abbreviations: M: Means; SD: Standard deviations; ANOVA: Analysis of variance.

Table 2. Sociodemographic features of women and men

	Women (*n*=288)		Men (*n*=240)		χ^2-value	Sig.
	n	**%**	***n***	**%**		
Education level						
Elementary studies	19	7.4	17	8.0	1.41	0.49
High school diploma or vocational training	150	58.4	134	62.9		
University degree	88	34.2	62	29.1		
Missing data	31		27			
Occupation						
Employed	73	25.7	63	26.3	2.05	0.36
Unemployed	17	6.0	22	9.2		
Student	194	68.3	155	64.6		
Missing data	4		0			
Marital status						
Never married, unpartnered	87	33.3	63	30.3	0.49	0.48
Never married, with partner	174	66.7	145	69.7		
Missing data	27		32			
	M	***SD***	***M***	***SD***	***t*-value**	**Sig.**
Age	24.56	6.92	24.28	6.02	0.49	0.63

Abbreviations: M: Means; SD: Standard deviations; ANOVA: Analysis of variance.

the most common profiles were that of students (66.6%), individuals with a high school diploma or vocational training (60.4%), and those who were never married but had a partner (68.0%). All respondents participated voluntarily and did not receive financial compensation for their participation.

Participants were recruited from educational and employment centers in Spain and through the network of undergraduate and graduate psychology students involved in data collection. All students who assisted with collecting information for psychological tests were previously trained and received course credit. Data were collected with paper and pencil. Research assistants contacted each participant, explained the general characteristics of the study, ensured confidentiality, and informed them of their right to withdraw at any time. Participants who agreed to take part received an envelope containing self-administered assessment tests and a sociodemographic data collection sheet, along with instructions for completing the tests. The research assistant arranged a time and place for collecting the completed tests, ensuring that the interval between test delivery and completion did not exceed 10 days.

All participants provided verbal consent to participate in the study after being informed about its purpose. Responses were completely anonymous, and no names or other identifying information were recorded. The study was approved by the Animal Research and Welfare Ethics Committee of the University of La Laguna (study approval number 2013 – 0058).

Data for this research were extracted from a larger study on dating violence, health, and gender, using the following criteria: (1) Participants were 17 years of age or older. (2) They currently or previously had a dating partner. (3) They were not married or living with a partner. (4) They completed all the questionnaires and scales.

To control for similar sociodemographic characteristics between opposite-sex and same-sex partners and between women and men, the group of men with same-sex partners was selected first considering their smaller numbers. Once their sociodemographic characteristics were established, a sample of women with same-sex partners was selected, ensuring that their age, occupation, education, and marital status were similar to those of men. Next, groups of women and men with opposite-sex partners were selected, with age, occupation, education, and marital status being comparable to those of the same-sex partner.

2.2. Measures

2.2.1. Dating violence

Dating violence was assessed using a scale developed by the authors, consisting of 42 items. Twenty-one items measure dating violence victimization and the remaining 21 measure dating violence perpetration. Each item collects information about the frequency (never, sometimes, often) of being a victim or perpetrator of violence or controlling behavior. The scale also asks about the sex of the dating partner whose violence was assessed. The dating violence victimization and perpetration items are categorized into three types of violence: (1) psychological violence, assessed with nine items that address behaviors such as insulting, belittling, manipulating, humiliating, blaming, or controlling; (2) physical violence, assessed with 10 items covering behaviors like slapping, shoving, beating, hitting, or threatening physical violence; and (3) sexual violence, assessed with two items: one related to forcing or threatening to perform unwanted sexual acts and the other related to threatening to leave if the partner's sexual desires are not accepted. For the current sample, the internal consistency (Cronbach's alpha) for the 21 items measuring victimization was 0.86 and for the 21 items measuring perpetration was 0.89. Regarding psychological, physical, and sexual violence, for victimization, Cronbach's alpha was 0.82, 0.77, and 0.69, respectively, and for perpetration, it was 0.64, 0.92, and 0.50, respectively.

2.2.2. Mental health symptoms

Mental health symptoms were assessed using the General Health Questionnaire (GHQ-28; Goldberg *et al*., 1996). The GHQ-28 is a self-administered screening test consisting of four subscales of seven items, each assessing anxiety and insomnia, somatic symptoms, severe depression, and social dysfunction. Items were scored on a Likert-type scale with each item weighted from 0 to 3, with higher scores indicating more symptoms. For the current sample, the internal consistency was 0.84 for somatic symptoms, 0.90 for anxiety and insomnia symptoms, 0.82 for social dysfunction symptoms, and 0.90 for severe depression symptoms.

2.2.3. Life satisfaction

Life satisfaction was assessed using the Spanish version of the Satisfaction with Life Scale (Diener *et al*., 1985). This five-item scale uses a seven-point Likert scale, with higher scores indicating greater overall life satisfaction. The internal consistency of the five items in the current study was 0.84.

2.2.4. Self-esteem

The Spanish version of the Rosenberg Self-esteem Scale (Rosenberg, 1965) was used to assess self-esteem. This scale consists of 10 items designed to measure global self-esteem, with each item scored on a four-point scale. Higher scores indicate higher self-esteem. The internal consistency for the current sample was 0.88.

2.2.5. Traditional gender role attitudes

Traditional attitudes toward gender roles were assessed using the Gender Roles Attitudes Questionnaire (Matud, 2001 – 2004). This 22-item measure evaluates adherence to traditional views about the social roles of men and women.

Items are scored on a seven-point Likert scale, with higher scores indicating more traditional gender role attitudes. The internal consistency for this sample was 0.87.

2.2.6. Feminine/expressive and masculine/instrumental and traits

To assess participants' self-attribution of personality traits stereotypically associated with masculinity and femininity, the reduced and Spanish-translated version of Bem's Sex Role Inventory (Bem, 1981) was used. The masculinity scale consists of 10 items describing attributes traditionally considered masculine, such as "independent," "assertive," "dominant," and "aggressive," assessing masculine/instrumental traits. The femininity scale includes 10 items with attributes traditionally considered feminine, such as "compassionate," "warm," "tender," and "kind," assessing feminine/expressive traits (Matud, 2018). A seven-point Likert-type scale was used for responses, with higher scores indicating greater self-attribution of these traits. In this study's sample, the internal consistency of the masculinity scale was 0.77 and that of the femininity scale was 0.88.

2.2.7. Demographic data

Participants' sociodemographic characteristics were collected using a sociodemographic data sheet, which included gender (woman, man, other), age, marital status, occupation, and education. Since very few people (<1%) selected the "other" category, only those identifying as either a woman or a man were included in the study.

2.3. Statistical analysis

Internal consistency was measured using Cronbach's alpha. Comparisons of sociodemographic characteristics between opposite-sex and same-sex partners and between men and women were made using student's *t*-tests for age and Pearson's Chi-squared test for education level, marital status, and occupation. To determine differences in dating violence perpetration and victimization between same-sex and opposite-sex partners and between women and men, six 2 × 2 between-subjects factorial analyses of variance (ANOVA) were conducted. The factor variables were partner type (opposite-sex partner, same-sex partner) and gender (women, men), with the dependent variables being psychological, physical, and sexual violence victimization in the first set of analyses and psychological, physical, and sexual violence perpetration in the second set. Correlational analyses were conducted to examine the associations between victimization and perpetration of dating violence, as well as the rest of the variables of the study. All correlations were performed using Pearson's *r* correlation coefficient, except for education, which was calculated using Spearman's rho because it is an ordinal variable. IBM Statistical Package for the Social Sciences Statistics for Windows, version 22.0, was used for statistical analyses and graphs.

3. Results

3.1. Dating violence victimization and perpetration

When analyzing the frequency of violence, we found the following percentages for victimization: 60.8% for men with a same-sex partner, 59% for women with a same-sex partner, 67.5% for men with an opposite-sex partner, and 48.6% for women with an opposite-sex partner. The differences in these percentages were statistically significant, χ^2 (3, n = 528) = 1.09, p = 0.018. For psychological violence victimization, the percentages were 55.8%, 56.3%, 60.8%, and 45.1%, respectively, and these differences were not statistically significant, χ^2 (3, n = 528) = 7.26, p = 0.064. The percentages of individuals who experienced physical violence victimization were 21.7%, 11.1%, 25.8%, and 9.7%, respectively; these differences were statistically significant, χ^2 (3, n = 528) = 17.77, P < 0.001. The percentages of sexual violence victimization were 10%, 9%, 7.5%, and 6.3%, respectively; these differences were not statistically significant, χ^2 (3, n = 528) = 1.46, p = 0.692.

The percentage of individuals reporting perpetration of dating violence was 51.7% for men with a same-sex partner, 52.1% for women with a same-sex partner, 56.7% for men with an opposite-sex partner, and 45.8% for women with an opposite-sex partner. The differences were not statistically significant, χ^2 (3, n = 528) = 3.15, p = 0.369. The percentages of psychological violence perpetration were 50%, 48.6%, 52.5%, and 44.4%, respectively, which were not significantly different, χ^2 (3, n = 528) = 1.82, p = 0.611. The percentages of physical violence perpetration were 10.8%, 9%, 20%, and 4.5%, respectively; these differences were statistically significant, χ^2 (3, n = 528) = 16.29, p = 0.001. The percentages of sexual violence perpetration were 5.8%, 2.1%, 3.3%, and 2.1%, respectively; these differences were not statistically significant, χ^2 (3, n = 528) = 3.83, p = 0.281.

Table 3 presents the ranges of scores for victimization and perpetration for each type of violence in the four groups. For both victimization and perpetration, the score range allowed by the scale was from 0 to 42 for total dating violence, from 0 to 18 for psychological violence, from 0 to 20 for physical violence, and from 0 to 4 for sexual violence. As shown in Table 3, for none of the types of violence victimization did the range of scores reach the maximum allowed by the scale, indicating that the violence victimization was not severe or very frequent, particularly for total and physical violence. The range of scores for total violence victimization was greater for men than for women, and the range of scores for physical violence

victimization was greater for men with an opposite-sex partner compared to the other groups. The range of scores for perpetration of dating violence was greater for men with an opposite-sex partner than for the other groups. The ranges of scores for total, psychological, and physical violence perpetration were significantly lower than those for victimization, except for the group of men with an opposite-sex partner.

Table 4 presents the main results of two-way factorial ANOVAs with participants' type of partner (opposite-sex partner, same-sex partner) and gender (women, men) as between-subjects factors and psychological, physical, and sexual dating violence victimization as dependent variables. According to the ANOVAs in which psychological violence and sexual violence victimization were considered the dependent variables, no statistically significant effects were found (Table 4). When the physical violence victimization score was considered the dependent variable, the ANOVA results indicated that only the main effect of gender was statistically significant. As shown in Table 4, men reported being victimized by physical dating violence more than women.

Table 5 presents the main results of two-way factorial ANOVAs with partner type (opposite-sex partner, same-sex partner) and gender (women, men) as between-subjects factors and psychological, physical, and sexual violence perpetration as dependent variables. The ANOVAs for psychological and sexual violence perpetration revealed no statistically significant effects (Table 5). However, when physical violence was considered the dependent variable, the results showed a statistically significant interaction between gender and partner type (Figure 1). *Post hoc* analysis with Scheffé adjustment, conducted to identify significant group differences, revealed a significant

Table 3. Dating violence victimization and perpetration range for the four groups

	Men		Women	
	Opposite-sex partner	**Same-sex partner**	**Opposite-sex partner**	**Same-sex partner**
Total victimization	0 – 25	0 – 24	0 – 16	0 – 19
Psychological victimization	0 – 16	0 – 17	0 – 14	0 – 11
Physical victimization	0 – 12	0 – 7	0 – 6	0 – 7
Sexual victimization	0 – 3	0 – 3	0 – 2	0 – 2
Total perpetration	0 – 36	0 – 6	0 – 6	0 – 8
Psychological perpetration	0 – 12	0 – 5	0 – 5	0 – 8
Physical perpetration	0 – 20	0 – 4	0 – 2	0 – 3
Sexual perpetration	0 – 4	0 – 2	0 – 1	0 – 2

Table 4. *M*, *SD*, and two-way factorial ANOVA for violence victimization

	Opposite-sex partner		Same-sex partner		ANOVA		
	M	***SD***	***M***	***SD***	**Effect**	***F* ratio**	**ηp^2**
Psychological violence							
Women	1.40	2.42	1.58	2.31	Type of partner	0.02	0.000
Men	1.77	2.40	1.65	2.46	Gender	1.06	0.002
Interaction Type of partner×gender					TP×G	0.50	0.001
Physical violence							
Women	0.21	0.80	0.21	0.80	Type of partner	1.16	0.002
Men	0.64	1.69	0.43	1.16	Gender	10.65**	0.020
Interaction Type of Partner×Gender					TP×G	1.02	0.002
Sexual violence							
Women	0.08	0.34	0.15	0.51	Type of partner	2.43	0.005
Men	0.12	0.45	0.18	0.56	Gender	0.46	0.001
Interaction type of partner×Gender					TP×G	0.02	0.000

Notes: TP×G: Interaction type of partner×gender. **$p<0.01$.
Abbreviations: M: Means; SD: Standard deviations; ANOVA: Analysis of variance.

Table 5. *M*, *SD*, and two-way factorial ANOVA for violence perpetration

	Opposite-sex partner		Same-sex partner		ANOVA		
	M	*SD*	*M*	*SD*	Effect	*F*	ηp^2
Psychological violence							
Women	0.75	1.09	1.01	1.51	Type of Partner	0.84	0.002
Men	0.97	1.49	0.92	1.21	Gender	0.33	0.001
Interaction type of partner×gender					TP×G	1.64	0.003
Physical violence							
Women	0.08	0.38	0.13	0.49	Type of Partner	2.66	0.005
Men	0.48	2.02	0.14	0.50	Gender	4.85*	0.009
Interaction Type of Partner×Gender					TP×G	4.68*	0.009
Sexual violence							
Women	0.02	0.14	0.04	0.29	Type of Partner	0.07	0.000
Men	0.07	0.42	0.06	0.30	Gender	1.47	0.003
Interaction Type of Partner×Gender					TP×G	0.29	0.001

Notes: TP×G: Interaction Type of Partner×Gender. *p<0.05.
Abbreviations: M: Means; SD: Standard deviations; ANOVA: Analysis of variance.

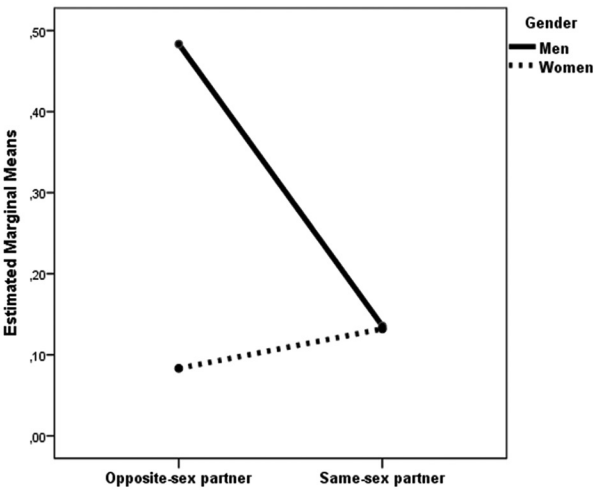

Figure 1. Changes in physical violence perpetration as a function of gender and type of partner

difference (p = 0.02) between men and women with opposite-sex partners, with a mean difference of 0.40 and 95% confidence interval (0.37 – 0.76). As shown in Figure 1 and Table 5, men with opposite-sex partners perpetrated more physical dating violence than women with opposite-sex partners. Differences between the other groups were not statistically significant.

To better understand differences in victimization and perpetration by same-sex and opposite-sex partners and by gender, we analyzed responses to each of the 21 items assessing dating violence victimization and perpetration. The results showed variability in the frequency of violence victimization across all items assessing psychological violence, except for item 7, which states "He/she watches you, tells you where to go, follows you." This behavior occurred only occasionally among women with same-sex partners but happened "many times" in the other groups. There was also variability in responses to an item assessing sexual violence, which states, "He/she imposes sexual acts that you do not like or want to do by using force or threats." Responses to another item assessing sexual violence, "He/she threatens to leave you if you do not comply with his/her sexual desires," showed that it occurred only occasionally among women and men with opposite-sex partners but frequently among some women and men with same-sex partners. In analyzing severe violence, we found that only one woman with an opposite-sex partner reported severe physical abuse or an attempt to suffocate her, and four individuals (two men with an opposite-sex partner, one man with a same-sex partner, and one woman with an opposite-sex partner) reported suffering serious injuries due to dating violence. No women with same-sex partners reported being victims of severe physical dating violence.

Analysis of the statistically significant mean differences between the four groups, adjusted with Scheffé, revealed differences in victimization for only three of the 21 items: Item 12, "he/she has grabbed and/or pulled your hair, twisted your arm.;" item 17, "he/she has caused you minor wounds, bruises, scratches.," for which men with opposite-sex partners scored higher than both groups of women; and item 13, "he/she has slapped you," for which men with opposite-sex partners scored higher than women with opposite-sex partners.

The most common complaints across the sample were "gets angry when you disagree with his/her views or beliefs,"

reported by 37% of respondents; "controls who you go out with, where you go, who you talk to, who calls you on the phone," reported by 18.9% of the total; "makes fun of your beliefs and/or what you think," reported by 17.6%; "blames you for everything bad that happens to both of you and/or him/her," reported by 16.6%; "criticizes you for taking time to study, do things you like, exercise...," reported by 14.9%; and "treats you like you are stupid or inferior to him/her or other people," reported by 12% of the total sample.

Analysis of the responses to each item on perpetration of dating violence showed greater variability. Notably, the item with the greatest variability across all groups was "You get angry when he/she disagrees with your views or beliefs," which was reported by all groups as occurring many times. In contrast, the behavior "You insult and/or humiliate him/her in front of other people" was reported only occasionally by all groups.

For four of the violent behaviors, only men reported engaging in them "many times." These behaviors were "You treat her/him as if she/he is stupid or inferior to you and/or other people;" "You have made fun of her/his beliefs and/or what she/he thinks;" "You have grabbed and/or pulled her/his hair, twisted her/his arm.;" "You have slapped her/him;" and "You have imposed sexual acts on him/her by force or threats." In addition, for 12 of the 21 items in the questionnaire, only men with opposite-sex partners reported engaging in these behaviors "many times." These included three items related to psychological violence, one to sexual violence, and eight to physical violence, including severe behaviors such as beatings or attempts to choke or strangle.

Analysis of statistically significant mean differences in the perpetration of dating violence among the four groups, adjusted with Scheffé, showed differences in only one of the items: men with opposite-sex partners reported causing more minor wounds, bruises, or scratches than the other groups.

3.2. Correlations between perpetration and victimization of dating violence and the study variables

Table 6 presents the results of the intercorrelations between perpetration and victimization across the four groups. As shown, the perpetration of each type of dating violence was moderately associated with the victimization of the same type, except in the case of physical violence among men with opposite-sex partners, where the association was large. Among women with opposite-sex partners, victimization of sexual violence was independent of perpetration of this type of violence. In addition, among men with same-sex partners, the association between victimization and perpetration of sexual violence was small.

To assess the extent to which being a victim was associated with being a perpetrator of each type of dating violence, categorical analyses were performed. Four categories were established: (1) neither victim nor perpetrator, which included individuals who scored 0 on both victimization and 0 on perpetration of dating violence; (2) never victim but perpetrator, which included individuals who scored 0 on victimization and >0 on perpetration; (3) victims but not perpetrators, including those who scored >0 on victimization and 0 on perpetration; and (4) victims and perpetrators, including those who scored >0 on both victimization and perpetration.

Table 7 shows the n and percentages for the four groups. The differences in percentages were not statistically significant, χ^2 (9, n = 528) = 10.62, p = 0.30. Except for women with opposite-sex partners, the majority of participants across groups reported being both victims and perpetrators of dating violence, with the highest prevalence among men with opposite-sex partners (53.3%), men with same-sex partners (47.5%), and women with same-sex partners (46.5%). The "neither victims nor perpetrator" category was reported by 35% of men with same-sex partners, 35.4% of women with same-sex partners, 29.2% of men with opposite-sex partners, and 44.4% of women with opposite-sex partners. Only 5.1% of the total sample reported being perpetrators of dating violence but not victims, while 12.3% reported being victims but not perpetrators.

Table 8 presents the correlation coefficients between women's victimization from dating violence and the study variables, disaggregated by partner type. Although the effect sizes were small, some statistically significant correlations were found between dating violence victimization and mental health symptomatology, self-esteem, feminine/expressive trait internalization, and traditional gender role attitudes. Women with both same-sex and opposite-sex partners who experienced higher levels of psychological and total victimization reported greater anxiety and insomnia symptoms. In addition, same-sex partnered women who internalized feminine/expressive traits experienced more physical violence; same-sex partnered women who experienced higher levels of psychological violence also reported lower levels of self-esteem and greater symptoms of severe depression. Among opposite-sex partnered women, higher levels of physical violence were associated with more symptoms of anxiety and insomnia, while higher levels of sexual violence were linked to greater symptoms of severe depression. Finally, women with opposite-sex partners who held more traditional gender role attitudes reported greater psychological violence in their dating relationships.

Table 6. Intercorrelations between violence perpetration and victimization for the four groups

	Men		Women	
	Opposite-sex partner	Same-sex partner	Opposite-sex partner	Same-sex partner
Total violence	0.70***	0.50***	0.52***	0.48***
Psychological violence	0.54***	0.48***	0.56***	0.46***
Physical violence	0.80***	0.52***	0.37***	0.43***
Sexual violence	0.53***	0.27**	−0.04	0.53***

Notes: **p<0.01; ***p<0.001.

Table 7. Contingency table between dating violence perpetration and victimization for the four groups

	Men				Women			
	Opposite-sex partner		Same-sex partner		Opposite-sex partner		Same-sex partner	
	n	%	*n*	%	*n*	%	*n*	%
Neither victim nor perpetrator	35	29.2	42	35	64	44.4	51	35.4
Never victim but perpetrator	4	3.3	5	4.2	10	6.9	8	5.6
Victims but not perpetrators	17	14.2	16	13.3	14	9.7	18	12.5
Victims and perpetrators	64	53.3	57	47.5	56	38.9	67	46.5

Table 8. Correlations between women's dating violence victimization and study variables disaggregated by partner type

	Total violence victimization	Psychological violence	Physical violence	Sexual violence
Same-sex partner				
Somatic symptoms	0.13	0.13	0.09	0.00
Anxiety and insomnia symptoms	**0.22****	**0.24****	0.08	0.04
Social dysfunction	0.07	0.07	0.01	0.07
Severe depression symptoms	0.15	**0.17***	0.05	0.04
Life satisfaction	−0.10	−0.14	0.02	0.01
Self-esteem	**−0.18***	**−0.17***	−0.13	−0.08
Traditional gender role attitudes	0.15	0.15	0.12	−0.02
Masculine/instrumental trait	−0.05	−0.09	0.12	−0.07
Feminine/expressive trait	0.04	−0.04	**0.19***	0.11
Age	−0.10	−0.09	−0.03	−0.10
Education level[a]	−0.07	−0.09	0.02	−0.01
Opposite-sex partner				
Somatic symptoms	0.10	0.08	0.09	0.03
Anxiety and insomnia symptoms	**0.21***	**0.20***	**0.17***	0.07
Social dysfunction	0.11	0.11	0.05	0.04
Severe depression symptoms	0.14	0.12	0.06	**0.19***
Life satisfaction	−0.14	−0.11	−0.14	−0.09
Self-esteem	−0.07	−0.04	−0.11	−0.11
Traditional gender role attitudes	0.15	**0.19***	−0.03	0.01
Masculine/instrumental trait	0.08	0.08	0.06	−0.01
Feminine/expressive trait	0.04	0.05	0.01	−0.09
Age	0.03	0.07	−0.03	−0.14
Education level[a]	0.14	0.16	0.00	−0.03

Notes: [a]Spearman's correlation coefficient. Statistically significant coefficients are shown in bold. *p<0.05; **p<0.01.

Table 9 shows the correlation coefficients between men's victimization from dating violence and the study variables, disaggregated by partner type. Men in both groups who experienced more total victimization reported greater anxiety and insomnia symptoms, although the effect size of the correlation coefficient was small. Men with more traditional gender role attitudes also reported greater dating victimization, though the correlations were not statistically significant for psychological violence among men with same-sex partners or for sexual violence among men with opposite-sex partners. Men with same-sex partners who experienced greater psychological violence victimization reported more anxiety and insomnia symptoms, while those who internalized masculine/instrumental traits reported greater psychological, physical, and total violence victimization. Men with opposite-sex partners who reported greater total dating violence victimization reported more severe depression, lower self-esteem, and reduced life satisfaction. In addition, men with higher levels of sexual victimization reported more somatic, anxiety, insomnia, and social dysfunction symptoms. Those with higher levels of physical violence victimization reported more somatic, anxiety, and insomnia symptoms. Finally, men with opposite-sex partners who had internalized feminine/expressive traits experienced less physical, psychological, and total dating violence victimization.

Table 10 presents the correlation coefficients between women's perpetration of dating violence and the study variables, disaggregated by partner type. There are some statistically significant correlation coefficients, although the effect size was small. In both groups, women with more traditional attitudes toward gender roles perpetrated greater psychological and total dating violence. In addition, women with same-sex partners who reported perpetrating more physical violence had more somatic, depressive, and anxiety and insomnia symptoms, as well as lower self-esteem. Those who internalized feminine/expressive traits reported less perpetration of psychological and total violence. Women with an opposite-sex partner who reported greater perpetration of psychological and total

Table 9. Correlations between men's dating violence victimization and study variables disaggregated by partner type

	Total violence victimization	Psychological violence	Physical violence	Sexual violence
Same-sex partner				
Somatic symptoms	0.05	0.05	0.06	−0.02
Anxiety and insomnia symptoms	**0.20***	**0.20***	0.14	0.08
Social dysfunction	−0.02	−0.07	0.04	0.11
Severe depression symptoms	0.05	0.03	0.06	0.07
Life satisfaction	0.09	0.06	0.13	0.05
Self-esteem	0.04	0.03	0.05	0.05
Traditional gender role attitudes	**0.18***	0.09	**0.19***	**0.40*****
Masculine/instrumental trait	**0.25****	**0.25****	**0.23***	0.01
Feminine/expressive trait	0.04	0.03	0.10	−0.07
Age	−0.01	0.01	−0.01	−0.06
Education level[a]	0.06	0.09	0.00	−0.04
Opposite-sex partner				
Somatic symptoms	**0.21***	0.14	**0.18***	**0.29****
Anxiety and insomnia symptoms	**0.20***	0.14	**0.20***	**0.22***
Social dysfunction	0.11	0.07	0.11	**0.19***
Severe depression symptoms	**0.30****	**0.20***	**0.28****	**0.40*****
Life satisfaction	**−0.46*****	**−0.41*****	**−0.36*****	**−0.34*****
Self-esteem	**−0.29****	**−0.24****	**−0.26****	**−0.20***
Traditional gender role attitudes	**0.30****	**0.22***	**0.32*****	0.14
Masculine/instrumental trait	0.05	0.00	−0.02	0.10
Feminine/expressive trait	**−0.27****	**−0.22***	**−0.27****	−0.10
Age	0.02	0.08	−0.06	−0.03
Education level[a]	0.03	0.03	−0.05	0.02

Notes: [a]Spearman's correlation coefficient. Statistically significant coefficients are shown in bold. *p<0.05; **p<0.01; ***p<0.001.

Table 10. Correlations between women's dating violence perpetration and study variables disaggregated by partner type

	Total violence perpetration	Psychological violence	Physical violence	Sexual violence
Same-sex partner				
Somatic symptoms	0.13	0.06	**0.21***	0.08
Anxiety and insomnia symptoms	0.14	0.11	**0.20***	−0.06
Social dysfunction	0.11	0.07	0.11	0.13
Severe depression symptoms	0.12	0.06	**0.26****	−0.07
Life satisfaction	−0.04	−0.05	−0.07	0.11
Self-esteem	**−0.17***	−0.14	**−0.17***	0.00
Traditional gender role attitudes	**0.25****	**0.26****	0.13	−0.09
Masculine/instrumental trait	−0.16	−0.17	−0.05	−0.01
Feminine/expressive trait	**−0.19***	**−0.23****	0.03	0.09
Age	−0.07	−0.04	−0.10	−0.05
Education level[a]	−0.02	−0.01	0.06	−0.01
Opposite-sex partner				
Somatic symptoms	0.16	0.12	0.14	0.09
Anxiety and insomnia symptoms	0.16	0.14	0.11	0.05
Social dysfunction	**0.24****	**0.26****	0.04	−0.01
Severe depression symptoms	0.07	0.08	−0.03	−0.01
Life satisfaction	−0.16	−0.13	−0.16	0.04
Self-esteem	−0.02	−0.03	−0.01	0.08
Traditional gender role attitudes	**0.17***	**0.19***	0.01	−0.02
Masculine/instrumental trait	−0.04	−0.05	0.01	−0.04
Feminine/expressive trait	−0.04	−0.04	−0.04	0.12
Age	**0.26****	**0.21***	**0.27****	−0.01
Education level[a]	0.09	0.01	0.09	−0.07

Notes: [a]Spearman's correlation coefficient. Statistically significant coefficients are shown in bold. *$p<0.05$; **$p<0.01$.

violence experienced greater social dysfunction and older aged women reported greater perpetration of physical, psychological, and total violence.

Table 11 displays the correlation coefficients between men's perpetration of dating violence and the study variables, disaggregated by partner type. Statistically significant correlation coefficients differ between men with same-sex partners and men with opposite-sex partners. Among men with same-sex partners, only three statistically significant correlation coefficients were observed. Specifically, men with same-sex partners who reported greater perpetration of psychological and total dating violence experienced more anxiety and insomnia symptoms; additionally, older men reported greater perpetration of sexual violence.

Men with opposite-sex partners who reported greater perpetration of physical, psychological, and sexual dating violence reported more severe depression symptoms, lower self-esteem, and decreased life satisfaction. Furthermore, men who reported greater perpetration of psychological, physical, and total violence also reported more somatic symptoms. Those with more traditional attitudes toward gender roles were more likely to perpetrate all types of violence, while men who internalized more feminine/expressive traits reported less psychological, physical, and sexual violence toward their dating partners.

4. Discussion

This study is based on a sample of individuals from the Spanish general population who have or had a dating partner, half of whom were in same-sex relationships and half in opposite-sex relationships, though none were married or cohabiting with their partner. The results show that dating violence is common, but significant differences exist in terms of the type of violence, partner type, and gender. The prevalence of being a victim to any form of dating violence was 60.8% for men with same-sex partners, 59% for women with same-sex partners, 67.5% for men with opposite-sex partners, and 48.6% for women with opposite-sex partners. These findings align with previous

Table 11. Correlations between men's dating violence perpetration and study variables disaggregated by partner type

	Total violence perpetration	Psychological violence	Physical violence	Sexual violence
Same-sex partner				
Somatic symptoms	0.10	0.05	0.13	−0.04
Anxiety and insomnia symptoms	**0.23***	**0.20***	0.11	0.03
Social dysfunction	0.09	0.07	0.06	0.03
Severe depression symptoms	0.06	0.03	0.10	−0.06
Life satisfaction	0.05	−0.02	0.15	0.11
Self-esteem	−0.06	−0.08	−0.01	0.10
Traditional gender role attitudes	0.00	−0.03	0.03	0.12
Masculine/instrumental trait	0.01	−0.07	0.18	0.01
Feminine/expressive trait	−0.01	−0.10	0.14	0.06
Age	−0.08	−0.04	−0.10	**0.29****
Education level[a]	0.11	0.09	−0.07	0.05
Opposite-sex partner				
Somatic symptoms	**0.22***	**0.23***	**0.21***	0.06
Anxiety and insomnia symptoms	0.17	0.16	0.18	0.04
Social dysfunction	0.15	0.13	0.15	0.06
Severe depression symptoms	**0.35*****	**0.32*****	**0.35*****	**0.18***
Life satisfaction	**−0.38*****	**−0.37*****	**−0.36*****	**−0.25****
Self-esteem	**−0.29****	**−0.30****	**−0.25****	**−0.19***
Traditional gender role attitudes	**0.36*****	**0.34*****	**0.34*****	**0.22***
Masculine/instrumental trait	−0.03	−0.07	−0.01	0.04
Feminine/expressive trait	**−0.42*****	**−0.46*****	**−0.35*****	**−0.25****
Age	−0.01	0.07	−0.05	−0.07
Education level[a]	0.09	0.11	−0.09	0.03

Notes: [a]Spearman's correlation coefficient. Statistically significant coefficients are shown in bold. *$p<0.05$; **$p<0.01$; ***$p<0.001$.

studies reporting similar or higher rates of IPV in same-sex relationships compared to opposite-sex relationships (Callan *et al.*, 2021; Cañete *et al.*, 2022; Martin-Storey, 2015; Messinger, 2011; Rollè *et al.*, 2018; Stephenson *et al.*, 2022).

In the present study, the prevalence of overall victimization among women and men with same-sex partners was slightly lower than that reported by men with opposite-sex partners and slightly higher than that reported by women with opposite-sex partners. Therefore, the results of this study do not support the findings of Parent *et al.* (2023), who found that IPV prevalence rates are higher among sexual minority men than among heterosexual men. However, it is essential to note that this study did not inquire about participants' sexual orientation, focusing instead on the sex of their current partner. As such, it cannot be ruled out that some individuals with opposite-sex partners identify as bisexual.

Across all groups, psychological violence was the most common form of abuse, affecting nearly half of the sample. In contrast, physical and sexual violence were much less prevalent, a pattern consistent with previous research (Callan *et al.*, 2021; Costa *et al.*, 2015; Stephenson *et al.*, 2011; Temple *et al.*, 2023). When comparing the prevalence rates of physical victimization across the four groups, women were less likely than men to report physical violence victimization. Physical violence was reported by 11.1% of women with same-sex partners and 9.7% of women with opposite-sex partners, while among men, 21.7% of those with same-sex partners and 25.8% of those with opposite-sex partners reported being victims of physical violence.

Analyses of mean differences in IPV victimization revealed that statistically significant differences existed only for physical violence, with men reporting greater victimization than women, although the effect size was small. These findings are consistent with those of previous research (Bates, 2020; Lewis & Fremouw, 2001; Shorey *et al.*, 2008). Lewis and Fremouw (2001) posit that such findings could be attributed to factors like selection bias and social desirability, where male perpetrators may avoid

participating in dating violence surveys or downplay their violence. In addition, evidence suggests that in cases of severe violence, women are more often the victims and men are the perpetrators (Hamberger & Larsen, 2015; Nicholls & Hamel, 2015).

An in-depth analysis of the experience of physical violence revealed that men with opposite-sex partners were the only group to report being subjected to behaviors such as slapping, bruising, scratching, and being threatened with objects "often," although this occurred in only one case. In addition, only men (in both same-sex and opposite-sex relationships) reported being victims of dating partners throwing an object that could have injured them "many times."

Analysis of the perpetration of dating violence revealed that men with opposite-sex partners reported a greater frequency of certain violent behaviors toward their partner compared to all other groups. This increased frequency was observed in three manifestations of psychological violence, one manifestation of sexual violence, and the most physically violent behaviors. While other groups had reported perpetrating such violence only a few times, some men with opposite-sex partners admitted to committing these acts many times. Given the association found between the perpetration and victimization of dating violence, one possible explanation for the particularly strong link observed among men with opposite-sex partners in this study is that the higher levels of victimization reported by these men might be a reaction to their own violence. This violence included behaviors like slapping, scratching, and hair pulling but did not escalate to more severe physical violence. This hypothesis should be tested in future research.

When analyzing severe physical violence, such as severe beatings, strangulation, and other serious injuries, it was found that none of the women with same-sex partners and only one man with a same-sex partner reported being victims of this type of violence. Among opposite-sex partners, two women and two men reported being victims of such violence, suggesting that severe physical violence is less common in same-sex relationships, especially among women. Future research should investigate these significant findings further.

Regarding the perpetration of severe dating violence, only one man with an opposite-sex partner reported inflicting both severe beatings and injuries on his female partner "many times." This finding aligns with research showing that men are often the perpetrators of IPV in cases of severe violence (Hamberger & Larsen, 2015; Nicholls & Hamel, 2015). However, the fact that only one man reported such behavior could be due to response biases, such as social desirability or male perpetrators being less willing to participate in studies. These biases have been suggested as factors in IPV research conducted among the general population (Lewis & Fremouw, 2001).

As seen in previous research (Kimmes *et al.*, 2019; Longobardi & Badenes-Ribera, 2017; López-Barranco *et al.*, 2022), there are statistically significant associations between the perpetration and victimization of violence across all groups, although the strength of these associations varied by partner type and gender. These findings, along with the other results of this study, suggest that while there are similarities in the patterns of dating violence between same-sex and opposite-sex partners and between women and men, each group exhibits unique characteristics and dynamics. Future research should analyze these differences in greater depth.

Further, the associations of the perpetration and victimization of dating violence and mental health symptoms with internalization of traits traditionally associated with masculinity and femininity and traditional gender role attitudes varied by partner type and gender. Traditional gender role attitudes were linked to greater victimization and perpetration of dating violence among men with opposite-sex partners but only to victimization among men with same-sex partners. More traditional gender role attitudes are associated with greater perpetration of psychological and total dating violence for all women, but for women with opposite-sex partners, these attitudes were also linked to greater psychological victimization.

Internalization of the masculine/instrumental trait was relevant only among men with same-sex partners, where greater internalization of this trait was associated with increased psychological, physical, and total victimization. Among women with same-sex partners, greater internalization of the feminine/expressive trait was linked to higher rates of physical violence victimization and lower rates of psychological and total dating violence perpetration. For men with opposite-sex partners, greater internalization of the feminine/expressive trait was associated with less perpetration and victimization of dating violence.

Overall, greater dating violence victimization and perpetration were associated with more mental health symptoms. These findings are consistent with those of previous research (Bates, 2020; Lagdon *et al.*, 2014; Okuda *et al.*, 2015; Spencer *et al.*, 2019; Yanez-Peñúñuri *et al.*, 2023), although important differences were discovered across the four groups. The strongest association between dating violence perpetration and victimization and mental health symptoms and well-being was found among men with opposite-sex partners, perhaps because this group has the highest prevalence of dating violence perpetration and victimization.

This study has several limitations. First, because the sample is non-probability-based, there may be biases, the most important being selection bias. Second, all data were obtained through self-report, which is susceptible to various biases, including social desirability. Finally, as this is a cross-sectional study, causal relationships cannot be established.

5. Practical implications

Although the results should be treated with caution considering the limitations mentioned above, they allow for the identification of risk profiles for dating violence. The group at the highest risk for both victimization and perpetration of dating violence is men in relationships with women. In addition to being at greater risk of experiencing psychological and physical dating violence, this group is also likely to perpetrate psychological and physical violence against women, including severe physical violence. Men in this group who hold more traditional gender role attitudes are at greater risk of perpetrating physical, psychological, and sexual violence against women, as well as being victims of physical and psychological violence. Conversely, men who internalize traits traditionally considered feminine, such as being understanding, tender, warm, compassionate, affectionate, sympathetic, or gentle, are at lower risk of victimization and perpetration of dating violence.

The risk of dating violence is slightly lower for same-sex partners than for men with opposite-sex partners. However, same-sex partners are more likely to experience sexual violence, particularly threats of ending the relationship if they do not comply with sexual requests. Men with same-sex partners who hold more traditional gender role attitudes are at greater risk of being victims of sexual and physical violence, while those who internalize traditionally masculine traits, such as independence and agency, are at a higher risk of physical and psychological violence. In addition, older men are more likely to perpetrate sexual violence in dating relationships.

Women with same-sex partners appear to be at a lower risk of being surveilled by their partner or becoming victims of severe physical dating violence. Women in this group, who internalize traits associated with femininity, such as being understanding, tender, warm, or compassionate, face a slightly higher risk of physical violence victimization and a decreased risk of perpetrating psychological dating violence. In contrast, women with same-sex partners who hold more traditional gender role attitudes show an increased risk of perpetrating psychological violence.

Women with opposite-sex partners who adhere to traditional gender role attitudes are likely to be both victims and perpetrators of psychological violence in dating relationships. Older women in this group face a heightened risk of perpetrating both physical and psychological dating violence.

Educational level appears to be unrelated to dating violence victimization and perpetration, as does age for men with opposite-sex partners and women with same-sex partners.

6. Conclusion

Dating violence perpetration and victimization are widespread phenomena. Although such violence occurs across both genders and with opposite-sex and same-sex partners, the type of partner and gender are distinguishing factors. This study's results offer valuable insights for designing policies, programs, and strategies aimed at preventing and addressing this form of violence.

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Conflict of interest

The authors declare they have no competing interests.

Author contributions

Conceptualization: M. Pilar Matud, María-José del Pino, D. Estefanía Hernández-Lorenzo, Demelsa Fortes, Ignacio Ibáñez

Investigation: M. Pilar Matud, María-José del Pino, D. Estefanía Hernández-Lorenzo, Demelsa Fortes, Ignacio Ibáñez

Methodology: M. Pilar Matud, Ignacio Ibáñez

Writing – original draft: M. Pilar Matud, María-José del Pino

Writing – review & editing: M. Pilar Matud, María-José del Pino, D. Estefanía Hernández-Lorenzo, Demelsa Fortes, Ignacio Ibáñez

Ethics approval and consent to participate

The study was performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments. All participants provided verbal informed consent to participate in the study after being informed about the study's aims. No names or any data identifying the participants were registered, and participants could cancel their participation at any time. We obtained approval from the Ethics Committee on Animal Research and Well-Being of the University of La Laguna (study approval number

2013 – 0058).

Consent for publication

Participants have given consent for publishing their data in this work.

Availability of data

Data can be obtained from corresponding author following formal request.

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ACCSCIENCE PUBLISHING

Global Health Economics and Sustainability

ORIGINAL RESEARCH ARTICLE

Evaluation of mental health law 21,331 in Chile

Gonzalo Leyton[1,2]*

[1]School of Public Health, Faculty of Medicine, University of Chile, Santiago, Chile

[2]Department of Studies, Superintendence of Health, Santiago, Chile

Abstract

This study evaluates whether the implementation of law 21,331 on mental health (MH) affected financing in Chile's private health-care system. The effects of effective financial coverage and the acceptance rate of sick leaves are analyzed. The results show increased coverage in plans without coverage constraints in MH concerning those with restricted coverage; however, differences imply a lower effective coverage in MH services concerning physical health services. Regarding sick leaves, the practice of refusing and reducing sick leaves for mental disorders increased, further deepening the gap concerning other diagnostic groups. Notably, medical consultations by telemedicine have allowed significant increases in coverage, including for MH. Analyzing the differences by gender shows that there is less financial coverage for women than for men regarding MH services. Furthermore, women experience a higher proportion of rejected and reduced sick leaves than men. Law 21,331 works toward the World Health Organization recommendations in this area; however, a significant gap remains between the effective financial coverage of MH services compared to physical health services and the resolution of sick leaves for mental disorders versus other diagnostic groups.

Keywords: Mental health; Mental health law; Financing; Evaluation; Financial coverage; Sick leaves; Law 21,331; Private health-care system

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***Corresponding author:**
Gonzalo Leyton
(gleyton@uchile.cl)

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1. Introduction

A phrase widely used in mental health (MH) is that there is no health without MH. The World Health Organization (WHO) conceives MH as a "state of well-being in which the individual realizes his or her capabilities, overcomes the normal stresses of life, works productively and fruitfully, and contributes something to his or her community" (WHO, 1946, p.1).

Worldwide, mental disorders have had a high prevalence and incidence for some time (The Lancet, 2022). The COVID-19 pandemic has highlighted the importance of MH, which has become a significant public health issue. As a result of the pandemic, the health needs associated with mental disorders have been identified as the fourth wave of effects, which, unlike other impacts (increased mortality, relocation of resources, and interruption of treatment of chronic diseases), is expected to have a stable behavior over time (without reductions) after reaching its peak. This situation is linked to the psychosocial burden, the emergence of new mental disorders, relapses in people with controlled mental disorders, and economic impacts (O'Connor *et al.*, 2021).

Depending on the local context, some individuals and social groups may be at significantly higher risk for mental disorders, and such individuals have excessively high rates of disability and mortality (Prince *et al.*, 2007).

Mental disorders increase the risk of communicable and noncommunicable diseases and contribute to accidental and intentional injuries. Conversely, many health conditions increase the risk of mental disorders, and comorbidity complicates help-seeking, diagnosis, and treatment and influences prognosis (Prince *et al.*, 2007).

Mental disorders often lead individuals and their families into poverty. Health systems do not adequately respond to the burden of mental disorders; thus, the divergence between the need for treatment and its provision is significant around the world (PAHO-WHO, 2018).

Nearly 1 billion people live with mental disorders; however, in low- and middle-income countries, more than 75% of people with mental, neurological, and substance use disorders receive no treatment. Every year, nearly 3 million people die due to the adverse effects of alcohol use, while every 40 s, a person dies by suicide (in the United States, 100,000 people a year die by suicide). Moreover, about 50% of mental disorders begin before the age of 14 (Source: Mental Health key facts, WHO, 2024).

More than 160 million people are estimated to need humanitarian assistance due to conflicts, natural disasters, and other emergencies. Rates of mental disorders can double during such crisis periods. An estimated one in five people affected by conflict subsequently suffer from mental disorders (Charlson *et al.*, 2019).

Affordable MH care before the pandemic was further diminished due to COVID-19, as it disrupted health services worldwide. Indeed, a WHO survey revealed that the COVID-19 pandemic either disrupted or completely halted critical MH services in 93% of countries (in the Americas region, 100% of MH services were affected by the pandemic) (WHO, 2020). In contrast, demand for MH is steadily increasing; given the chronic nature of MH problems, this carries a significant economic impact (present and future) worldwide.

The pandemic has had a significant and uneven impact on MH worldwide, where cases of mental disorders, particularly in young people and mainly women, have increased dramatically (e.g., depression and anxiety disorders increased 25% in the first year of the pandemic) (WHO, 2022).

In this context, it is important to consider that most countries allocate <2% of their health budgets to MH. In contrast, the figure reaches 2.06% in Chile (the region's average) (WHO, 2018). Nonetheless, the WHO recommends an MH budget of 6% of the total budget, covering promotion, prevention, treatment, and rehabilitation actions, aiming to collaborate that individuals, families, and communities reach the highest possible level of well-being (National Plan of MH 2017 – 2025). In contrast, the Lancet Commission on Global MH and Sustainable Development (2018) suggests that MH should be allocated at least 5% of the health budget in low- and middle-income countries and 10% in high-income countries (the World Bank classifies Chile as a high-income country).

In this aspect, spending reflects MH's priority within each country's health system. Low spending should be a warning to governments, especially since, in the next 10 years, depression is predicted to be a more significant burden for countries than any other disease.

Health expenditure as a % of the global gross domestic product (GDP) has increased from 3% in 1948 to 10.35% in 2021 (Source: World Bank Health Data, 2024). In Chile, it reached 9.0% in 2022 (7.0% in 2000), while the average for Latin America and the Caribbean (LAC) was 8.65% (2020) and 9.3% for the Organisation for Economic Co-operation and Development (OECD) countries (2022).

The consistent increase in health spending raises the question of who finances health systems and how they are financed. The question is crucial because the ability to pay should not hinder people from access to health system services.

In this sense, the issue of the mechanisms of contribution to the financing of Chile's health system becomes relevant. Figures show that private health spending (also known as out-of-pocket [OOP] spending) in Chile reached 29.8% in 2022 (Source: OECD Health Statistics, 2024) from 42.8% in 2000 and 34.5% in 2010. Comparatively, the average OOP spending in 2021 was 17.05% globally and 27.5% in LAC (Source: World Bank Health Data, 2024). In comparison, OECD countries with similar levels of health spending as a proportion of GDP had an average of 20.4% (i.e., OOP is 46% higher in Chile). This relatively high OOP spending in Chile indicates the low financial protection that the current health system offers to its insured population. OOP health expenditure has the most significant impact on the household budget; it could even become a catastrophic event for families, as it is an integral part of the decision to seek health care and is the most inequitable and least efficient source of financing.

For beneficiaries in Chile's private health-care system, suffering from a mental disorder is not the same as contracting a physical illness; from a financing point of view, most health plans in the private health-care system have coverage constraints for MH services.

In this context, the 21,331 Law on the Recognition and Protection of the Rights of Persons in MH Care was enacted on May 11, 2021 (Biblioteca del Congreso Nacional, 2021). Regarding the financing system, Article 20, in its numeral 6, establishes that "health care may not give rise to discrimination concerning other diseases, about coverage of services and rate of acceptance of sick leaves." The above law aligns with the WHO proposal to reduce the importance of household OOP spending as a source of health financing, particularly for mental disorders.

Telemedicine in the private health system is a factor that is in total development. The MH analyses show a lower OOP expenditure concerning face-to-face consultations and lower costs for the system. These decreased expenditures are essential for universal health coverage (UHC), helping to solve the low rate of MH professionals in several regions of Chile (excluding the Metropolitan Region), facilitating treatment adherence, and helping reduce the stigma-related barriers in the care of mental disorders.

This current study aims to evaluate whether the entry into force of law 21,331 affected the financing of mental disorders in Chile's private health-care system. Specifically, this study analyzes the effects of increased financial coverage associated with services for mental disorders (i.e., decrease in OOP expenses) and the acceptance rate of medical leave compared to the effects observed in physical health care.

2. Data and methods

Effective financial coverage corresponds to the value of the care charged by the provider that the insurer covers. In the present study, referring to the private health-care system in Chile, effective financial coverage corresponds to the amount covered by the private insurer (called Isapre).

Analyzing the effective financial coverage of MH requires examining the provisions of Article 190 of DFL 1[1] (2005), which states, "A supplementary plan may not stipulate services for any specific benefit for a value <25% of the coverage that the same plan confers to the corresponding generic benefit. Likewise, the services may not have a bonus lower than the financial coverage that the National Health Fund assures, in the free choice modality, to all the services contemplated in the tariff referred to in Article 31 of Law No. 19,966, which establishes the General Health Guarantees Regime. Any clauses that contravene this rule shall be deemed not to be written."

The aforementioned is relevant since MH services typically have substantial financial coverage constraints through annual or per-event caps in health plans (Superintendencia de Salud, 2021b).

[1] This corresponds to the Health Law that governs the entire system in Chile.

From a regulatory perspective, two relevant milestones occur for developing this study's analysis. In effect, the 21,331 law was enacted in May 2021. To comply with the law above, the Superintendence of Health (SoH) issued Circular IF/Nº 396 on November 8, 2021 (Superintendencia de Salud, 2021a), which provides instructions on coverage and access for MH services in Isapres by 21,331 law. Regarding effective financial coverage, the aforementioned circular states that "health plans may not stipulate for health services related to mental or intellectual disabilities, mental illness, and MH, bonus ceilings and maximum contract year ceilings per beneficiary lower than those established for physical health services," which was effective as of March 2022.

Given the above, two periods of 12 months are contrasted for this study. The first period, 2021, comprises March 2021 – February 2022, while 2022 comprises from March 2022 to February 2023. In 2021, it is assumed that there will be no effects of the law above or the circular (in its scope of financing), while 2022 will be used as a contrast to see the potential expected impacts of the law and the circular above.

The data used in the study correspond to administrative data sent by the insurers to the SoH every month.

3. Results

3.1. Before the enactment of 21,331 law: Financial coverage and sick leaves in Chile's private health-care system

Table 1 presents information as of January 2022, showing that of the total number of individual health plans in force (40,838), 3.2% are being sold (1,297), of which 62% (801 plans) have coverage constraints associated with MH. Of the total number of individual plans in force that are not being sold (39,541), 51% (20,026) have MH coverage constraints. When analyzing the information as of January 2023 (i.e., after the SoH Circular on the subject is implemented), none of the total number of health plans sold (1,083) has coverage constraints associated with MH.

All individual health plans sold out by Colmena, Cruz Blanca, Vida Tres, and Banmédica have coverage constraints associated with MH. In contrast, none of the individual plans sold out by Nueva Masvida or Consalud have MH coverage constraints.

The relative importance of MH spending is low in Chile's private health-care system. In fact, by 2021, 5.8% of the total billed at the system level corresponds to services related to MH; however, concerning the total covered by the insurers, it represents only 3.9% of the total, which is correlated with copayments, where the weight of MH rises to 8.9%.

Table 1. Total individual health plans and with coverage constraints in MH, according to the commercial situation as of January 2022

Insurer	Total individual health plans			Individual health plans with MH coverage constraint			% MH coverage constraint	
	Not on sale	On sale	Total	Not on sale	On sale	Total	Not on sale	On sale
Colmena	3,203	152	3,355	3,199	152	3,351	99.88	100.00
Cruz Blanca	9,701	256	9,957	8,249	256	8,505	85.03	100.00
Vida Tres	6,566	105	6,671	3,252	105	3,357	49.53	100.00
Nueva Masvida	3,601	157	3,758					
Banmédica	11,652	288	11,940	5,326	288	5,614	45.71	100.00
Consalud	4,818	339	5,157					
Total	39,541	1,297	40,838	20,026	801	20,827	50.6	61.8

Source: Superintendence of Health, Health Plan Master File.
Abbreviation: MH: Mental health.

By 2022, 6.1% of the total billed at the system level corresponds to services related to MH; however, the total covered by insurers represents only 4.2% of the total, which is correlated in terms of copayments, where the weight of MH rises to 9.3%.

Two phenomena can be observed in terms of the components of MH expenditure. On the one hand, the adequate coverage of the GES[2] amounted to 95.2% in 2021 (95.7% in 2022), reflecting absolute financial protection for individuals who used coverage for health problems, entirely in line with the WHO's proposal to reduce OOP health expenditure. Conversely, there is low inpatient and outpatient financial coverage of what is not covered by the GES (i.e., the coverage provided for each health plan to MH services). This situation represents a clear disincentive to seek care, given that the low coverage generates a high impact on the family budget for the first care and eventual treatment of the mental disorders. This impact is expected to increase in the post-pandemic situation and the cooling of the economy, with the usual impact on the labor market and, therefore, on disposable income (WHO, 2011).

3.1.1. Outpatient and inpatient services

The population analyzed in this section corresponds to the entire portfolio of insured insurers (i.e., contributors and charges).

Table 2 presents the average effective financial coverage in medical consultations associated with MH (which represents the gateway to the care system) versus medical consultations of other specialties in 2021. Psychiatry medical consultations show the lowest effective financial coverage (between 20% and 35% depending on the Isapre) of all medical specialties. Similarly, clinical psychology consultations have coverage ranging from 25% to 35%, depending on the Isapre. In contrast, the remaining consultation types showed that the average coverage levels were approximately 13 percentage points (pp) higher (associated with emergency medicine), with many already reaching around 58% average coverage (associated with adult neurology, internal medicine, and dermatology).

Table 3 presents the consultations associated with telemedicine, showing a similar reality concerning face-to-face consultations. The average effective coverage of medical consultations other than MH shows values between 60% and 70%, well above those of MH consultations whose coverage fluctuates between 30% and 40%.

At the system level, telemedicine medical consultations have higher coverage than face-to-face consultations in all analyzed specialties. Notably, higher effective coverage of MH consultations than face-to-face consultations under telemedicine (between 5 and 11 pp) occurs in all Isapres, with Consalud standing out (between 12 and 22 pp). This fact is particularly relevant for MH since some key factors limiting access and adherence to treatment include stigma and OOP expenses. In the case of telemedicine, these disparities can be attributed to consultations with more effective financial coverage than face-to-face consultations, with a nascent virtuous circle that should be analyzed and strengthened.

Table 4 presents the analysis of bed days, indicating a similar reality to that described for outpatient MH services. The most critical MH bed day in expenditure (psychiatry hospitalization bed day) also shows the lowest effective financial coverage among all beds (20%). In comparison, the next bed day shows an average effective coverage close to 69.8% (surgery hospitalization bed day).

3.1.2. Sick leaves

In this subsection, the population analyzed corresponds to contributors, i.e., those who use sick leave.

[2] GES is a mandatory guaranteed plan for health insurance, *i.e.*, it is a UHC plan.

Table 2. Average effective financial coverage (%) of face-to-face medical consultations by Isapre in 2021

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Pediatric and adolescent psychiatry specialty medical consultation	20.7	31.6	27.6	21.5	26.7	33.4	26.9
Specialty medical consultation in adult psychiatry	21.9	31.0	32.2	24.3	29.8	34.3	28.9
Clinical psychologist consultation (45 sessions)	26.7	34.6	31.6	29.0	33.2	25.7	30.1
Specialty medical consultation in emergency medicine	51.6	61.0	38.2	52.3	49.7	52.8	50.9
Specialty medical consultation in adult neurology	54.6	59.9	57.8	50.5	55.0	58.8	56.1
Specialty medical consultation in internal medicine	57.2	60.7	59.0	54.6	56.7	59.1	57.9
Dermatology specialty medical consultation	57.3	62.5	58.6	51.5	56.8	61.3	58.0
Ophthalmology specialty medical consultation	57.8	64.5	60.7	60.6	58.0	67.6	61.5
Specialty medical consultation in traumatology and orthopedics	60.1	64.8	63.8	57.1	61.6	65.0	62.1
Specialty medical consultation in otorhinolaryngology	60.0	66.2	63.0	59.8	61.2	65.0	62.5
Specialty medical consultation in pediatrics	61.4	67.2	62.5	58.8	62.0	67.1	63.2
General medicine consultation	65.2	69.1	58.2	60.8	61.8	64.8	63.3
Obstetrics and gynecology specialty medical consultation	62.0	66.8	62.3	60.6	62.4	67.5	63.6
Urology specialty medical consultation	62.4	67.5	64.9	63.2	64.0	67.7	64.9

Source: Superintendence of Health, Claims Services Master File.

Table 3. Average effective financial coverage (%) of telemedicine medical consultations by Isapre in 2021

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Specialty medical teleconsultation in pediatric and adolescent psychiatry	21.0	34.4	33.1	25.6	33.1	45.0	32.0
Teleconsultation of medical specialty in adult psychiatry	34.3	39.1	35.2	36.2	35.7	56.5	39.5
Telerehabilitation: clinical psychologist (45 sessions)	38.0	52.7	40.9	35.0	43.6	35.6	41.0
Teleconsultation of medical specialty in adult neurology	60.3	65.4	63.1	54.7	60.6	64.1	61.4
Teleconsultation of medical specialty in obstetrics and gynecology	63.5	74.2	58.9	57.5	60.2	68.9	63.9
Teleconsultation of medical specialty in internal medicine	64.9	66.8	63.8	61.6	61.9	66.0	64.2
Teleconsultation of medical specialty in pediatrics	63.9	72.6	63.7	58.5	63.3	69.2	65.2
Specialty medical consultation in adult gastroenterology	64.8	73.1	68.3	58.0	65.2	63.4	65.5
Teleconsultation of medical specialty in dermatology	64.7	77.2	66.6	59.1	65.6	68.2	66.9
General medicine teleconsultation	71.6	80.5	61.2	64.1	63.2	74.6	69.2

Source: Superintendence of Health, Claims Services Master File.

Regarding sick leave, the 21,331 law states that health care may not give rise to discrimination concerning other illnesses in the rate of acceptance of sick leave. In this regard, the circular issued by the SoH does not refer to sick leave. In any case, this study analyzes whether any changes occurred due to the 21,331 law's implementation.

Sick leave is an element that distorts the financing system because part of the funds allocated to health (7% mandatory in Chile) are used to pay for sick leave (which in other countries is understood as a labor right and financed exclusively by the employer); for Chile and MH, it is a particularly relevant issue.

In 2021, curative sick leaves (Tables 5 and 6) linked to mental disorders (ICD-10 group F) were first in the number of processed (497,952, or 28% of the total) and the number of authorized sick leaves (175,146, or 14.4% of the total). However, sick leaves related to mental disorders also occupy the first place in rejected (235,285 or 63.7% of the total) and reduced sick leaves (87,521 or 45.3%).

Analyzing sick leaves within each diagnostic group according to the type of resolution reveals discouraging results that should concern the health sector, specifically for MH. Indeed, of the total number of sick leaves processed for MH, 64.8% are either rejected or reduced, i.e., two of every three sick leaves processed for mental disorders are

Table 4. Average effective financial coverage (%) in bed days by Isapre (2021)

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Psychiatric bed days		4.4	18.3	5.8	23.6	3.4	11.1
Psychiatric hospitalization bed days	20.2	28.6	17.5	24.2	17.6	11.7	20.0
Surgery hospitalization bed days (1-bed ward with bathroom)	77.5	80.5	70.2	62.9	64.9	63.1	69.8
Adult hospitalization in ITU bed days	72.7	90.0	79.0	63.0	76.6	61.5	73.8
Adult integral hospitalization in ITU bed days		93.3	77.1	68.5	72.8	59.3	74.2
Integral hospitalization basic care bed days (1 bed)	74.4	98.0	76.4	65.7	71.7	65.3	75.2
Integral adult hospitalization in ICU bed days		89.8	76.9	72.3	72.0	68.3	75.9
Obstetrics and gynecology hospitalization bed days (1 bed with bathroom)	77.2	96.5	78.4	62.7	75.2	72.5	77.1
Obstetrics and gynecology comprehensive hospitalization day beds (1 bed)		97.4	79.4	56.5	78.4	74.1	77.2
Adult hospitalization in ICU bed days	76.2	86.7	82.8	72.4	78.6	68.5	77.5
Medicine and specialties hospitalization bed days (1 bed with bathroom)	82.8	96.8	80.1	72.8	76.8	64.3	78.9

Source: Superintendence of Health, Claims Services Master File.
Abbreviations: ICU: Intensive care unit; ITU: Intermediate treatment unit.

Table 5. Curative sick leaves processed (N and %), according to ICD-10 group and type of resolution, in 2021

ICD-10 group	Processed		Authorized		Rejected		Reduced		% Authorized	% Rejected & reduced
	N	%	N	%	N	%	N	%		
A00 – B99	54,967	3.1	49,990	4.1	2,845	0.8	2,132	1.1	90.9	9.1
C00 – D48	39,658	2.2	33,601	2.8	4,207	1.1	1,850	1.0	84.7	15.3
COVID	220,258	12.4	201,835	16.6	10,422	2.8	8,001	4.1	91.6	8.4
D50 – D89	1,684	0.1	1,259	0.1	239	0.1	186	0.1	74.8	25.2
E00 – E90	10,320	0.6	8,381	0.7	1,074	0.3	865	0.4	81.2	18.8
F00 – F99	497,952	28.0	175,146	14.4	235,285	63.7	87,521	45.3	35.2	64.8
G00 – G99	52,970	3.0	37,264	3.1	10,335	2.8	5,371	2.8	70.3	29.7
H00 – H59	19,655	1.1	16,942	1.4	1,638	0.4	1,075	0.6	86.2	13.8
H60 – H95	17,804	1.0	13,920	1.1	1,942	0.5	1,942	1.0	78.2	21.8
I00 – I99	27,233	1.5	21,182	1.7	4,018	1.1	2,033	1.1	77.8	22.2
J00 – J99	95,317	5.4	82,308	6.8	6,032	1.6	6,977	3.6	86.4	13.6
K00 – K93	85,444	4.8	75,119	6.2	4,986	1.3	5,339	2.8	87.9	12.1
L00 – L99	12,077	0.7	9,722	0.8	1,316	0.4	1,039	0.5	80.5	19.5
M00 – M99	249,992	14.1	157,515	13.0	52,244	14.1	40,233	20.8	63.0	37.0
N00 – N99	41,373	2.3	35,313	2.9	2,857	0.8	3,203	1.7	85.4	14.6
O00 – O99	32,708	1.8	27,759	2.3	3,019	0.8	1,930	1.0	84.9	15.1
Other diagnoses	125,815	7.1	112,786	9.3	4,125	1.1	8,904	4.6	89.6	10.4
P00 – P96	329	0.0	255	0.0	44	0.0	30	0.0	77.5	22.5
Q00 – Q99	2,635	0.1	2,038	0.2	388	0.1	209	0.1	77.3	22.7
R00 – R99	32,598	1.8	26,530	2.2	3,494	0.9	2,574	1.3	81.4	18.6
S00 – T98	112,432	6.3	87,572	7.2	14,749	4.0	10,111	5.2	77.9	22.1
V01 – Y98	3,843	0.2	3,451	0.3	255	0.1	137	0.1	89.8	10.2
Z00 – Z99	38,422	2.2	33,023	2.7	4,063	1.1	1,336	0.7	85.9	14.1

Source: Superintendence of Health, Sick Leaves Master File.

Table 6. ICD-10 groups and disease details

ICD-10 group	Description
A00 – B99	Infectious and parasitic
C00 – D48	Tumors (neoplasms)
COVID	COVID-19
D50 – D89	Blood and hematopoietic organ diseases
E00 – E90	Endocrine, nutritional, and metabolic disorders
F00 – F99	Mental and behavioral disorders
G00 – G99	Nervous system
H00 – H59	Of the eye and its appendages
H60 – H95	Of the ear and mastoid process
I00 – I99	Circulatory system
J00 – J99	Respiratory system
K00 – K93	Digestive system
L00 – L99	Skin and subcutaneous tissue
M00 – M99	Musculoskeletal and connective tissue system
N00 – N99	Genitourinary system
O00 – O99	Pregnancy, childbirth, and puerperium
Other diagnoses	Other diagnoses
P00 – P96	Certain conditions originating in the perinatal period
Q00 – Q99	Congenital malformations, deformities, and chromosomal abnormalities
R00 – R99	Symptoms, signs, and abnormal clinical findings
S00 – T98	Trauma, poisoning, and other consequences of external causes
V01 – Y98	External causes of morbidity and mortality
Z00 – Z99	Factors influencing health status and contact with health services
	Unclassified

dismissed or reduced by the Isapre. This situation occurs exclusively in diagnoses for mental disorders since, in all other diagnostic groups, the proportion of authorized sick leaves far exceeds the proportion of rejected/reduced – the following lowest proportion of authorized after mental disorders is that of group G (nervous system) with 70.3%.

Regarding the number of sick leaves in MH, if one considers the elements above concerning restricted financial coverage, a plausible hypothesis is that the number of sick leaves processed should be even higher than those observed without such highly restricted coverage.

3.2. Enforcement of 21,331 Law: Financial coverage and sick leaves in the Chilean private healthcare system

As mentioned in the previous section, the 21,331 law, together with circular IF/Nº 396 issued by the SoH, provides clear instructions concerning the nondifferentiation of the effective financial coverage of services for mental disorders concerning physical health services. The instruction issued by the SoH through the circular means that the Isapres (in their health plans sold from March 2022 onward) must not differentiate financial coverage between MH and physical health services.

In this sense, for the 2022 analysis, two groups of health plans are formed. On the one hand, individual plans sold from March 2022 onward are analyzed, which theoretically have no constraints on coverage for MH services. This group contrasts with the rest of all the individual plans in force during the period, which may or may not have constraints on MH services coverage (excluding those in the other group mentioned above). This study seeks to establish whether the instruction issued by the SoH increased the effective financial coverage of MH services, on average, to the same level as physical health services.

When analyzing the GES health problems for 2022, a high level of effective coverage occurs (similar to 2021, it reached 95.7%), reflecting absolute financial protection for those who use the health problems covered therein.

3.2.1. Outpatient and inpatient services

Analyzing the average effective coverage in face-to-face medical consultations for 2022 (Tables 7 and 8) in plans without restricted coverage, concerning those with restricted coverage, the absence of information for Colmena on amounts billed for MH medical consultations without restricted coverage is striking. This study assumes that there would have been no services for face-to-face MH medical consultations in that period for that group of plans.

In Vida Tres and Banmédica, in plans without coverage constraints, the low financial coverage in psychiatric medical consultations of MH (adult and pediatric) is maintained. In both cases, it is even lower than the average 2021 level (i.e., before the issuance of the SoH regulations). In addition, for these two Isapre, the effective coverage for individuals in plans without coverage constraints is even lower than in plans with restricted coverage.

In the case of Isapre Cruz Blanca, Nueva Masvida, and Consalud, coverage increased from 2021 to 2022 and in plans with restricted coverage.

Analyzing plans without restricted coverage shows that all the Isapres increased significantly in the coverage of clinical psychologist consultation.

Despite the relative increase in MH medical consultation coverage in some Isapres, the coverage is lower compared to medical consultations of other specialties. Although the differences are narrowing, MH medical consultations still

Table 7. Average effective financial coverage (%) of face-to-face medical consultations in plans without restricted coverage by Isapre (2022)

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Pediatric and adolescent psychiatry specialty medical consultation		49.0	24.4	47.2	26.5	35.7	36.6
Specialty medical consultation in adult psychiatry		56.6	27.1	47.1	28.1	41.9	40.1
Clinical psychologist consultation (45 sessions)	62.3	56.1	42.3	64.9	45.7	58.5	55.0
Specialty medical consultation in emergency medicine	51.7	62.5	48.2	68.3	54.4	53.3	56.4
Specialty medical consultation in adult neurology	54.7	66.0	53.2	57.8	56.2	58.5	57.7
Specialty medical consultation in internal medicine	56.9	66.5	55.8	61.6	55.0	59.5	59.2
Dermatology specialty medical consultation	58.3	68.4	54.6	60.9	55.0	59.5	59.4
Otolaryngology specialty medical consultation	59.5	70.1	59.7	61.6	61.4	62.0	62.4
Ophthalmology specialty medical consultation	58.0	68.8	56.1	69.3	57.9	65.2	62.6
Specialty medical consultation in traumatology and orthopedics	59.7	69.6	59.8	63.0	61.0	64.0	62.8
Specialty medical consultation in pediatrics	62.3	71.1	59.5	69.1	61.2	65.0	64.7
General medicine consultation	65.2	74.3	59.6	65.9	63.5	62.0	65.1
Urology specialty medical consultation	61.8	71.4	61.1	66.0	65.0	66.1	65.2
Obstetrics and gynecology specialty medical consultation	65.9	72.7	62.1	72.7	64.3	68.7	67.7

Source: Superintendence of Health, Claims Services Master File.

Table 8. Average effective financial coverage (%) of face-to-face medical consultations in plans with restricted coverage by Isapre (2022)

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Pediatric and adolescent psychiatry specialty medical consultation	22.8	32.1	28.6	23.6	27.7	33.3	28.0
Specialty medical consultation in adult psychiatry	28.9	32.2	32.5	27.1	31.0	33.2	30.8
Clinical psychologist consultation (45 sessions)	30.9	34.5	32.6	27.5	34.3	26.4	31.0
Specialty medical consultation in emergency medicine	53.3	61.0	43.0	60.3	51.6	57.0	54.4
Specialty medical consultation in adult neurology	56.2	60.1	59.3	48.2	56.0	59.7	56.6
Dermatology specialty medical consultation	59.1	63.6	59.5	52.5	57.4	61.8	59.0
Specialty medical consultation in internal medicine	58.9	62.3	60.4	56.3	57.6	60.6	59.3
Ophthalmology specialty medical consultation	60.3	66.0	62.1	62.3	59.3	67.6	62.9
Specialty medical consultation in traumatology and orthopedics	62.1	66.2	65.2	57.2	62.6	66.0	63.2
Otolaryngology specialty medical consultation	61.9	67.5	64.3	59.6	62.0	65.5	63.5
Obstetrics and gynecology specialty medical consultation	64.1	68.5	63.7	61.7	63.6	68.6	65.0
Specialty medical consultation in pediatrics	64.1	69.0	63.9	62.0	63.3	68.0	65.1
General medicine consultation	67.1	70.3	61.3	61.8	64.1	65.9	65.1
Urology specialty medical consultation	64.1	68.3	65.8	63.4	64.6	68.1	65.7

Source: Superintendence of Health, Claims Services Master File.

have the lowest average effective coverage among specialty consultations.

Analyzing the consultations associated with telemedicine (Tables 9 and 10) shows the same phenomenon observed in 2021, where systematically higher coverage is found concerning face-to-face medical consultations in all the specialties analyzed (both in plans without coverage restriction and plans with restricted coverage). The most significant differences in favor of telemedicine consultations are precisely those associated with MH. The same result is obtained when analyzing this result by Isapre (except for pediatric psychiatry consultations in Cruz Blanca).

Table 9. Average effective financial coverage (%) of telemedicine medical consultations in plans without restricted coverage by Isapre (2022)

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Teleconsultation of medical specialty in adult psychiatry	46.2	61.4	62.0	31.0	38.5	50.7	48.3
Specialty medical teleconsultation in pediatric and adolescent psychiatry	42.3	42.5	80.0	54.7	36.9	39.7	49.4
Teleconsultation of medical specialty in adult neurology	60.9	73.8	48.5	57.2	65.2	71.6	62.9
Specialty medical teleconsultation in internal medicine	66.8	76.7	53.1	78.8	58.1	68.4	67.0
Teleconsultation of medical specialty in pediatrics	67.1	80.3	48.8	69.1	65.3	75.4	67.7
Specialty medical consultation in adult gastroenterology	67.9	76.1	66.7	77.5	64.3	59.2	68.6
Teleconsultation of medical specialty in obstetrics and gynecology	65.5	81.3	56.5	71.3	63.8	73.7	68.7
Telerehabilitation: clinical psychologist (45 sessions)	68.0	73.1	66.5	76.2	60.9	68.4	68.8
Teleconsultation of medical specialty in dermatology	66.6	81.2	66.1	68.6	67.5	73.6	70.6
General medicine teleconsultation	72.3	86.1	62.6	66.4	63.2	74.7	70.9

Source: Superintendence of Health, Claims Services Master File.

Table 10. Average effective financial coverage (%) of telemedicine medical consultations in plans with restricted coverage by Isapre (2022)

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Specialty medical teleconsultation in pediatric and adolescent psychiatry	29.7	27.7	42.4	27.0	36.7	51.6	35.9
Teleconsultation of medical specialty in adult psychiatry	33.7	35.4	36.0	40.0	35.8	57.3	39.7
Telerehabilitation: clinical psychologist (45 sessions)	39.5	44.8	42.3	34.9	43.2	38.7	40.6
Teleconsultation of medical specialty in adult neurology	63.4	69.2	64.1	56.4	62.3	65.2	63.4
Teleconsultation of medical specialty in internal medicine	66.8	68.7	65.1	59.5	62.1	69.5	65.3
Teleconsultation of medical specialty in obstetrics and gynecology	66.4	75.0	63.5	60.2	64.6	72.9	67.1
Specialty medical consultation in adult gastroenterology	69.1	71.2	69.1	62.2	67.1	65.7	67.4
Specialty medical teleconsultation in pediatrics	68.6	75.1	64.5	60.9	65.0	73.9	68.0
Teleconsultation of medical specialty in dermatology	67.6	76.0	69.4	60.2	65.6	72.0	68.5
General medicine teleconsultation	73.4	79.4	63.4	64.6	63.7	77.2	70.3

Source: Superintendence of Health, Claims Services Master File.

Comparing MH consultations by telemedicine between plans without coverage restriction versus plans with restricted coverage shows consistently increased coverage in plans without coverage restriction (excluding Nueva Masvida for adult psychiatric consultations). Here, the opposite occurs in Consalud since individuals using plans with restricted coverage obtain the highest average coverage in adult and pediatric psychiatrist consultations.

Analyzing plans without coverage constraints shows that although the gap narrows with the other specialties, medical consultations by MH telemedicine again have the lowest average effective coverage among specialty consultations.

The analysis of bed days (Tables 11 and 12) shows an increase in average coverage in 2021, especially when considering plans without coverage constraints; however, 2022 more than doubles the 2021 coverage. Furthermore, the MH bed day again has the lowest effective financial coverage among all beds in plans without coverage constraints and restricted coverage. In contrast, the MH bed day in the plans without coverage restriction exhibits an average coverage 79% higher than those with restricted coverage.

3.2.2. Sick leaves

In 2022, curative sick leaves (Table 13) related to mental disorders (ICD-10 group F) were again first in the number of sick leaves processed (457,038, or 24.4% of the total). In contrast, in all diagnostic groups, there is a decrease (2022 vs. 2021) in the proportion of authorized sick leaves (concerning those processed), where the most significant decrease occurs in mental disorders.

Table 11. Average effective financial coverage (%) of bed days in plans without restricted coverage by Isapre (2022)

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Psychiatric hospitalization bed days	72.4				16.9		44.7
Adult hospitalization in ICU bed days	69.5				44.6		57.1
Adult hospitalization in ITU bed days	80.9		46.6		43.8		57.1
Obstetrics and gynecology hospitalization bed days (1 bed with bathroom)	62.9	52.6		62.6			59.4
Integral adult hospitalization in ICU bed days		63.6	77.0	60.6	77.9	70.4	69.9
Integral adult hospitalization in ITU bed days		70.9	75.5	68.7	72.5	65.7	70.7
Obstetrics integral hospitalization bed days (1 bed)		72.6	73.9	70.6	77.1	76.9	74.2
Medicine and specialties hospitalization bed days (1 bed with bathroom)	77.6		82.3		69.9	67.5	74.3
Integral basic care hospitalization bed days (1 bed)		75.2	73.5	78.7	71.3	76.6	75.1
Surgery hospitalization bed days (1 bed with bathroom)	75.1				100.0		87.6

Source: Superintendence of Health, Claims Services Master File.
Abbreviations: ICU: Intensive care unit; ITU: Intermediate treatment unit.

Table 12. Average effective financial coverage (%) of bed days in plans with restricted coverage, according to Isapre (2022)

Health service	Colmena	Cruz Blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
Psychiatric hospitalization bed days	20.9	22.3	5.8	16.8	75.0	9.3	25.0
Adult hospitalization in ICU bed days	73.9	78.1	75.8	70.4	55.0	49.3	67.1
Obstetric integral hospitalization bed days (1-bed ward)	25.0	88.0	79.9	58.2	77.1	75.0	67.2
Adult hospitalization in ITU bed days	74.3	76.9	78.8	58.5	75.7	61.2	70.9
Adult integral hospitalization in ITU bed days		80.6	80.2	66.5	74.8	60.3	72.5
Integral basic care hospitalization bed days (1-bed ward)	70.0	85.0	78.8	70.9	74.7	66.7	74.4
Integral adult hospitalization in ICU bed days		81.7	77.8	75.3	71.0	67.8	74.7
Surgery hospitalization bed days (1 bed with bathroom)	79.1	85.0	71.3	79.0	75.9	63.5	75.7
Obstetrics and gynecology hospitalization bed days (1 bed with bathroom)	80.5	75.4	82.9	79.9	89.5	59.2	77.9
Medicine and specialties hospitalization bed days (1 bed with bathroom)	84.5	87.2	75.2	80.9	79.5	77.3	80.8

Source: Superintendence of Health, Claims Services Master File.
Abbreviations: ICU: Intensive care unit; ITU: Intermediate treatment unit.

As mentioned above, in 2021, sick leaves for mental disorders exhibited the lowest proportion of authorized sick leaves among all diagnostic groups. This group was the only one where the proportion of rejected/authorized sick leaves exceeded that of authorized sick leaves, which was further accentuated in 2022. The proportion of authorized sick leaves associated with MH again exhibited the lowest percentages among all diagnoses. This proportion decreased even more in 2021, when only 1 of 5 (20%) processed sick leaves were authorized and 4 of 5 (80%) processed were rejected or reduced. These figures again represent the highest proportion among all diagnoses (followed by musculoskeletal sick leaves with 50.8%).

3.3. Analysis by gender

Regarding MH, analysis by gender is relevant because the figures indicate different realities in terms of incidence and prevalence (e.g., in terms of the burden of disease due to depressive disorders and anxiety disorders) (Li *et al.*, 2022).

Regarding this study, the same phenomenon is observed when analyzing the average effective coverage in face-to-face medical consultations for 2021 (Table A1): consultations associated with MH have the lowest effective financial coverage among all medical specialties, where coverage for women is slightly lower than for men. The same pattern is repeated when analyzing telemedicine consultations (Table A2): although consultations associated with MH have a higher level of coverage concerning face-to-face consultations, telemedicine consultation of MH is the lowest concerning the other specialties, and its coverage is higher for men.

For 2022, face-to-face medical consultations (Tables A3 and A4) in plans without restricted coverage

Table 13. Curative sick leaves processed (N and %) by ICD-10 group and type of resolution in 2022

ICD-10 group	Processed		Authorized		Rejected		Reduced		% Authorized	% Rejected and reduced
	N	%	N	%	N	%	N	%		
A00 – B99	79,512	4.2	66,683	5.8	5,455	1.3	7,374	2.5	83.9	16.1
C00 – D48	42,473	2.3	32,322	2.8	6,420	1.5	3,731	1.3	76.1	23.9
COVID	260,490	13.9	239,500	20.9	14,209	3.3	6,781	2.3	91.9	8.1
D50 – D89	1,792	0.1	1,098	0.1	415	0.1	279	0.1	61.3	38.7
E00 – E90	10,653	0.6	7,415	0.6	1,523	0.4	1,715	0.6	69.6	30.4
F00 – F99	457,038	24.4	91,519	8.0	253,366	58.2	112,153	38.5	20.0	80.0
G00 – G99	51,899	2.8	31,763	2.8	12,518	2.9	7,618	2.6	61.2	38.8
H00 – H59	20,018	1.1	14,878	1.3	2,403	0.6	2,737	0.9	74.3	25.7
H60 – H95	19,516	1.0	13,257	1.2	2,719	0.6	3,540	1.2	67.9	32.1
I00 – I99	26,687	1.4	17,897	1.6	5,182	1.2	3,608	1.2	67.1	32.9
J00 – J99	237,813	12.7	184,244	16.0	18,440	4.2	35,129	12.1	77.5	22.5
K00 – K93	105,581	5.6	85,438	7.4	8,171	1.9	11,972	4.1	80.9	19.1
L00 – L99	12,271	0.7	8,416	0.7	1,820	0.4	2,035	0.7	68.6	31.4
M00 – M99	232,099	12.4	114,116	9.9	60,732	14.0	57,251	19.7	49.2	50.8
N00 – N99	45,829	2.4	33,861	2.9	4,573	1.1	7,395	2.5	73.9	26.1
O00 – O99	32,247	1.7	22,427	2.0	5,823	1.3	3,997	1.4	69.5	30.5
Other diagnoses	76,710	4.1	72,674	6.3	3,083	0.7	953	0.3	94.7	5.3
P00 – P96	301	0.0	207	0.0	49	0.0	45	0.0	68.8	31.2
Q00 – Q99	2,573	0.1	1,671	0.1	592	0.1	310	0.1	64.9	35.1
R00 – R99	36,755	2.0	26,892	2.3	5,066	1.2	4,797	1.6	73.2	26.8
S00 – T98	115,680	6.2	76,972	6.7	21,539	5.0	17,169	5.9	66.5	33.5
V01 – Y98	3,034	0.2	2,439	0.2	314	0.1	281	0.1	80.4	19.6
Z00 – Z99	3,486	0.2	2,794	0.2	564	0.1	128	0.0	80.1	19.9

Source: Superintendence of Health, Sick Leaves Master File.

(compared to those with restricted coverage) increase in the coverage of MH consultations compared to 2021. In contrast, higher average coverage is observed in plans without restricted coverage than those with restricted coverage. In plans without coverage constraints, psychiatry consultations (adult and pediatric) show higher coverage for women (excluding clinical psychology).

By 2022, medical consultations by telemedicine (Tables A5 and A6) plans without restricted coverage show an increase in the coverage of consultations by MH in 2021 compared to plans with restricted coverage. The increase in coverage is not as significant in favor of women as in the case of face-to-face consultations, suggesting that coverage is always higher for men (by a minimal difference of 0.6 pp) in MH consultations by telemedicine (except for adult psychiatry teleconsultations).

For 2021, the most critical MH bed day (Table A7) in expenditure (psychiatry hospitalization bed day) shows a lower financial coverage for women of approximately 5.6 pp. For 2022 (Tables A8 and A9), more plans with restricted coverage are used, with high coverage in Colmena, especially for women.

Concerning curative sick leave, in 2021 (Table A10), the proportion of women on sick leave for mental disorders is always higher than that of men in sick leaves processed, authorized, rejected, and reduced. In 2022 (Table A11), the same phenomenon occurs. Nonetheless, the proportion of women in sick leaves processed, authorized, rejected, and reduced increased, where the more significant growth in rejected sick leaves stands out.

4. Discussion

In terms of its financing system, enacting the new 21,331 law establishes a premise that makes perfect sense from the UHC perspective: MH and physical health services must have the same financial coverage, eliminating the coverage constraints that existed in the health plans of Chile's private health-care system. The new law effectively sells new health

plans that eliminate coverage constraints, which the SoH instructed through circular IF/No. 396.

Comparing the results of effective financial coverage between the plans without and with coverage constraints in terms of medical consultations and bed days shows an increase in coverage in plans without coverage constraints concerning those with restricted coverage (the favorable result of the law). However, differences still show lower effective coverage in MH services concerning physical health services, which in some cases are pretty marked (e.g., in face-to-face medical consultations).

Interestingly, medical consultations by telemedicine, which led to significant increases in coverage in the case of MH, were already observed before the law and further strengthened after it, reaching coverage close to 50% in psychiatry consultations and 69% in clinical psychologist consultations. From a financing perspective, telemedicine decreases OOP expenses and containment of health expenditures (due to the lower value of the service). This effect is particularly relevant in MH to improve access to care for mental disorders and treatment adherence, especially in regions (excluding the capital city) with low presence of lack of professionals. Telemedicine also has the benefit of reducing the barriers associated with stigma in the care of mental disorders, especially in specific populations. Additional issues arise that require further study, such as whether social determinants influence access to and use of telemedicine, whether health outcomes equivalent to face-to-face consultations are achieved, and whether the same quality of care is ensured versus face-to-face consultations.

Regarding sick leaves, the 21,331 law stated that health care could not give rise to discrimination concerning other diseases about the acceptance rate of sick leaves. However, the subsequent SoH regulations provide no further information (this study found nothing from the Superintendence of Social Security); thus, this condition was only established in the law but not operationalized through other administrative regulations. In this sense, the practice of rejection and reduction of sick leaves for mental disorders is more pronounced, where only 1 of every 5 sick leaves (20%) processed is authorized. In comparison, 49.2% of intermuscular sick leaves are authorized (more than double that of MH), further deepening the gap concerning other diagnostic groups. This disparity may be due to the significant increase in the number of licenses processed by HM, which implies a considerable increase in the number of days granted; thus, it is an expected (though not desirable) response from insurers to contain costs in the short term.

The results show no change concerning sick leaves with the 21,331 law; the figures show that the opposite has occurred, with the proportion of authorized sick leaves decreasing even more and the gap concerning other diagnostic groups increasing. In this sense, it is essential to complement the provisions of the law through other specific regulations issued by the Superintendence of Social Security and the SoH.

It is essential to pay attention to the differences by gender in the financing of MH, both in terms of lower financial coverage for women than men (except in specific cases, this occurs in most MH services), as well as a higher proportion of rejected and reduced sick leaves for women. It is a worrying and relevant issue to consider in public policy. Worldwide figures show a deterioration in the MH of girls and adolescents with significant increases in suicide rates (higher than in men) (Jo *et al.*, 2023), experiences of sadness and hopelessness, which is ratified for Chile, where the 10th National Youth Survey (2022) shows that for each MH discomfort consulted, a higher proportion of women than men reported having experienced them. Actions must be taken to address this latent, silent, and growing demand expected to come on an equal footing with men. For example, measures could be applied, such as improving the administrative institutional framework for sick leaves, as well as improving the institutional framework for the authorization of sick leaves and the regulation of the appeals process.

The results show the reality faced by beneficiaries who use MH services: on average, and despite the law, they continue to face low relative effective coverage (except GES), i.e., high relative levels of OOP expenses (copayments). However, this has been attenuated with the new health plans without theoretical constraints on MH coverage. Coverage is far from equal to physical health services, which ultimately discourages health care and adherence to treatment (which we also know in the long term implies higher costs, both for the system and OOP). The most affected are people who face mental disorders without adequate financial coverage. Insufficient coverage may dissuade such individuals from going to health providers to treat their mental disorders, as such treatment could generate an economic catastrophe for the household.

Although the 21,331 law goes in the right direction of what the WHO recommends in this matter, in practice, a significant gap remains between the effective financial coverage of MH services concerning physical health and the resolution of sick leaves for mental disorders versus another diagnostic group.

5. Conclusion

The implementation of law 21,331 on MH affected financing in Chile's private health-care system and shows

an increased coverage in plans without coverage constraints in MH concerning those with restricted coverage; however, differences maintain a lower effective coverage in MH services concerning physical health services.

Regarding sick leaves, the practice of refusing and reducing sick leaves for mental disorders increased, further deepening the gap concerning other diagnostic groups. Notably, medical consultations by telemedicine have allowed significant increases in coverage, including for MH.

The differences by gender show that there is less financial coverage for women than for men regarding MH services. Furthermore, women experience a higher proportion of rejected and reduced sick leaves than men.

Law 21,331 works toward the WHO recommendations in this area; however, a significant gap remains between the effective financial coverage of MH services compared to physical health services and the resolution of sick leaves for mental disorders versus other diagnostic groups.

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Appendix

Table A1. Average effective financial coverage (%) of face-to-face medical consultations by Isapre and gender (2021)

Health service	Sex	Colmena	Cruz blanca	Vida Tres	Nueva Masvida	Banmédica	Consalud	Whole system
General medicine consultation	F	61.9	66.1	55.4	57.3	58.7	63.4	60.5
	M	70.4	72.6	62.9	64.2	65.5	66.4	67.0
Dermatology specialty medical consultation	F	55.2	60.6	57.1	47.5	55.3	60.2	56.0
	M	60.5	65.1	60.7	56.5	58.8	62.7	60.7
Ophthalmology specialty medical consultation	F	55.7	63.2	59.5	57.7	56.6	66.7	59.9
	M	60.7	66.2	62.3	63.9	59.5	68.6	63.5
Otolaryngology specialty medical consultation	F	57.2	64.3	61.5	56.6	59.5	63.6	60.5
	M	63.0	68.0	64.5	62.6	62.8	66.3	64.5
Specialty medical consultation in adult neurology	F	52.7	58.6	56.4	45.8	53.7	58.4	54.3
	M	57.7	61.8	59.8	56.2	56.9	59.4	58.6
Specialty medical consultation in adult psychiatry	F	21.5	28.0	30.3	21.7	28.2	33.3	27.2
	M	22.5	36.3	35.2	28.3	32.0	35.8	31.7
Specialty medical consultation in pediatric and adolescent psychiatry	F	21.3	30.8	26.7	21.3	25.9	32.4	26.4
	M	17.7	32.9	28.7	21.8	27.8	36.0	27.5
Specialty medical consultation in internal medicine	F	54.2	58.4	56.9	50.2	54.5	57.7	55.3
	M	61.9	63.9	61.6	60.5	59.5	61.0	61.4
Specialty medical consultation in obstetrics and gynecology	F	62.0	66.9	62.3	60.6	62.4	67.5	63.6
	M	58.9	64.2	54.5	60.3	56.2	66.2	60.0
Specialty medical consultation in pediatrics	F	61.2	67.0	62.2	58.5	61.9	66.9	62.9
	M	61.6	67.4	62.8	59.1	62.2	67.2	63.4
Specialty medical consultation in traumatology and orthopedics	F	57.1	62.5	62.3	52.1	59.8	63.6	59.6
	M	63.2	66.8	65.3	61.3	63.2	66.2	64.3
Urology specialty medical consultation	F	57.2	64.3	62.9	57.6	61.2	66.2	61.6
	M	63.3	68.0	65.3	64.0	64.4	67.9	65.5
Specialty medical consultation in emergency medicine	F	50.3	59.9	35.5	51.7	46.3	59.9	50.6
	M	53.1	62.0	44.2	52.7	52.8	49.4	52.3
Clinical psychologist consultation (45 sessions)	F	26.1	30.3	30.6	26.7	31.9	25.3	28.5
	M	27.8	41.1	33.2	32.3	35.3	26.3	32.7

Source: Superintendence of Health, Claims Services Master File.

Table A2. Average effective financial coverage (%) of telemedicine medical consultations, by Isapre and gender (2021)

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
General medicine teleconsultation	F	68.3	78.9	58.6	57.0	60.4	73.9	66.2
	M	76.7	82.2	65.4	72.5	67.0	75.5	73.2
Dermatology specialty medical teleconsultation	F	63.4	76.5	64.7	54.6	64.2	67.8	65.2
	M	67.0	78.3	69.5	64.2	67.6	68.9	69.2
Teleconsultation of medical specialty in adult neurology	F	57.0	63.7	62.2	52.4	59.3	63.0	59.6
	M	65.9	67.8	64.2	57.9	62.2	65.5	63.9

(Cont'd...)

Table A2. *(Continued)*

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
Teleconsultation of medical specialty in adult psychiatry	F	33.9	36.6	32.6	32.2	33.3	57.1	37.6
	M	35.5	43.5	39.7	41.3	40.2	55.1	42.6
Teleconsultation of medical specialty in pediatric and adolescent psychiatry	F	20.5	33.1	34.8	21.5	35.6	45.5	31.8
	M	22.2	36.6	31.3	29.8	28.1	44.2	32.0
Specialty medical teleconsultation in internal medicine	F	61.3	64.4	60.8	54.3	57.9	64.8	60.6
	M	70.3	70.4	67.3	69.7	66.4	67.6	68.6
Specialty medical teleconsultation in obstetrics and gynecology	F	63.5	74.3	59.0	57.7	60.2	68.9	63.9
	M	74.3	59.6	49.5	39.3	56.3	65.4	57.4
Teleconsultation of medical specialty in pediatrics	F	62.7	72.1	62.3	57.0	62.4	68.7	64.2
	M	65.0	73.1	65.3	60.3	64.1	69.7	66.2
Specialty medical consultation in adult gastroenterology	F	61.0	71.3	66.2	51.2	63.0	62.2	62.5
	M	70.8	75.6	70.6	67.6	67.7	65.0	69.6
Telerehabilitation: clinical psychologist (45 sessions)	F	36.3	48.8	36.7	25.1	41.7	34.6	37.2
	M	42.2	59.8	51.3	45.6	47.6	37.4	47.3

Source: Superintendence of Health, Claims Services Master File.

Table A3. Average effective financial coverage (%) of face-to-face medical consultations in plans without restricted coverage by Isapre and gender (2022)

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva Masvida	Banmédica	Consalud	Whole system
General medicine consultation	F	64.8	73.7	59.4	66.3	62.3	62.7	64.9
	M	65.9	75.2	60.1	65.4	65.6	61.2	65.6
Dermatology specialty medical consultation	F	58.0	68.1	53.6	60.3	54.6	59.3	59.0
	M	58.8	68.8	56.5	61.9	55.8	59.7	60.3
Ophthalmology specialty medical consultation	F	58.0	69.4	56.3	69.7	57.9	65.5	62.8
	M	57.9	68.0	55.6	68.9	58.0	64.9	62.2
Otolaryngology specialty medical consultation	F	59.2	70.1	61.2	60.7	61.5	62.0	62.5
	M	59.9	70.1	57.9	62.5	61.3	62.0	62.3
Specialty medical consultation in adult neurology	F	54.7	66.9	53.7	56.4	56.3	59.2	57.9
	M	54.8	64.4	52.1	59.8	55.9	57.3	57.4
Specialty medical consultation in adult psychiatry	F		56.8	28.3	47.1	27.9	42.0	40.4
	M		56.0	23.5	47.2	28.3	41.7	39.3
Specialty medical consultation in pediatric and adolescent psychiatry	F		51.3	24.7	44.3	28.3	37.3	37.2
	M		43.2	22.8	49.0	24.0	33.6	34.5
Specialty medical consultation in internal medicine	F	56.0	66.2	56.2	60.9	55.0	59.4	58.9
	M	58.6	67.3	54.9	63.3	54.9	59.7	59.8
Specialty medical consultation in obstetrics and gynecology	F	65.9	72.7	62.1	72.7	64.3	68.7	67.8
	M	42.2	66.6	78.4	72.0	48.3	58.2	61.0
Specialty medical consultation in pediatrics	F	62.3	71.1	59.5	68.9	61.3	65.5	64.8
	M	62.3	71.0	59.4	69.2	61.1	64.5	64.6

(Cont'd...)

Table A3. *(Continued)*

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva Masvida	Banmédica	Consalud	Whole system
Specialty medical consultation in traumatology and orthopedics	F	59.4	69.9	60.5	63.1	61.2	64.5	63.1
	M	60.1	69.2	58.9	62.9	60.6	63.5	62.5
Urology specialty medical consultation	F	58.4	71.1	60.6	70.7	65.2	66.1	65.4
	M	62.6	71.5	61.2	65.6	64.9	66.1	65.3
Specialty medical consultation in emergency medicine	F	52.7	64.0	48.2	69.5	63.0	55.6	58.8
	M	50.2	60.3		64.8	41.0	51.1	53.5
Clinical psychologist consultation (45 sessions)	F	61.8	55.4	42.1	64.1	45.5	57.7	54.4
	M	63.4	57.8	42.9	66.1	46.2	60.1	56.1

Source: Superintendence of Health, Claims Services Master File.

Table A4. Average effective financial coverage (%) of face-to-face medical consultations in plans with restricted coverage, by Isapre and gender (2022)

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
General medicine consultation	F	64.5	68.1	58.8	59.1	61.9	65.1	62.9
	M	71.2	73.2	65.4	64.5	67.0	66.8	68.0
Dermatology specialty medical consultation	F	57.2	62.1	58.2	48.9	56.0	60.9	57.2
	M	61.8	65.6	61.3	56.8	59.3	62.9	61.3
Ophthalmology specialty medical consultation	F	58.6	64.8	61.0	59.6	58.0	66.9	61.5
	M	62.7	67.4	63.5	65.3	60.7	68.4	64.7
Otolaryngology specialty medical consultation	F	59.9	66.0	63.1	56.7	60.6	64.4	61.8
	M	64.1	69.0	65.6	62.2	63.4	66.6	65.1
Specialty medical consultation in adult neurology	F	54.5	59.0	58.0	44.2	54.8	59.6	55.0
	M	58.7	61.5	61.0	53.5	57.5	59.9	58.7
Specialty medical consultation in adult psychiatry	F		29.4	31.0	24.8	28.9	32.6	29.3
	M		37.0	34.6	30.2	33.8	34.2	34.0
Specialty medical consultation in pediatric and adolescent psychiatry	F		31.0	27.9	23.4	26.6	32.7	28.3
	M		34.2	29.7	23.9	29.5	34.3	30.3
Specialty medical consultation in internal medicine	F	56.2	60.4	58.6	52.1	55.7	59.3	57.0
	M	63.2	64.8	62.7	62.1	60.1	62.3	62.5
Specialty medical consultation in obstetrics and gynecology	F	64.1	68.5	63.7	61.7	63.6	68.6	65.1
	M	64.3	65.9	56.7	67.2	53.8	63.4	61.9
Specialty medical consultation in pediatrics	F	64.1	68.9	63.7	61.9	63.2	67.7	64.9
	M	64.1	69.2	64.1	62.1	63.4	68.3	65.2
Specialty medical consultation in traumatology and orthopedics	F	59.5	64.2	64.1	53.5	61.1	64.8	61.2
	M	64.7	68.0	66.3	60.5	63.9	67.0	65.1
Urology specialty medical consultation	F	60.1	65.4	63.7	58.8	62.0	67.2	62.9
	M	64.9	68.7	66.2	64.0	65.1	68.2	66.2
Specialty medical consultation in emergency medicine	F	52.5	60.5	46.5	54.0	52.1	56.8	53.7
	M	54.2	61.5		66.5	51.1	57.2	58.1
Clinical psychologist consultation (45 sessions)	F	30.4	30.1	31.2	25.6	32.7	26.1	29.4
	M	31.7	40.8	34.7	30.1	36.8	26.8	33.5

Source: Superintendence of Health, Claims Services Master File.

Table A5. Average effective financial coverage (%) of telemedicine medical consultations in plans without restricted coverage by Isapre and gender (2022)

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
General medicine teleconsultation	F	72.4	86.0	61.2	65.6	63.0	75.0	70.5
	M	72.0	86.4	67.1	68.4	63.6	74.3	72.0
Dermatology specialty medical teleconsultation	F	66.9	80.5	68.3	77.6	66.5	74.3	72.3
	M	66.2	82.3	58.1	60.8	70.0	72.2	68.3
Teleconsultation of medical specialty in adult neurology	F	63.2	76.2	48.3	57.2	66.4	72.0	63.9
	M	54.4	67.3	49.0		63.1	71.1	61.0
Teleconsultation of medical specialty in adult psychiatry	F	49.0	62.2	59.9	30.1	40.1	50.4	48.6
	M	39.6	59.6	70.3	31.3	35.1	51.7	48.0
Teleconsultation of medical specialty in pediatric and adolescent psychiatry	F	47.6	30.6	80.0	54.4	24.6	36.6	45.6
	M	36.3	70.0		56.2	54.1	44.0	52.1
Specialty medical teleconsultation in internal medicine	F	67.0	78.8	50.9	79.1	54.5	66.3	66.1
	M	66.3	70.2	56.8	78.0	70.8	73.4	69.3
Specialty medical teleconsultation in obstetrics and gynecology	F	65.5	81.2	56.5	72.4	63.8	73.8	68.9
	M		90.0		52.4	70.0	66.8	69.8
Teleconsultation of medical specialty in pediatrics	F	64.6	79.3	62.9	63.6	68.2	77.6	69.4
	M	69.1	81.6	44.2	74.6	63.4	73.3	67.7
Specialty medical consultation in adult gastroenterology	F	64.1	76.9	67.4	80.0	65.2	56.0	68.2
	M	76.1	74.7	64.2	71.5	63.0	68.1	69.6
Telerehabilitation: clinical psychologist (45 sessions)	F	68.1	73.3	64.2	80.0	59.7	66.1	68.6
	M	67.8	72.6	82.1	69.9	63.5	74.2	71.7

Source: Superintendence of Health, Claims Services Master File.

Table A6. Average effective financial coverage (%) of telemedicine medical consultations in plans with restricted coverage by Isapre and gender (2022)

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
General medicine teleconsultation	F	71.3	78.3	61.2	60.1	61.4	76.4	68.1
	M	76.8	80.8	66.8	69.8	67.0	78.2	73.2
Dermatology specialty medical teleconsultation	F	66.0	74.2	66.7	50.7	63.7	71.3	65.4
	M	70.2	78.3	72.4	70.9	67.9	73.0	72.1
Teleconsultation of medical specialty in adult neurology	F	61.8	66.9	61.9	55.2	60.7	63.6	61.7
	M	66.0	72.1	66.9		64.2	67.2	67.3
Teleconsultation of medical specialty in adult psychiatry	F	33.3	32.1	32.7	37.8	33.5	58.0	37.9
	M	34.5	41.8	40.9	43.3	39.9	55.9	42.7
Teleconsultation of medical specialty in pediatric and adolescent psychiatry	F	29.7	25.0	40.2	23.7	37.0	52.5	34.7
	M	29.8	32.0		31.5	35.7	49.9	35.8
Specialty medical teleconsultation in internal medicine	F	64.8	66.4	62.5	52.6	59.6	69.1	62.5
	M	70.3	72.1	68.1	69.1	65.5	70.0	69.2
Specialty medical teleconsultation in obstetrics and gynecology	F	66.4	75.0	63.5	60.1	64.6	72.9	67.1
	M		74.6		86.0	64.6	73.8	74.8
Teleconsultation of medical specialty in pediatrics	F	68.2	74.7	65.0	60.5	64.4	73.5	67.7
	M	68.9	75.4	64.1	61.4	65.5	74.3	68.3
Specialty medical consultation in adult gastroenterology	F	66.5	68.9	66.9	57.2	65.0	65.3	65.0
	M	73.0	74.2	71.9	69.3	69.5	66.1	70.7
Telerehabilitation: clinical psychologist (45 sessions)	F	37.6	39.6	36.1	36.0	39.8	37.5	37.8
	M	43.9	53.0	55.0	34.2	50.0	40.8	46.1

Source: Superintendence of Health, Claims Services Master File.

Table A7. Average effective financial coverage (%) of bed days, by Isapre and gender (2021)

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
Integral basic care hospitalization bed days (1-bed ward)	F	77.0	97.7	74.9	61.7	70.5	65.5	74.6
	M	40.0	98.2	77.8	69.4	72.8	65.2	70.6
Adult integral hospitalization in ICU bed days	F		85.0	74.6	66.6	67.3	68.0	72.3
	M		91.6	77.9	74.8	73.8	68.4	77.3
Integral adult hospitalization in ITU bed days	F		92.7	73.7	70.5	70.5	53.9	72.3
	M		93.6	79.5	66.8	74.2	63.0	75.4
Obstetrics integral hospitalization bed days (1-bed ward)	F		97.4	79.4	56.4	78.4	74.0	77.1
	M		100.0	86.1	78.7	73.6	77.0	83.1
Psychiatric hospitalization bed days	F	19.0	21.2	16.4	19.1	17.0	12.3	17.5
	M	22.1	39.1	19.0	29.1	18.3	11.1	23.1
Psychiatric bed days	F			14.3	5.8	26.6		15.6
	M		4.4	23.3		22.5	3.4	13.4
Medicine and specialties hospitalization bed days (1 bed with bathroom)	F	79.5	96.0	77.0	64.8	74.5	63.7	75.9
	M	85.8	97.5	82.3	78.8	78.8	64.9	81.3
Surgery hospitalization bed days (1 bed with bathroom)	F	74.5	71.3	70.5	53.5	61.1	61.5	65.4
	M	81.4	89.2	70.0	71.9	68.8	64.9	74.4
Obstetrics and gynecology hospitalization bed days (1 bed with bathroom)	F	77.2	96.6	78.3	62.7	75.2	72.5	77.1
	M		68.1	96.6	70.7	84.7	72.5	78.5
Adult hospitalization in ICU bed days	F	74.2	88.0	79.2	70.7	74.9	70.2	76.2
	M	77.3	86.2	84.5	72.9	79.9	67.8	78.1
Adult hospitalization in ITU bed days	F	70.2	87.5	76.4	54.8	73.9	58.4	70.2
	M	74.7	91.7	80.6	67.6	78.2	63.1	76.0

Source: Superintendence of Health, Claims Services Master File.
Abbreviations: ICU: Intensive care unit; ITU: Intermediate treatment unit. ICU: Intensive Care Unit.

Table A8. Average effective financial coverage (%) of bed days in plans without restricted coverage by Isapre and gender (2022)

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
Integral basic care hospitalization bed days (1-bed ward)	F		74.8	74.1	77.3	74.7	78.0	75.8
	M		76.1	72.8	81.7	66.2	73.2	74.0
Adult integral hospitalization in ICU bed days	F		73.5	81.9	61.6	76.3	77.1	74.1
	M		39.2	66.4	55.5	79.2	64.0	60.9
Integral adult hospitalization in ITU bed days	F		71.5	70.3	64.7	73.0	67.3	69.4
	M		69.6	78.6	74.9	71.9	64.2	71.9
Obstetrics integral hospitalization bed days (1-bed ward)	F		72.6	73.9	70.6	77.1	76.9	74.2
	M					60.0		60.0
Psychiatric hospitalization bed days	F	92.0						92.0
	M	56.6				16.9		36.8
Medicine and specialties hospitalization bed days (1-bed ward with bathroom)	F	74.4		82.3		67.4		74.7
	M	83.6				96.6	67.5	82.6
Surgery hospitalization bed days (1-bed ward with bathroom)	F	75.9				100.0		87.9
	M	73.5						73.5

(Cont'd...)

Table A8. *(Continued)*

Health service	Sex	Colmena	Cruz blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
Obstetrics and gynecology hospitalization bed days (1-bed ward with bathroom)	F	62.9	52.6		62.6			59.4
Adult hospitalization in ICU bed days	F	64.3				41.7		53.0
	M	90.4				100.0		95.2
Adult hospitalization in ITU bed days	F	83.6		46.6		37.0		55.7
	M	77.5				45.8		61.6

Source: Superintendence of Health, Claims Services Master File.
Abbreviations: ICU: Intensive care unit; ITU: Intermediate treatment unit. ICU: Intensive Care Unit.

Table A9. Average effective financial coverage (%) of bed days in plans with restricted coverage by Isapre and gender (2022)

Health service	Sex	Colmena	Cruz Blanca	Vida tres	Nueva masvida	Banmédica	Consalud	Whole system
Integral basic care hospitalization bed days (1-bed ward)	F		82.9	76.9	66.4	73.6	67.0	73.4
	M	70.0	86.8	80.7	75.1	75.9	66.5	75.8
Adult integral hospitalization in ICU bed days	F		81.6	77.3	72.8	65.9	60.1	71.6
	M		81.8	78.0	76.6	74.1	71.2	76.3
Adult integral hospitalization in ITU bed days	F		80.3	77.9	60.3	71.9	59.1	69.9
	M		80.9	81.8	71.1	77.0	61.1	74.4
Obstetrics integral hospitalization bed days (1-bed ward)	F		88.0	79.9	58.1	77.1	75.0	75.6
	M	25.0	86.5	89.2	64.4	78.2	83.1	71.1
Psychiatric hospitalization bed days	F	21.1	15.4	5.8	12.9	88.8	11.2	25.9
	M	20.5	31.3		22.1	22.8	4.8	20.3
Medicine and specialties hospitalization bed days (1-bed ward with bathroom)	F	83.0	81.7	75.5	76.1	79.2	78.4	79.0
	M	86.0	91.0	74.9	83.4	79.7	73.4	81.4
Surgery hospitalization bed days (1-bed ward with bathroom)	F	76.6	79.6	67.5	80.0	68.1	61.3	72.2
	M	82.5	98.6	76.8	78.1	83.6	65.5	80.8
Obstetrics and gynecology hospitalization bed days (1-bed ward with bathroom)	F	80.5	75.4	82.9	79.9	89.5	59.2	77.9
Adult hospitalization in ICU bed days	F	72.7	71.3	73.7	58.7	29.3	16.0	53.6
	M	74.7	81.5	76.9	73.4	71.6	77.7	76.0
Adult hospitalization in ITU bed days	F	72.0	77.8	76.4	54.6	68.8	66.9	69.4
	M	76.4	76.2	82.1	60.5	81.6	59.6	72.7

Source: Superintendence of Health, Claims Services Master File.
Abbreviations: ICU: Intensive care unit; ITU: Intermediate treatment unit.

Table A10. Curative sick leaves processed (N and %) by ICD-10 group, type of resolution, and gender (2021)

ICD-10 group	Processed			Authorized			Rejected			Reduced		
	N	%	% Females	N	%	% Females	N	%	% Females	N	%	% Females
A00 – B99	54967	3.1	47.3	49990	4.1	47.9	2845	0.8	38.9	2132	1.1	44.4
C00 – D48	39658	2.2	54.1	33601	2.8	55.1	4207	1.1	45.2	1850	1.0	57.2
COVID	220258	12.4	36.0	201835	16.6	36.3	10422	2.8	30.5	8001	4.1	35.2
D50 – D89	1684	0.1	63.9	1259	0.1	64.1	239	0.1	62.3	186	0.1	64.5
E00 – E90	10320	0.6	57.5	8381	0.7	60.2	1074	0.3	43.6	865	0.4	48.4
F00 – F99	497952	28.0	55.9	175146	14.4	57.9	235285	63.7	55.4	87521	45.3	53.5
G00 – G99	52970	3.0	49.8	37264	3.1	52.6	10335	2.8	41.3	5371	2.8	47.3
H00 – H59	19655	1.1	44.8	16942	1.4	46.1	1638	0.4	33.1	1075	0.6	42.5

(Cont'd...)

Table A10. *(Continued)*

ICD-10 group	Processed			Authorized			Rejected			Reduced		
	N	%	% Females	N	%	% Females	N	%	% Females	N	%	% Females
H60 – H95	17804	1.0	53.1	13920	1.1	54.2	1942	0.5	44.6	1942	1.0	53.3
I00 – I99	27233	1.5	30.3	21182	1.7	31.3	4018	1.1	25.2	2033	1.1	30.5
J00 – J99	95317	5.4	47.9	82308	6.8	48.5	6032	1.6	44.2	6977	3.6	43.7
K00 – K93	85444	4.8	45.9	75119	6.2	46.8	4986	1.3	37.2	5339	2.8	41.9
L00 – L99	12077	0.7	40.6	9722	0.8	40.6	1316	0.4	40.5	1039	0.5	40.7
M00 – M99	249992	14.1	39.8	157515	13.0	40.9	52244	14.1	37.6	40233	20.8	38.3
N00 – N99	41373	2.3	63.1	35313	2.9	64.1	2857	0.8	53.2	3203	1.7	61.3
O00 – O99	32708	1.8	99.9	27759	2.3	99.9	3019	0.8	100.0	1930	1.0	99.8
Other diagnoses	125815	7.1	56.1	112786	9.3	53.9	4125	1.1	35.3	8904	4.6	93.2
P00 – P96	329	0.0	74.5	255	0.0	74.1	44	0.0	65.9	30	0.0	90.0
Q00 – Q99	2635	0.1	54.2	2038	0.2	55.0	388	0.1	49.7	209	0.1	54.5
R00 – R99	32598	1.8	52.1	26530	2.2	52.8	3494	0.9	49.4	2574	1.3	47.9
S00 – T98	112432	6.3	32.7	87572	7.2	33.6	14749	4.0	28.4	10111	5.2	31.3
V01 – Y98	3843	0.2	45.8	3451	0.3	46.5	255	0.1	38.4	137	0.1	42.3
Z00 – Z99	38422	2.2	40.0	33023	2.7	40.0	4063	1.1	38.9	1336	0.7	43.6

Source: Superintendence of Health, Sick Leaves Master File.

Table A11. Curative sick leaves processed (N and %) by ICD-10 group, type of resolution, and gender (2022)

ICD-10 group	Processed			Authorized			Rejected			Reduced		
	N	%	% Females	N	%	% Females	N	%	% Females	N	%	% Females
A00 – B99	79,512	3.1	53.9	66,683	5.8	54.5	5,455	1.3	46.3	7,374	2.5	53.8
C00 – D48	42,473	4.1	54.8	32,322	2.8	55.6	6,420	1.5	46.9	3,731	1.3	60.9
COVID	260,490	5.1	49.1	239,500	20.9	49.3	14,209	3.3	44.4	6,781	2.3	53.4
D50 – D89	1,792	6.1	65.7	1,098	0.1	65.8	415	0.1	63.9	279	0.1	68.1
E00 – E90	10,653	7.1	57.5	7,415	0.6	60.6	1,523	0.4	43.4	1,715	0.6	56.7
F00 – F99	457,038	8.1	59.3	91,519	8.0	61.8	253,366	58.2	59.8	112,153	38.5	56.3
G00 – G99	51,899	9.1	55.5	31,763	2.8	59.8	12,518	2.9	45.7	7,618	2.6	53.5
H00 – H59	20,018	10.1	48.5	14,878	1.3	50.0	2,403	0.6	40.3	2,737	0.9	47.4
H60 – H95	19,516	11.1	58.7	13,257	1.2	60.3	2,719	0.6	51.4	3,540	1.2	58.3
I00 – I99	26,687	12.1	33.5	17,897	1.6	34.5	5,182	1.2	27.5	3,608	1.2	37.3
J00 – J99	237,813	13.1	58.2	184,244	16.0	58.8	18,440	4.2	55.7	35,129	12.1	56.8
K00 – K93	105,581	14.1	50.0	85,438	7.4	51.2	8,171	1.9	42.1	11,972	4.1	46.5
L00 – L99	12,271	15.1	45.4	8,416	0.7	46.5	1,820	0.4	41.8	2,035	0.7	44.0
M00 – M99	232,099	16.1	44.2	114,116	9.9	45.6	60,732	14.0	42.7	57,251	19.7	42.9
N00 – N99	45,829	17.1	66.5	33,861	2.9	68.5	4,573	1.1	57.9	7,395	2.5	62.9
O00 – O99	32,247	18.1	100.0	22,427	2.0	100.0	5,823	1.3	100.0	3,997	1.4	99.9
Other diagnoses	76,710	19.1	51.6	72,674	6.3	51.8	3,083	0.7	47.0	953	0.3	52.3
P00 – P96	301	20.1	67.1	207	0.0	61.8	49	0.0	79.6	45	0.0	77.8
Q00 – Q99	2,573	21.1	56.0	1,671	0.1	55.2	592	0.1	55.1	310	0.1	62.6
R00 – R99	36,755	22.1	59.3	26,892	2.3	60.5	5,066	1.2	56.8	4,797	1.6	54.8
S00 – T98	115,680	23.1	34.7	76,972	6.7	35.8	21,539	5.0	31.5	17,169	5.9	33.8
V01 – Y98	3,034	24.1	50.7	2,439	0.2	51.4	314	0.1	45.9	281	0.1	50.5
Z00 – Z99	3,486	25.1	85.9	2,794	0.2	85.5	564	0.1	88.8	128	0.0	82.0

Source: Superintendence of Health, Sick Leaves Master File.

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Global Health Economics and Sustainability

LETTER TO EDITOR

Authors' reply: Inadequate analysis of the budgetary impact of new label indications after initial drug registration in Brazil: A response to a published case study

Marcus Carvalho Borin[1,2*], Mariana Michel Barbosa[1,2], Camila Oliveira Pereira[1,2], Carina Rejane Martins[1], Daniel Pitchon dos Reis[1], Geraldo José Coelho Ribeiro[1,3], Júlia Teixeira Tupinambás[1], Karina de Castro Zocrato[1], Lélia Maria de Almeida Carvalho[1], Marcela Pinto de Freitas[1], Maria da Glória Cruvinel Horta[1], Mariza Cristina Torres Talim[1], Ernesto Gomes de Azevedo[1], Sergio Adriano Loureiro Bersan[1], and Silvana Marcia Bruschi Kelles[1,3]

[1]Unimed-BH, Health Technology Assessment Group, Belo Horizonte, Minas Gerais, Brazil

[2]Department of Social Pharmacy, Federal University of Minas Gerais (UFMG), Faculty of Pharmacy, Belo Horizonte, Minas Gerais, Brazil

[3]Department of Medicine, Pontifical Catholic University of Minas Gerais, Institute of Biological and Health Sciences, Betim, Minas Gerais, Brazil

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Mihajlo Jakovljevic M.D. Ph.D. MAE

***Corresponding author:**
Marcus Carvalho Borin
(marcusborin@ufmg.br)

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We appreciate the detailed feedback provided by Riveros *et al.* (2024) on our paper "Budgetary impact of new label indications after initial drug registration in Brazil: A case study of pembrolizumab and trastuzumab deruxtecan." We welcome this opportunity to clarify and expand upon the methodology, findings, and inherent limitations of our study.

Rather than actual sales of the two drugs in question, our study aimed to describe a hypothetical scenario based on all label indications for these drugs. Thus, regarding the comparison of our estimates with real-world sales data, it is important to clarify that our objective was to explore the potential impact of expanding label indications while maintaining the initial price for specific patient niches. This hypothetical scenario was designed to underscore the financial implications of broader drug usage under existing pricing structures. By doing so, we aimed to provide insights into how expanded indications could influence overall healthcare expenditures.

The scenario we presented envisages a situation in which all potentially eligible patients can access the drugs. Our intention was not to conduct a budgetary impact analysis for drug incorporation into the health-care system but to illustrate the potential financial impact of expanded label indications at current price points. This approach helps highlight the broader economic consequences of such expansions and underscores the need for strategic planning in health-care budgeting.

While we acknowledge the ISPOR Good Practice guidelines, it is crucial to consider the specific context of Brazil's supplementary health system, wherein prices often align with the maximum price listed by CMED (ANS realiza a 30ª reunião técnica da Cosaúde, n.d.). Our analysis focused on the current pricing scenario for eligible patients within each niche instead of on prices in the public health system. This distinction is vital for

understanding the regulatory and market environment in which our study was conducted (Cruz *et al*., 2022; Sullivan *et al*., 2014).

Our assumption of a median treatment time of 1 year was based on a balanced estimate, recognizing that treatment duration can vary. We aimed to provide a reasonable average for our analysis, acknowledging the inherent variability in treatment durations.

To determine the appropriate patient population for the drugs, we utilized a combination of epidemiological data from INCA, clinical trial data, reimbursement documents from Conitec, and the KEYNOTE studies for pembrolizumab. These sources provided comprehensive insights into the specific inclusion criteria for the drugs and helped determine patient populations for different indications. The epidemiological funnel used in our study to enhance clarity and reproducibility can be shared upon request (INCA, 2022; Marabelle *et al*., 2020).

A recent decision by the National Institute for Health and Care Excellence (NICE) in the UK highlights a similar issue. NICE expressed disappointment in being unable to recommend Enhertu (trastuzumab deruxtecan) for HER2-low advanced breast cancer for use within the National Health Service due to the company's pricing decisions. This scenario underscores the critical challenge of balancing innovation with affordability, a dilemma not unique to the UK and highly relevant in the Brazilian context. The inability of health-care systems to access innovative therapies because of prohibitive costs reinforces the urgency of reevaluating drug pricing strategies globally. This decision by NICE serves as a reminder that even in more affluent countries, the tension between drug pricing and accessibility remains a significant barrier. For countries such as Brazil, with a low gross domestic product (GDP) and limited health-care resources, these challenges are even more pronounced. This further supports our argument for a comprehensive evaluation of drug pricing strategies to ensure that life-saving treatments are accessible to all who need them, regardless of the economic constraints of the healthcare system (NICE, 2024).

It is crucial to address a significant oversight in the response by Riveros *et al*. (2024): the authors did not declare their conflict of interest. This omission is concerning and should have been addressed as it directly pertains to the objectivity of their critique. Transparency regarding potential conflicts of interest is essential to maintain the integrity and trustworthiness of scientific discourse. Failure to disclose such conflicts can undermine the credibility of the feedback provided and the overall scientific discussion (Bero, 2017).

Finally, it is important to highlight the broader context of our findings. Not all Brazilians have access to these innovative drugs despite their proven beneficial outcomes. A primary barrier is the significant financial burden associated with the use of such drugs. If all eligible patients in Brazil were to benefit from these drugs, the healthcare system would need to spend an amount comparable to its entire budget for therapies treating widespread chronic conditions, such as diabetes and hypertension, which serve a much larger portion of the population. This disparity highlights the unsustainable nature of current drug pricing strategies, where high-cost treatments for smaller populations strain the system disproportionately. This stark reality underscores the challenges faced by countries with low GDPs, especially when their drug pricing techniques mirror those of developed nations. Thus, while the authors have highlighted certain limitations in our study, we believe that these limitations underscore the critical need for a comprehensive evaluation of drug pricing strategies. Addressing these issues is essential to ensure broader accessibility and equity in healthcare, particularly in countries with low GDPs.

Conflict of interest

The authors declare that they have no competing interests.

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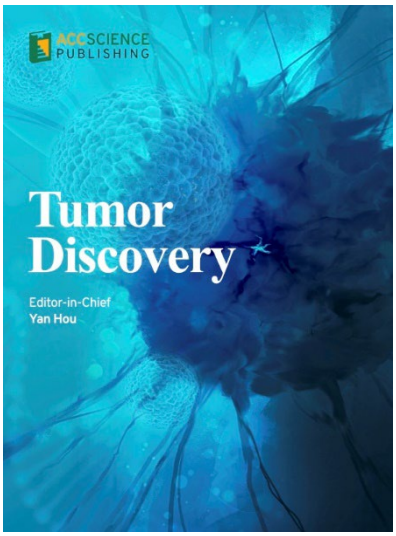

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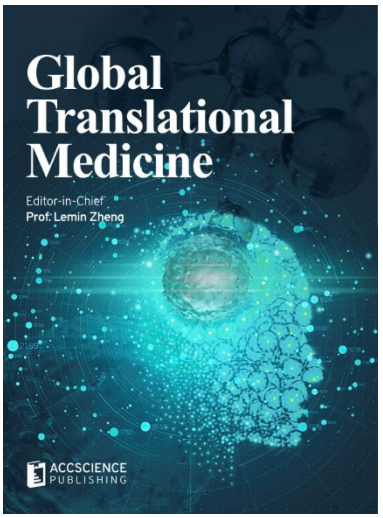

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