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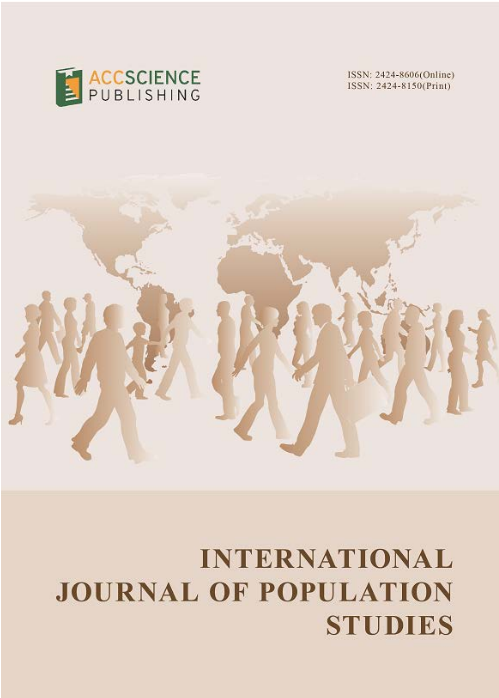

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REVIEW ARTICLE

Accessibility and utilization of health-care services among rural–urban migrants in Ghana: A scoping review

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Abstract

Since the second half of the 20th century, internal migration patterns in Ghana have been dominated by movements from rural (or northern) to urban (or southern) areas. Numerous studies report wide socioeconomic gaps between the geographical north and south of Ghana, explaining the unidirectional movement in search of better opportunities. Differences in personal health profiles, values, and beliefs mean that internal migrants face a higher risk of ill health than urban natives. Compounding this issue is the barriers that impede their access to and utilization of health-care services. We synthesized evidence from existing literature to understand internal migrants' access to and utilization of healthcare in Ghana, as well as their coping strategies. This review followed Arksey and O'Malley's guidelines for conducting scoping reviews. We searched PubMed, EconLit, CINAHL, PsychINFO, and Medline (Ovid) electronic databases for studies published from January 2012 to June 2022. In addition, a manual literature search was conducted on Google by examining the reference lists of selected articles to identify other relevant studies. The majority of the studies (n = 12 [75%]) focused on female migrants, while 4 (25%) included both male and female migrants. This review identified several factors affecting access to health-care services for internal migrants in Ghana. These factors included infrastructural, financial, and language barriers, as well as long patient waiting times. Significantly, these barriers resulted in increased self-medication and self-diagnosis among internal migrants, leading to overall poor health outcomes. Based on the study findings, we propose a multidimensional approach to bridging the health access gap for internal migrants. This approach involves improving health system factors such as health service delivery, health workforce, availability of essential medicines, and health finance reforms to provide quality health-care services at affordable or no cost, while considering the socioeconomic and cultural conditions of the internal migrants.

Keywords: Internal migrants; Access; Healthcare; Utilization; Ghana; Health system

1. Introduction

Internal migration, also referred to in this study as rural–urban migration, has driven ongoing intensive urbanization in Ghana (Ghana Statistical Service, 2013; UNICEF, 2018; United Nations High Commissioner for Refugees, 2017). These migration patterns in Ghana have predominantly been from rural to urban areas, or in other words, from the north to the south, particularly since the second half of the 20th century (Dick & Schraven, 2018; United Nations High Commissioner for Refugees, 2017). Numerous studies have reported a wide socioeconomic gap between the geographical north and south of Ghana, which drives these internal migration patterns (Figure 1). Data from the Ghana Statistical Service show that about 80% of migration in Ghana is internal. Of this, over 4 million people (70%) settle in urban areas and cities (Ghana Statistical Service, 2021). For instance, Ghana's Population and Housing Census migration report (2023:80) highlights north–south migration from the Upper West, Upper East, and Northern Regions to the Greater Accra, Ashanti, Ahafo, Western North, and Western Regions of Ghana (Figure 1).

Migrants move in search of better working opportunities, education, healthcare, recreation, and, in some cases, to escape political instability or environmental disasters (Hjelm *et al.*, 2012; Ziblim, 2013). Despite the benefits this migration may bring, it also exposes migrants to various forms of hazards (Abubakar *et al.*, 2018). For instance, internal migrants are more vulnerable to health issues due to differences in their health profiles, values, and beliefs compared to the host population (Wickramage & Annunziata, 2018). In general, they have poorer health outcomes than the urban natives because they often lack adequate access to and the capability to utilize health-care services, as well as other social support in their new environment (Afeadie, 2021; Amrevurayire & Ojeh, 2016). For instance, a study conducted in Ghana by Amankwaa *et al.* (2003) affirmed that the mortality rate of children under age five is higher (84.2 per 1000) among internal migrants than among urban natives (77.2 per 1000). Another study by Meyer-Weitz & Komesuor (2023) in Ghana also discovered a higher prevalence of depression, anxiety, and stress among internal migrants.

Some attempts have been made by the government of Ghana to ensure equitable access to and utilization of health-care services for all citizens through the implementation of the National Health Insurance Scheme (NHIS) (Act 650/852) (Amporfu & Grépin, 2019; Okoro, 2019). The NHIS, further, provides exemption packages

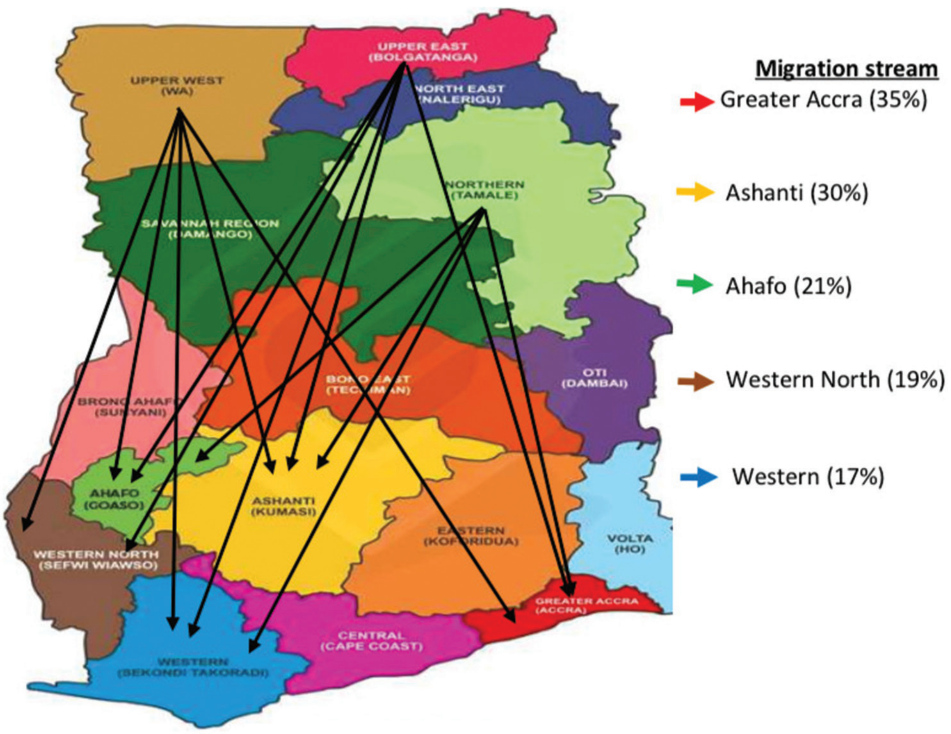

Figure 1. The north–south migration patterns in Ghana. Source: Authors' design based on Ghana's 2021 Population and Housing Census migration data (2023:80).

such as premium exemptions, free enrolment, free maternal healthcare, and free antenatal and childbirth care for vulnerable populations, including internal migrants, as specified under the National Health Insurance Regulation (sections 56 and 58) (Aryeetey *et al.*, 2015; Blanchet *et al.*, 2012; National Health Insurance Regulations, 2004). Notwithstanding, these policies and interventions to address the health access problems, socioeconomic factors such as cultural barriers, occupation, food, housing, utilities, transportation, and access to education also play a major role in determining healthcare access to and utilization for internal migrants (Doshi *et al.*, 2020). Thus, despite several interventions to improve health-care services and facilitate full-range access among internal migrants in Ghana, evidence still points to growing health inequality between internal migrants and urban natives (Akazili *et al.*, 2017; Sznajder *et al.*, 2020). This evidence, however, has not yet been synthesized to understand the various factors influencing their access to and utilization of health-care services. This review, therefore, seeks to address these gaps by systematically identifying literature on internal migrants' access to and utilization of health-care services in Ghana. The review also examines their coping mechanisms and proposes strategies to improve their health outcomes.

2. Data and methods

This review followed Arksey & O'Malley's (2005) guidelines for conducting scoping reviews, which involve five steps: (i) identify research question(s); (ii) identify relevant papers; (iii) select studies; (iv) extract and chart data; and (v) collate, summarize, and report findings.

2.1. Identify research question

The research questions were informed by the population, concept, and context framework (Ankomah *et al.*, 2021; Chambers *et al.*, 2016; Peters *et al.*, 2015), as shown in Figure 2. The population refers to internal migrants in Ghana; the concept entails healthcare access and utilization; and the context is Ghana. The review addressed the following questions:

(i) What are the facilitators and barriers to accessing and utilizing health-care services among internal migrants?
(ii) What coping mechanisms do internal migrants use when faced with barriers to accessing and utilizing health-care services?
(iii) What health system interventions and strategies could be used to improve internal migrants' access to and utilization of health-care services?

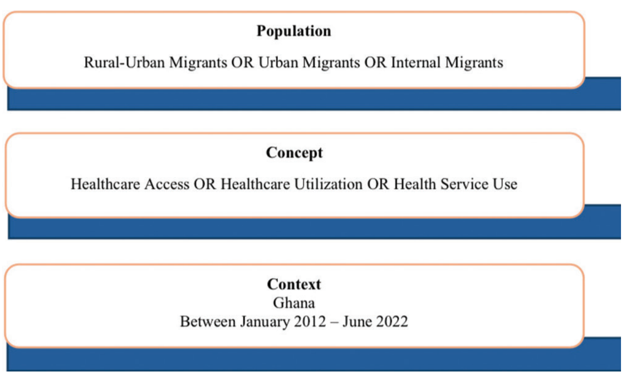

Figure 2. The population, concept, and context framework

2.2. Identify relevant papers

A three-step search strategy for scoping reviews was used to achieve a comprehensive search, as recommended by the Joanna Briggs Institute (2015). First, an initial search of the PubMed database (Table 1) was conducted. Second, the search strategy developed for the PubMed database was applied to the following databases: EconLit, CINAHL, PsychINFO, and Medline (Ovid). Third, the reference lists of all eligible articles were searched and screened for additional relevant studies. The final search strategy in PubMed was conducted in June 2022.

2.3. Select studies

All article citations were exported to the EndNote Version X9 library for further screening of titles and abstracts. Duplicate records were removed electronically using Endnote. Subsequently, abstract screening was conducted, followed by a full-text screening to select eligible relevant papers by applying the inclusion and exclusion criteria:

- Inclusion criteria
  - (i) Published gray literature and peer-reviewed English language articles from January 2012 to June 2022.
  - (ii) Papers on facilitators and/or barriers to healthcare access among internal migrants in Ghana.
  - (iii) Papers showing coping mechanisms internal migrants use when faced with barriers to healthcare in Ghana.

Table 1. Search term developed for the PubMed database

Concept#	Search terms entered in PubMed	Result
1	urban OR internal migrants OR internal migrants OR migrants OR migrants	308,492
2	Utilization OR utilization OR usage OR uptake OR use OR access OR health care OR health care OR health service	5,073,467
3	#1 AND #2	99,766
4	Ghana	5,073,467
5	#3 AND #4	665

(iv) Papers reporting on health system interventions to improve access to and utilization of healthcare among internal migrants in Ghana.

- Exclusion criteria

The following criteria were excluded from the study:
(i) Papers not conducted in English but in other languages.
(ii) Papers reporting on internal migrants' health in countries other than Ghana.

2.4. Extract and chart data

A data extraction form was designed using a Microsoft Excel spreadsheet with the following column headings: author, publication year, country, aim/purpose, study sample, study design, study outcomes, and main findings. This form was designed to extract relevant information from the selected articles. This process served as the foundation for appraising, analyzing, summarizing, and interpreting findings that correspond to the aim and research question of scoping reviews (Büchter *et al.*, 2020).

2.5. Collate, summarize, and report findings

We conducted a quantitative descriptive summary analysis and a qualitative thematic analysis of the selected eligible papers. This process involved identifying themes in the selected papers and summarizing the key results in a summary table, with each result under a thematic heading (Molyneux *et al.*, 2012).

2.6. Quality assessment and assurance

Two reviewers independently applied the eligibility criteria to screen the full text of the selected titles and abstracts. The eligibility criteria provided clear guidelines and consistency in the selection process (Arksey & O'Malley, 2005). This application minimized the risk of error and, thus, enhanced the credibility of the review findings (Arksey & O'Malley, 2005). The reviewers compared results and reached a consensus after each stage of the selection process, with a third reviewer serving as a tiebreaker in instances where the two reviewers failed to reach an agreement. After full screening, the data were entered into the designed data extraction spreadsheet using Microsoft Excel. The data were reported using the Preferred Reporting Item for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR) guidelines by Tricco *et al.* (2016:16b). The risk of bias of the eligible studies was not assessed as this review is not a systematic review. However, the quality of the selected studies was not compromised by strictly applying the eligibility criteria.

3. Results

3.1. Extent of the literature

The initial search identified a total of 932 papers, including 805 from the electronic database search and 127 from a manual search. After removing duplicate articles, 801 remained. A total of 729 articles were removed during the abstract and title screening, leaving 72 for full-text screening. The full-text screening resulted in the exclusion of 56 articles. These papers were excluded for the following reasons: lack of focus on facilitators and barriers to healthcare (n = 28), lack of focus on internal migrants in Ghana (n = 19), and not reporting on health system interventions to improve health among the internal migrants (n = 9). In total, 16 eligible studies were included in the final analysis. The PRISMA flow diagram (Figure 3) depicts the stages of study identification and selection.

3.2. Nature of the literature

A detailed description of the study characteristics is presented in Table 2. The publications came from the research fields of global and public health, social science, and policy disciplines. Thirteen (n = 13 [81%]) were original peer-reviewed journal articles, while 3 (19%) were theses. The study designs and methods from all identified sources were clearly described. A total of 5092 internal migrants were included in the 16 studies. Most (n = 12 [75%]) publications focused on female migrants, while 4 (25%) included a mix of male and female migrants. All 16 (100%) studies focused on internal migrants' experiences with both public and private health facilities.

3.3. Thematic findings

Several health-system and individual-level factors were identified in the included studies as barriers to accessing and utilizing health-care services among internal migrants. Summary of result is shown in Table 3.

3.3.1. Barriers to health-care utilization among internal migrants

All 16 eligible studies (Akazili *et al.*, 2018; Asaana, 2015; Baada *et al.*, 2021; Boateng, 2020; Boateng *et al.*, 2017; Lattof, 2017; Lattof, 2018; Munemo *et al.*, 2021; Nyarko & Tahiru, 2018; Owusu-Ansah *et al.*, 2016; Owusu & Yeboah, 2018; Rizwan *et al.*, 2022; Shamsu-Deen & Adadow, 2019; Sznajder *et al.*, 2020; Teye, 2019; Yiran *et al.*, 2015) reported on barriers to accessing and utilizing health-care services among the internal migrants. These barriers have been grouped into eight sub-themes, as presented below.

(a) Infrastructural barriers to health-care utilization
Seven articles (Baada *et al.*, 2021; Boateng *et al.*, 2017; Munemo *et al.*, 2021; Owusu & Yeboah, 2018;

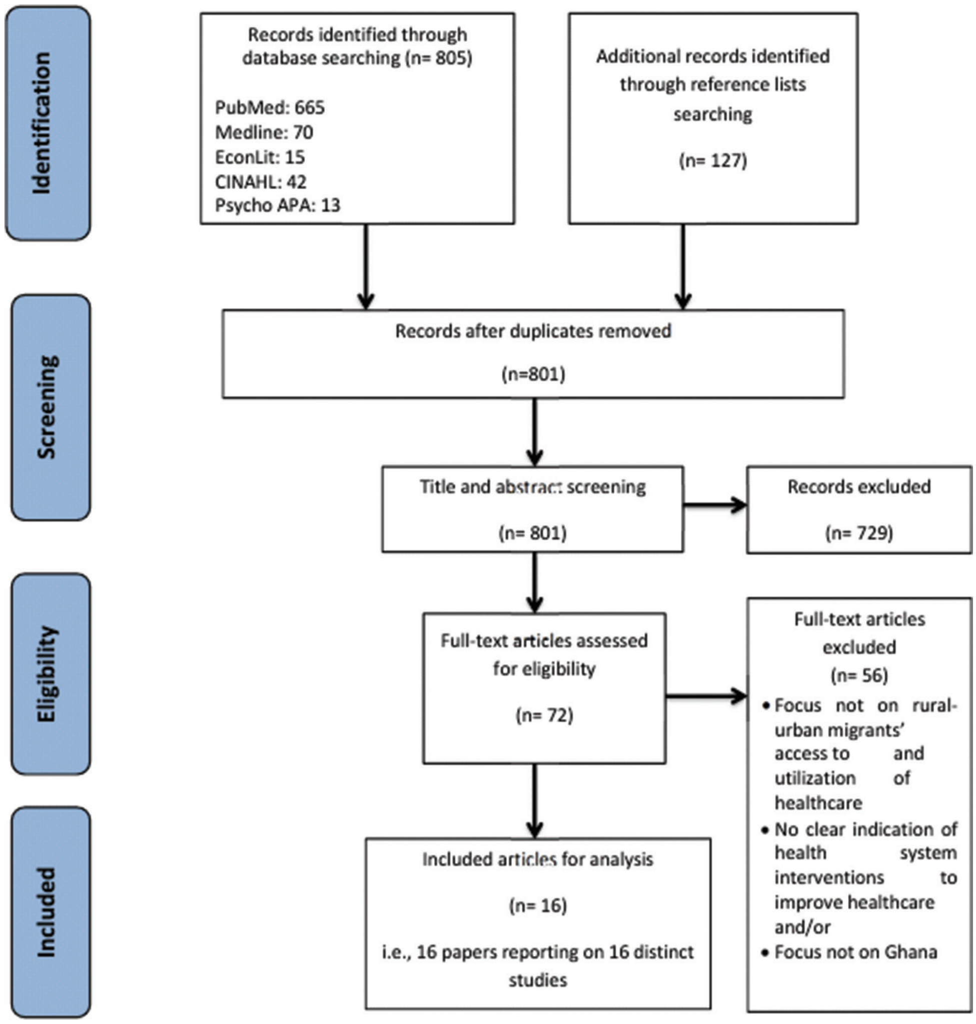

Figure 3. PRISMA flow chart summarizing search and selection of articles

Rizwan *et al*., 2022; Shamsu-Deen & Adadow, 2019; Yiran *et al*., 2015) identified distance from health-care facilities as a barrier to health-care utilization. Our review discovered that most internal migrants live in slum areas and, therefore, find it difficult to travel from their residences to health facilities for appropriate medical care when they are sick. For instance, a study conducted by Owusu & Yeboah (2018) revealed that health facilities were often over 5 km away from the slum areas where internal migrants live. Even in cases where internal migrants wanted to seek formal healthcare, they had to walk several hours because they could not afford any form of transport services.

(b) Financial constraints and affordability of quality health services

Most of the studies (Akazili *et al*., 2018; Baada *et al*., 2021; Boateng, 2020; Boateng *et al*., 2017; Lattof, 2017; Lattof, 2018; Munemo *et al*., 2021; Owusu & Yeboah, 2018; Rizwan *et al*., 2022; Shamsu-Deen & Adadow, 2019; Sznajder *et al*., 2020; Teye, 2019; Yiran *et al*., 2015) reported financial barriers as a deterrent to healthcare access and utilization among the internal migrants in Ghana. Findings from our review identified significant financial barriers for all the internal migrants as they were required to pay additional fees despite being enrolled in the NHIS (Akazili *et al*., 2018). Particularly, a study by Yiran *et al*. (2015) showed that female internal migrants were asked to provide medical consumables such as gauze and other items during childbirth, despite the provision of free maternal health under the NHIS.

Furthermore, this review revealed that health facilities were inadequately stocked with many essential drugs, leading to prescriptions being issued for purchase out-of-pocket after spending hours at the health facility. Most internal migrants earn an average of $4.9 – $23.9 weekly (whereas formal sector workers earn $37.3 – $46.6 weekly) (Boateng, 2020). As a result,

Table 2. Characteristics of included studies

Author, year of publication	Study aim/Purpose	Study design	Study sample
Baada *et al*., 2021	Explore reproductive health experiences among migrant women	Qualitative descriptive design	Interviews with 30 female migrants and five focus group discussions with ten women in each group
Akazili *et al*., 2018	Identify factors affecting access to health-care services among informal workers in Northern Ghana	Exploratory study design through qualitative approach	68 migrants through six FGDs with a maximum of 8 – 10 in each FGD and 15 IDIs
Asaana, 2015	Examine migrant women's access to health services post-migration	Qualitative descriptive design	70 female migrants
Boateng *et al*., 2017	Examine the factors associated with the use of NHIS among migrant female head porters in Kumasi	Quantitative cross-sectional study design	392 female migrants
Nyarko & Tahiru, 2018	Identify health-related concerns of female head porters	Qualitative descriptive study design	122 female migrants through IDIs
Owusu-Ansah *et al*., 2016	Describe and analyze factors associated with the utilization of health-care facilities among migrants	Quantitative cross-sectional study design	465 internal migrants
Sznajder *et al*., 2020	Explore migration narratives of migrants' sexual and reproductive lives in an informal settlement in Accra	Qualitative descriptive study design	20 migrants
Rizwan *et al*., 2022	Explore the impact of social determinants of health among migrants	Qualitative approach	N/A
Lattof, 2017	Examine the health status of female migrants who work in the informal sector	Secondary analysis through a mixed approach	625 female migrants through IDI (n=48) and remaining questionnaires
Teye, 2019	Examine access to and utilization of health-care services in Ghana after migration	Mixed approach using census and survey processing System (CSPro) data	116 migrants and 116 non-migrants through ten IDIs and one unstructured expert interview
Owusu & Yeboah, 2018	Examine factors affecting access to and utilization of healthcare among female migrants	Qualitative case study design	N/A
Munemo *et al*., 2021	Examine family practices among female migrant women	Qualitative descriptive design	Interviews with 19 female migrants and three key informants
Lattof, 2018	Identify factors that affect female migrants' access to health-care services in Accra	Mixed methods using primary survey data	625 female migrants through semi-structured interviews (four internal migrants) and remaining questionnaires
Boateng, 2020	Investigate health-seeking behaviors of migrant female head porters in the Kumasi metropolis	Quantitative case study approaches	378 female migrants
Yiran *et al*., 2015	Identify factors that promote or hinder access to maternal healthcare	Mixed-method approaches	70 female migrants through 70 questionnaire survey
Shamsu-Deen & Adadow, 2019	Examine female migrants' health-seeking behavior in Accra	Mixed-method using cross-sectional design	216 female migrants through survey questionnaires

Note: N/A indicates the unavailability of information regarding the study sample.
Abbreviations: FGD: Focus group discussion; IDI: In-depth interview; NHIS: National Health Insurance Scheme.

many are unable to afford the medications prescribed to them. It was also reported that doctors referred them to private laboratories for tests to be conducted at their own expense (Akazili *et al*., 2018).

(c) Perception of attitude of health personnel

The reviewed studies documented unfriendly attitudes and misconduct by some health professionals, who were reported to be cold toward internal migrants, particularly those who work as head porters (Akazili *et al*., 2018; Asaana, 2015; Lattof, 2017; Munemo *et al*., 2021; Owusu & Yeboah, 2018; Yiran *et al*., 2015). Specifically, a study by Owusu & Yeboah (2018) disclosed that some female internal migrants were reluctant to attend antenatal clinics because they perceived health-care professionals as unfriendly toward them due to their attire. Furthermore, this review revealed that some internal migrants at times felt demeaned by health professionals due to their migrant status, indicating differences in respect and the quality of care they received. In addition, some health professionals blamed them for their illnesses, which affected their confidence in the health system (Asaana, 2015).

(d) Adequacy of the National Health Insurance Scheme
Six articles (Akazili *et al*., 2018; Baada *et al*., 2021; Boateng, 2020; Boateng *et al*., 2017; Lattof, 2017; Teye, 2019) described enrolment difficulties (such as long processing times, registration costs, and distance to the NHIS registration office) and the inadequacy of the NHIS as barriers to health-care utilization among internal migrants in Ghana. For instance, a study by Boateng (2017) found that despite the high (78.8%) NHIS enrolment among internal migrants (specifically head porters), 53.8% were unable to renew their NHIS enrolment annually, which is required to access health-care services. It was also reported that internal migrants, who are not required to pay for health-care services in the northern part of the country, are always asked to pay additional bills for health-care services in the south (Boateng *et al*., 2017).

(e) Linguistic barriers
This review found that most internal migrants could only speak their local dialect and lacked confidence in their ability to communicate effectively to seek health-care services (Lattof, 2017; Owusu & Yeboah, 2018; Rizwan *et al*., 2022; Yiran *et al*., 2015). Many migrants have difficulties with the dominant languages (Twi and English) in southern Ghana. Health professionals, on the other, often do not comprehend the languages spoken by the migrants, which affect effective communication during diagnosis and the provision of care.

(f) Time spent at the health facility for medical care
While the availability of health services was not a problem for internal migrants in the south (urban areas), 8 articles (Akazili *et al*., 2018; Lattof, 2017; Lattof, 2018; Munemo *et al*., 2021; Nyarko & Tahiru, 2018; Owusu & Yeboah, 2018; Sznajder *et al*., 2020; Yiran *et al*., 2015) reported that long queues and unnecessary waiting times at health facilities deterred them from seeking healthcare. These delays have influenced their health-seeking behaviors. Our review identified that long waiting hours for medical care at health facilities negatively affected internal migrants' daily productivity, as most of them work in the informal sector, particularly in the head porterage business (Owusu & Yeboah, 2018; Yiran *et al*., 2015). In addition, the articles reported that internal migrants risked losing their daily income or jobs if they had to consistently visit health facilities for medical care.

(g) Influence of gender and sociocultural barriers
Four articles (Baada *et al*., 2021; Munemo *et al*., 2021; Owusu & Yeboah, 2018; Rizwan *et al*., 2022) revealed that female internal migrants had to obtain permission from the male head of their households before accessing reproductive health-care services. Our review reported that cultural norms or customs affect women's use of reproductive health services, such as contraceptives, as they are obliged to seek consent from their male counterparts. Among the Dagaaba and Sissala of the Upper West Region (UWR), a study by Baada *et al*. (2021) described how the payment of a bride price confers a woman's reproductive rights to her spouse. It was reported that internal migrants from UWR still maintain this tradition, which limits their ability to independently seek reproductive healthcare.

Another barrier discovered was the failure of health-care professionals to consider patients' cultural values and health practices, leading to negative health-seeking behavior among these migrant populations (Munemo *et al*., 2021). Our review identified that cultural orientation and perceptions of migrants have implications for their health-seeking behavior. Thus, many internal migrants only use formal health services when their health condition significantly deteriorates (Owusu & Yeboah, 2018).

(h) Health illiteracy and ignorance of formal structures for the National Health Insurance Scheme
Internal migrants' level of knowledge and understanding of health information also affected their utilization of healthcare in urban areas (Lattof, 2017; Rizwan *et al*., 2022). Most of them were unaware or uncertain about whether health insurance cards from the north (rural areas) could be used to access healthcare in the south (urban areas) of Ghana (Teye, 2019). It was reported that internal migrants were unaware of the NHIS registration costs in Ghana. For example, Boateng *et al*. (2020) revealed that some internal migrants believed that they needed to save GH₵ 80 – 100 ($7.95 – $9.95) before they could register with the NHIS, which far exceeds the actual GH₵ 25 – 30 ($2.5) NHIS registration fee. In addition,

Table 3. Summary of results from included studies

Author, year of publication	Outcome (s)			Main finding (s)
	Barrier (s)	Coping mechanism (s)	Health system factors/ Possible interventions	
Baada *et al*., 2021	(i) Financial barrier. (ii) Infrastructural and sociocultural barriers. (iii) Regarded the quality of health services as poor.	(i) Supreme being as their source of relief for their health challenges. (ii) Rely on herbs/barks.	(i) Organize periodic social programs that provide health information and resources. (ii) Equipping health workers with the necessary logistics.	Migrant women are restricted by their male counterparts to use family planning services and limited social support in their new community or society.
Akazili *et al*., 2018	(i) Long waiting hours at the health facility. (ii) Shortage or lack of medicines at the health facilities. (iii) Difficulties to register with NHIS. (iv) Unprofessional conduct of health workers.	(i) Borrowed money and/or use of earnings from the sale of properties to buy medicines. (ii) Rely on herbal or traditional medication to treat their condition.	(i) Reforming the National Health Insurance Policy. (ii) Behavioral change among health workers. (iii) Lower NHIS registration fee. (iv) Extension of the NHIS renewal period instead of the annual renewal.	Health system challenges and poor quality of health-care services under the NHIS influence migrants' health-seeking behavior.
Asaana, 2015	(i) Poor care experiences often experienced by health practitioners. (ii) Long waiting times and/or delays when seeking care. (iii) Expensive allopathic care.	(i) Self-medicating and traditional medicines.	N/A	Financial challenges, negative encounters with health professionals, and limited autonomy to use health services.
Boateng *et al*., 2017	(i) Physical challenges. (ii) Unsatisfied with drug prescriptions. (iii) Challenges in renewing their NHIS. (iv) Attitude of the care providers.	N/A	(i) Decentralizing NHIS operation to the district level. (ii) Delivery of NHIS services through mobile van.	Limited NHIS service coverage.
Nyarko & Tahiru, 2018	(i) Financial constraints. (ii) Limited NHIS coverage. (iii) Long waiting times at the health facilities.	(i) Resort to purchasing drugs from licensed medical dealers or pharmacies. (ii) Taking rest without seeking professional healthcare.	N/A	Seeking medical services from licensed chemical dealers and/ or pharmacies.
Owusu-Ansah *et al*., 2016	Financial constraints to enroll on the NHIS.	Migrants (61.1%) relied on drug stores, self-medication (3.3%), or consulted the herbalist (2.4%).	N/A	Most migrants (71.2%) had not been south for professional health services for some time.
Sznajder *et al*., 2020	(i) Financial barriers. (ii) Long waiting hours prohibited taking time to seek healthcare.	Seeking medical help from pharmacies and drug stores/ chemical sellers.	N/A	Financial difficulties and lack of social support affect migrants' sexual and reproductive health outcomes.
Rizwan *et al*., 2022	(i) Physical barriers. (ii) Societal gender norms or male dominance. (iii) Poor quality of health-care services under the NHIS. (iv) High illiteracy rate and language barriers.	(i) Strong belief in traditional medicine. (ii) Religious power.	Design a health system that meets the needs of the migrants.	Access to health-care services is affected by cultural, financial, and social factors.

(Cont'd...)

Table 3. ***(Continued)***

Author, year of publication	Outcome (s)			Main finding (s)
	Barrier (s)	Coping mechanism (s)	Health system factors/ Possible interventions	
Lattof, 2017	(i) Financial and language barriers. (ii) Stigma and discrimination. (iii) Long processing times to renew NHIS membership. (iv) Ignorant of the health-care costs.	(i) Relied on religious power. (ii) Self-medication. (iii) Social support. (iv) Seeking medical help from drug/licensed chemical sellers.	(i) Design culturally appropriate care. (ii) Higher indigent exemptions than the national average. (iii) Reform the NHIS's exemption criteria.	Reform and design culturally sensitive health systems.
Teye, 2019	(i) Challenges to enrolling on the NHIS. (ii) Financial barriers.	(i) Self-medication. (ii) Traditional healers or drug peddlers.	Robust NHIS system.	The majority of migrants (50.9%) have limited access to healthcare than the non-migrants (33.6%).
Owusu & Yeboah, 2018	(i) Financial and physical challenges. (ii) Long waiting times and disappointments of not receiving prescribed medication. (iii) Unsatisfactory conduct of health providers. (iv) Unequal distribution of health resources. (iv) Cultural and language differences.	N/A	(i) Substantial health investment. (ii) Develop mobile health clinics in slum areas. (iii) Behavioral change on the part of health officials. (iv) Intensive health awareness campaigns.	Economic, cultural, and institutional factors affect access to and utilization of health-care services.
Munemo *et al.*, 2021	(i) Poor attitudes of Family Planning Nurses. (ii) Male dominance, that is, cultural norms. (iii) Lack of physical access and operational days and time of health facilities.	N/A	N/A	Social and cultural barriers and institutional challenges affect the utilization of family planning services by migrant female head porters.
Lattof, 2018	Financial constraints and long waiting times at health facilities.	Rely on prayers to feel better.	N/A	Socioeconomic challenges and lack of social support affect the mental health of migrants.
Boateng, 2020	(i) Delays in processing health insurance cards. (ii) Financial barriers, that is, high out-of-pocket health expenses. (iii) Poor quality of care.	(i) The majority of migrants (67%) seek health medication from over-the-counter chemical sellers. (ii) Borrow money for their medical bills.	(i) Improve community participation in the District's Mutual Health Insurance. (ii) Introduce high indigent exemption. (iii) Establish mobile clinics and organize health outreach programs.	The majority of female head porters sought care from over-the-counter chemical sellers.
Yiran *et al.*, 2015	(i) Hostile attitude of health professionals. (ii) Proximity challenges, language barrier, longer waiting times at health facilities, and financial accessibility.	Use of over-the-counter medicines, drug peddlers, and local herbalists.	Establish a mobile health-care system.	Lack of health facilities in slum areas, high cost of maternal healthcare, delays and longer waiting times and strong preference for traditional medicines by migrants.
Shamsu-Deen & Adadow, 2019	(i) Proximity of the health facilities. (ii) Availability of health staff.	Drug peddlers, local herbalists, and licensed chemical shops.	N/A	The majority of migrants (75.5%) seek healthcare from traditional healers and licensed drug sellers.

Note: N/A represents the study did not examine the outcome.
Abbreviation: NHIS: National Health Insurance Scheme.

a study by Lattof (2017) revealed that the majority (88%) of internal migrants who worked as head porters were unaware of the procedures to register for health insurance and did not know about NHIS registration exemptions such as free antenatal and childbirth care.

3.3.2. Coping strategies of internal migrants for their health needs

Eleven studies (Akazili *et al*., 2018; Asaana, 2015; Baada *et al*., 2021; Boateng, 2020; Nyarko & Tahiru, 2018; Owusu-Ansah *et al*., 2016; Rizwan *et al*., 2022; Shamsu-Deen & Adadow, 2019; Sznajder *et al*., 2020; Teye, 2019; Yiran *et al*., 2015) reported on measures taken by internal migrants to access and utilize healthcare at their present locations. Four sub-themes were identified.

(a) Local chemists, drug peddlers, and traditional healers
Eleven articles (Akazili *et al*., 2018; Asaana, 2015; Baada *et al*., 2021; Boateng, 2020; Nyarko & Tahiru, 2018; Owusu-Ansah *et al*., 2016; Rizwan *et al*., 2022; Shamsu-Deen & Adadow, 2019; Sznajder *et al*., 2020; Teye, 2019; Yiran *et al*., 2015) reported that internal migrants often resort to traditional healers, local chemists, and drug peddlers for herbal medicines to treat their health conditions instead of seeking help from the formal health-care system. For instance, a study by Asaana (2015) discovered that internal migrants carried traditional medicines with them when they migrated to Kumasi (or other southern part of Ghana) to treat ailments such as malaria, back pain, and flu. It was revealed that they preferred the services of traditional healers because they are affordable and allow for payment in installments when they do not have enough money (Akazili *et al*., 2018; Baada *et al*., 2021). Our review discovered that most of these traditional healers are from the north and can speak the migrants' northern dialects.

(b) Savings, borrowing, and selling properties
Borrowing or selling properties was a common source of finance for internal migrants to pay for their health-care costs (Akazili *et al*., 2018; Boateng, 2020). This trend was most prevalent among internal migrants working in the informal sector, especially head porters. This review identified that limited avenues for health support often resulted in dependence on community groups and programs that encourage internal migrants to save for their basic needs, including health-care expenditures. Thus, they often used savings meant for other essential needs, such as food and shelter, to cover health-care expenses.

(c) Supreme being as their healer
Another significant finding from three articles (Baada *et al*., 2021; Lattof, 2017; Rizwan *et al*., 2022) identified that internal migrants relied on divine interventions or higher religious powers when faced with health challenges. Many of the migrants sought or relied on religious powers for relief, especially when facing reproductive health challenges. They preferred to rely on religion rather than seeking help from neighbors or local health professionals in their new communities, due to concerns that local people would not care enough to help them or keep their information confidential.

(d) Taking a rest
Another coping strategy identified was taking a rest without medication. A study by Nyarko & Tahiru (2018) found that internal migrants with health conditions would take some time off to recuperate and then return to work without taking any medication. Most internal migrants neither bought drugs nor visited health facilities for assessment. They perceived visiting a hospital for medical care as irrelevant unless their condition was critical.

3.3.3. Health system interventions and strategies

Recommendations on potential health system measures and interventions to improve healthcare access for internal migrants were identified in six eligible studies (Akazili *et al*., 2018; Boateng, 2020; Boateng *et al*., 2017; Lattof, 2017; Owusu & Yeboah, 2018; Teye, 2019). Based on the findings, five sub-themes were identified.

(a) Reforming of the National Health Insurance Policy
Four articles (Akazili *et al*., 2018; Boateng, 2020; Boateng *et al*., 2017; Lattof, 2017) proposed that policymakers should review the pooled pre-payment mechanisms, such as community-based insurance schemes, for rural–urban migration populations to improve the enrolment of migrants in the scheme. Our review recommended implementing mobile van operations to bring NHIS services to slum areas where most of the internal migrants live. It was, further, suggested that an effective reimbursement system be put in place to promptly reimburse health-care providers. The authors argued for an extension of the annual NHIS renewal period to 5 years to reduce the financial and bureaucratic burdens internal migrants face when trying to renew their insurance each year. To complement the function of the NHIS, Akazili *et al*. (2018) suggested adopting a family health-care system, which would contain all relevant health information for each family, enabling internal migrants to access health services countrywide.

(b) Restructuring primary health-care services and political support
To address proximity challenges faced by internal migrants, the articles argued for the establishment of

mobile health services and the construction of fully equipped health centers closer to slum areas (Boateng, 2020). Our review discovered that the majority of well-resourced health centers are situated in large residential areas, while the few available health facilities in smaller communities (slum areas) lack adequate resources, negatively impacting health-care delivery services, particularly reproductive health services (Owusu & Yeboah, 2018). This review, therefore, suggests the need for increased government investment in the health sector in Ghana. In addition, a study conducted by Boateng *et al.* (2017) examined the impact of the political environment on healthcare accessibility, especially in meeting the needs of the underserved. In their view, a clear political commitment to health equity is essential to tackle inequalities in health-care provision.

(c) Community participation and intensive awareness campaigns
To enhance the utilization of health services for internal migrants, two articles (Boateng, 2020; Owusu & Yeboah, 2018) reported the need for intensive health awareness campaigns and health outreach programs to change migrants' cultural orientation regarding their health-seeking behavior. Our review identified that the participation of the community in defining problems, planning, implementing, and evaluating community resources makes individuals feel responsible not only for their own health but also for that of others.

(d) Change in behavior of health workers toward clients
In terms of health professionals' attitudes toward vulnerable migrants, three articles (Akazili *et al.*, 2018; Owusu & Yeboah, 2018; Teye, 2019) recommended the need for behavioral change by introducing regular training programs for health professionals on the principles of healthcare and instituting a feedback system through client satisfaction surveys to improve health-care delivery services, particularly concerning patients' satisfaction. It was, further, reported that the attitude of health workers significantly influenced internal migrants' help-seeking behavior.

(e) Appropriate health technology and culturally appropriate care
Three articles (Akazili *et al.*, 2018; Lattof, 2017; Owusu & Yeboah, 2018) suggested the need for adequate health resources and equipment, as well as training of staff on culturally appropriate care techniques to work at health-care facilities. Adequate training involves identifying methods and equipment that facilities can afford to invest in, ensuring they do not contravene local beliefs and cultural practices.

4. Discussion

Most of the reviewed articles focused on internal migrants – rural – urban migrants' access to and utilization of health-care services in Ghana – examining the institutional, health system, and socioeconomic factors. Differences in the utilization rate of health-care services between different groups show inequity in access to and use of these services (Rodney & Hill, 2014).

4.1. Barriers to accessing and utilizing healthcare

Financial barriers to healthcare were commonly identified among internal migrants in Ghana. Despite the financial protection the NHIS guarantees, our review found that NHIS users, particularly vulnerable internal migrants, still had to pay some medical bills, discouraging them from seeking healthcare. It was discovered that due to internal migrants' low income levels, they struggle to meet their basic needs (such as food, shelter, and clothing) and cannot afford additional health-care expenses. The authors argued that internal migrants' inability to access formal health services was due to their low income. Similarly, evidence from the previous studies affirmed that economic status is a key social determinant of health (Adjei & Buor, 2012; Alfers, 2013; Gyasi *et al.*, 2016).

Institutional barriers such as physical inaccessibility and inconvenient opening hours at health-care facilities were other common obstacle for internal migrants to access and utilize formal health-care services. It was reported that many internal migrants live in slum areas far from health facilities. The previous studies (Apanga & Adam, 2015; Eliason *et al.*, 2014; Farmer *et al.*, 2015; Fayehun *et al.*, 2022; Ganle *et al.*, 2016; Otu, 2019; Saeed *et al.*, 2016) in other West African countries found similar results with regard to physical barriers to health facilities. This violates the WHO's recommendation of ensuring that health facilities are located within a 5 km radius of residential communities for quality health-care delivery (World Health Organization, 2018). On the contrary, Owusu-Ansah *et al.* (2016) reported that neither distance nor access to transportation hindered participants from accessing health facilities for their health needs. However, their study reported other barriers to healthcare access among internal migrants.

Another major obstacle to healthcare access identified in this review was the negative attitude and discriminatory behavior of health professionals (Sahile *et al.*, 2019). Evidence from other studies (Cooper *et al.*, 2019; Dauvrin & Lorant, 2014; Jakič & Pavlič, 2016) affirms that this negative attitude not only influences internal migrants' health-seeking behavior but also affects their confidence in the orthodox health system. The existence of poor attitudes has further endangered the lives of patients, especially internal migrants, who are already in a precarious condition with regard to healthcare access (Cooper *et al*., 2019).

It was, further, revealed that the absence of qualified translators increased the risk of internal migrants receiving improper care or being unable to follow physicians' instructions. This lack of translation services echoes observations in other studies, which revealed that language barriers threaten physicians' communication with their patients and affect their ability to give adequate medical advice (Floyd & Sakellariou, 2017; Woofter & Sudhinaraset, 2022). In addition to obvious cultural barriers such as language differences, there are also invisible cultural barriers, including gender influence, body language, notions of modesty, rules of conduct, gestures, and childbearing practices, which have been proven to influence a person's perception and approaches to healthcare (Woofter & Sudhinaraset, 2022). As this review finds, gender influence and childbearing practices influence internal migrants' behavior toward seeking reproductive health-care services in Ghana. Often, cultural differences are overlooked in their role in healthcare delivery, disregarding the fact that they can cause misunderstandings between patients and health professionals. These misunderstandings reiterate the importance of considering patients' diverse cultural values in healthcare delivery and planning (Ferdous *et al*., 2020; Moyer *et al*., 2013; Robertshaw *et al*., 2017).

Moreover, this review demonstrates a widespread lack of awareness of NHIS guidelines and exemptions, such as free maternal healthcare for internal migrants who work as head porters. The NHIS has been one of the key drivers for promoting universal access to affordable and equitable healthcare, irrespective of socioeconomic background. However, the high level of ignorance and illiteracy poses a threat to achieving these goals and undermines the NHIS's ability to remove financial barriers to healthcare (Alhassan *et al*., 2016). This lack of awareness highlights the relevance of health campaigns and awareness creation, as proposed by Dzúrová *et al*. (2014), who argue that there is no health equity without awareness.

4.2. Coping strategies of internal migrants for their health needs

Our review found that self-diagnosis and self-medication are common strategies among internal migrants. They rely on local chemists, drug peddlers, traditional healers, and local herbs brought from the north. Scientific evidence suggests that such practices could complicate their health status, as self-medicating may lead to drug addiction, allergy, incorrect diagnosis and dosage, disability, or premature death (De Sanctis *et al*., 2020). However, many internal migrants are unaware of these possible implications or are indifferent to their impact. Furthermore, most internal migrant rely on divine intervention or religious beliefs as their source of relief for health ailments. This observation agrees with scientific arguments that spirituality has a positive impact on health behaviors (Kharitonov, 2012; Unterrainer *et al*., 2014). However, despite the positive influence of spirituality on general well-being, it may lead to undetected sicknesses without proper healthcare and may influence migrants to forego needed medical care or refuse life-saving procedures (Saeed *et al*., 2016; Thomson *et al*., 2015).

Moreover, internal migrants in Ghana were found to use monies from their savings or borrow to meet their health needs. This strategy is also prevalent in other African low- and middle-income countries such as Zambia, Cote d'Ivoire, and Chad (Etiaba *et al*., 2015). Although this approach helps internal migrants pool money to cover health-care costs, it may worsen their future well-being as it leads to further impoverishment (Badurdeen *et al*., 2013). In this regard, they compromise future financial returns and well-being, suffering food insecurity, poor nutrition, child labor, and reduced resilience against poverty.

Another coping strategy adopted by internal migrants is taking a break from work to recover from illness without taking any specific medication. A similar coping strategy is found among female migrant domestic workers in Singapore (Markova & Sandal, 2016; Van Bortel *et al*., 2019). This strategy allows internal migrants to avoid the financial and physical burdens of accessing healthcare.

4.3. Potential interventions to improve healthcare access and utilization

A well-functioning health system is crucial for bridging health inequity gaps and achieving "Health for All" and "Healthy People 2030" targets, which seek to improve the health and well-being of all populations (Atun, 2012). This review highlights key interventions to improve access to and utilization of healthcare for internal migrants. The implementation of mobile health services and NHIS registration vans was cited as relevant strategies to help meet the needs of populations in slum and deprived communities. Findings support this argument, revealing that the use of mobile vans greatly helps to identify and meet the health needs of people in slum areas (Atun, 2012). Evidence from a previous study (Sorensen *et al*., 2019) revealed that many health professionals lack adequate training in cultural competence in medical practice. Therefore, it is important for health managers and policymakers to prioritize this area.

Furthermore, organizing regular or periodic awareness campaigns and health outreach programs will educate internal migrants on the available structures and procedures to register and use formal healthcare. This approach aligns with the WHO guidelines on health promotion, which encourage health program managers, including governmental and non-governmental organizations, and policymakers to increase knowledge of interventions important for increasing access to healthcare (World Health Organization, 2015).

4.4. Public health implications

Improving access to healthcare is a key indicator of health system performance and an important mechanism to bridge health disparities experienced by vulnerable populations, particularly internal migrants (Cookson *et al*., 2016). The findings will assist policymakers in building robust health systems that focus on equity and demographic adaptations to improve access to and use of affordable and quality healthcare for all populations. This argument is premised on the notion that designing effective interventions to improve migrant health outcomes could reduce long-term economic, health, and social costs (World Health Organization, 2015). It will also facilitate the promotion of migrant health and emphasize the need for more proactive measures to address the strategies internal migrants adopt to mitigate their inability to access and utilize appropriate healthcare.

Our review sheds light on the experiences of previous migrants, serving as a source of learning for future migrants regarding challenges during the migration trajectory and their effect on health, as well as information about existing structures and interventions for their health needs.

4.5. Strengths and limitations

The search limitation, from January 2012 to June 2022, may have excluded other relevant articles. A secondary limitation is that the analysis of qualitative data may be influenced by the cultural, political, and socioeconomic conditions existing at the time of data collection. Therefore, it is possible that data reinterpreted in this review may suggest different conclusions. However, despite these limitations, the search strategy for this review was designed to comprehensively assess significant public health and health sciences literature on internal migrants' access to and utilization of healthcare in Ghana.

5. Conclusion

This review examined internal migrants' access to and utilization of health-care services in Ghana. Most of the studies (n = 12 [75%]) focused on female migrants who migrate for economic opportunities, with less attention given to children and male migrants. While access to healthcare is crucial for all populations, we found several factors affecting access to appropriate health-care services among internal migrants in Ghana. These factors included infrastructural, financial, and linguistic barriers, ignorance of NHIS structures, male dominance, hostile attitudes of some health staff, and long patient waiting times. Significantly, these barriers increased self-medication and self-diagnosis among internal migrants, leading to poor overall health outcomes. Suggestions on the implementation of mobile health services and NHIS registration van were cited as relevant to help meet the needs of populations, especially the vulnerable internal migrants, in slum areas. In addition, awareness campaigns and health outreach programs were highly recommended as a way to educate internal migrants on the available structures and procedures for registering for the NHIS and utilizing formal health-care services.

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Conflict of interest

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ACCSCIENCE PUBLISHING

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REVIEW ARTICLE

Health-related challenges faced by men who had sex with other men amid the COVID-19 pandemic in the context of sexualized drug use (chemsex): A literature review

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Abstract

The COVID-19 pandemic has had widespread effects, impacting various aspects of human life, including sexual behaviors and substance use activities. This article aims to review and synthesize findings from existing published and unpublished research regarding health-related issues related to sexualized drug use (chemsex) among men who had sex with men (MSM) during the COVID-19 pandemic. The information was gathered from various databases, and 21 articles were included in this review. The results focused on the following seven health-related aspects: (i) Trends in chemsex practices among MSM during the pandemic; (ii) sexual behaviors and drug usage issues among MSM during the pandemic; (iii) mental and psychological health issues among MSM participating in chemsex during the pandemic; (iv) challenges and obstacles regarding health-care service access for MSM during the pandemic; (v) health disparity issues among MSM during the pandemic; (vi) digital health technology offering health care to MSM during the pandemic; and (vii) health-care interventions related to MSM engaging in chemsex during the pandemic. During the pandemic, targeted interventions were required that not only focused on mitigating physical health risks but also on addressing the mental health and socioeconomic challenges faced by MSM participating in chemsex. Moreover, digital health technologies and telemedicine offered promising avenues to provide necessary services remotely during the COVID-19.

Keywords: Chemsex; COVID-19; Sexualized drug use; Men who have sex with men; Literature review

1. Introduction

The COVID-19 pandemic has had widespread adverse effects, impacting not only social dynamics but also individual physiological and psychological health (Clemente-

Suárez *et al*., 2020; Saladino *et al*., 2020). In addition, it has influenced sexual behaviors and substance use activities (Sanchez *et al*., 2020). The COVID-19 pandemic has had negative consequences on well-being, health behaviors, mental health, social relationships, and the economy compared to pre-pandemic times (Alizadeh *et al*., 2023; Hosseinzadeh *et al*., 2022; Manchia *et al*., 2022; Sanchez *et al*., 2020). In particular, the COVID-19 situation has been argued to negatively influence mental health and sexual wellness, especially among those within the lesbian, gay, bisexual, transgender, queer or questioning, or another diverse gender identity (LGBTQ+) community (Eleuteri *et al*., 2022; Nowaskie & Roesler, 2022; Roux *et al*., 2022). Members of this community included men who were engaging in same-sex activities, some of whom were already grappling with elevated mental health issues (Brennan *et al*., 2020; Petrova *et al*., 2022). Despite the high contagiousness of the virus and its impact on everyday life, some of these men continued to pursue intimate connections beyond their households through risk-prone sexual practices (Starks *et al*., 2020; Sousa *et al*., 2020).

In recent times, the trend of consuming mind-altering substances during sexual encounters, referred to as chemsex, has escalated among men who have sex with men (MSM), a group more inclined to use illegal substances compared to those who identify as heterosexual (Maxwell *et al*., 2019). These substances, typically used to enhance sexual experiences, include stimulants such as mephedrone, methamphetamine, and ketamine, as well as sedatives such as gamma-hydroxybutyrate/gamma-butyrolactone (GHB/GBL) (Giorgetti *et al*., 2017; Power *et al*., 2018). Several research efforts have investigated how the global outbreak influenced the sexual practices of MSM across different nations, including trends in chemsex and the effects of social distancing measures (Starks *et al*., 2020; Sanchez *et al*., 2020). Certain findings indicated a surge in drug use during intimate encounters amid the health crisis (Charest, 2021; Torres *et al*., 2021; Lyu *et al*., 2022; Xavier Hall *et al*., 2022), while others found a decline due to quarantine regulations (Shilo & Mor, 2020; Starks *et al*., 2020; Chow *et al*., 2021; Reyniers, 2021; Gómez-Castro *et al*., 2022). However, when sexual encounters occur, the effects of recreational drug use can increase the occurrence of issues, such as sexually transmitted diseases due to not using condoms and unsafe injection practices (Donnadieu-Rigole *et al*., 2020; Sanchez *et al*., 2020; Sousa *et al*., 2021).

Furthermore, several studies have shown a correlation between the COVID-19 pandemic and changes in sexual health behaviors. Notably, there has been a significant decrease in condom and pre-exposure prophylaxis (PrEP) usage during this period, accompanied by an increase in chemsex practices, which involved the use of drugs during sexual activity (Uhrmacher *et al*., 2022). These trends have indirectly contributed to a heightened risk of sexually transmitted diseases during the pandemic (Starks *et al*., 2020; Sousa *et al*., 2021; Xavier Hall *et al*., 2022). In addition, it was found that the quarantine measures created challenges for MSM using drugs to access health-care providers for help in reducing their drug use (Card *et al*., 2021; Petrova *et al*., 2022).

The aforementioned oversight of sexualized drug use or chemsex practice among MSM demonstrates the behavioral health impact on both physical and mental health. However, the sexualized drug use or chemsex practice among MSM during the COVID-19 pandemic has not been systematically narrated. In addition, the current situation and findings on this topic from the existing literature, which could lead to further research and practice in the field, have not been identified. Therefore, this literature review aims to examine the health-related issues regarding sexualized drug use among MSM amid the COVID-19 pandemic to ascertain the effects of these practices. It also seeks to summarize the role of health-care providers in proactively managing MSM's drug use behavior while attempting to halt the spread of COVID-19 and continuing to offer addiction treatment. The findings from this study could potentially guide the design and implementation of public health and behavioral science interventions to address the health behavior risks, prevention, and safety of drug use among MSM during and after the pandemic.

2. Methods

2.1. Search strategy

This study is a narrative review of existing literature, conducted using narrative review methods. The search strategy was based on the PICO model. In this model, "P" or "Population" referred to MSM engaging in sexualized drug use or chemsex. "I" or "Intervention" refers to the type of chemsex or sexualized drug use. "C" or "Comparison" involved comparing MSM participating in chemsex with those who did not, in order to identify health outcome differences during the pandemic. Finally, "O" or "Outcome" encapsulated usage patterns and impacts of sexualized drug use or chemsex among MSM in the midst of the COVID-19 pandemic. Moreover, the PICo model was used as a search strategy when looking for descriptive and cross-sectional research. Here, "P" or "Population" again stood for MSM engaging in chemsex, while "I" or "Phenomena of Interest" referred to behaviors such as casual sex encounters during social distancing regulations or the impact of lockdown measures on MSM engaging in chemsex. "Co" or "Context" referred to a comparison of behaviors before and during the pandemic among MSM partaking in chemsex and those who did not. Keywords within each category were joined using the Boolean operator "OR," while separate categories were linked using "AND." The authors conducted a search of existing pieces of literature across several databases, including Scopus, Semantic Scholar, PubMed, Google Scholar, ScienceDirect, ProQuest, ThaiJo, and ThaiLIS, to review pertinent articles related to the research topic. The search terms incorporated keywords and MeSH terms such as "chemsex," "sexualized drug use," "men who have sex with men," "COVID-19," and "pandemic." After searching these databases, the citations and references were collected and inputted into Endnote 20, a bibliography management software program. Duplicated citations and references were then eliminated by the program. The literature search strategy also involved analyzing keywords, titles, and abstracts of the literature, followed by a full-text review performed independently by at least two reviewers. The reviewers categorized the literature as relevant, irrelevant, or possibly relevant. In cases where the two reviewers could not agree on the categorization, the publication was referred to a third reviewer for additional consideration. The selection procedure is illustrated in Figure 1. After completing the selection process and final evaluation of the retrieved literature, 21 articles were included in this literature review.

2.2. Eligibility criteria

The following criteria were used to determine the eligibility of articles for inclusion in this review:

(i) The peer-reviewed literature should include clinical trials, controlled trials, randomized controlled trials, quasi-experimental studies, descriptive research, qualitative studies, and cross-sectional studies addressing sexualized drug use or chemsex behaviors. Specifically, the focus was on the use of methamphetamine, mephedrone, GHB/GHL, cocaine, and ketamine before or in conjunction with sexual activity among males engaged in homosexual relations amid the COVID-19 pandemic

(ii) Comprehensive analysis based on full-text article availability

(iii) Consideration was given to both published and unpublished pieces of work in English or Thai, released between December 1, 2019, and August 1, 2023.

The exclusion criteria were focused on empirical studies unrelated to sexualized drug usage among individuals during the pandemic. Other literature types, such as letters to editors, commentaries, and general comments, were also excluded.

2.3. Characteristics of the identified studies and data mapping

When selecting studies for this review, 1,383 articles were initially identified using subject headings. After removing duplicates using Endnote 20, 792 studies remained for consideration. The authors then screened the titles and abstracts simultaneously, resulting in the exclusion of an additional 385 studies. Exclusion reasons encompassed a lack of information on chemsex among MSM amid the pandemic, no information on the COVID-19 pandemic, failure to determine the pandemic's influence on chemsex behavior, irrelevant study types, and unavailability of the full text. Following applying these exclusion criteria, 21 relevant studies were included in this review.

A significant proportion of the studies adopted a cross-sectional design (n = 20 [95.24%]), whereas one study was qualitative (n = 1 [4.76%]). These studies encompassed research from 14 distinct nations. Notably, the United States of America (USA) was represented in four of the studies as a data-collecting country (n = 4 [18.18%]). Five countries, namely Australia, Brazil, Canada, the People's Republic of China, and Portugal, contributed two studies each (n = 10 [45.45%]). The remaining countries, including Belgium, France, Israel, Malaysia, Mexico, the Netherlands, Switzerland, and the United Kingdom, were each represented by one study (n = 8 [36.40%]). A clearer overview of the identified data is provided in Table 1 below.

Moreover, a summary of the data extraction process, focused on extracting data from the included articles, is shown in Table 2 below. This table provides a closer look at the mapping, analysis, and synthesis of findings from the included studies.

3. Key findings

As previously mentioned, after carefully considering the inclusion and exclusion criteria set for this narrative review, 21 articles were included in the review process. The results of this narrative review encompassed various topics, such as the involved countries, study designs, sample sizes, chemsex trends, sexual behaviors, drug usage issues, mental health issues, accessibility to health-care services, health disparity issues, digital health technologies used to offer care, and health-care interventions or measures.

3.1. Trends of sexualized drug use or chemsex practices among men who have sex with men during the pandemic

This section describes the evolving patterns of drug-involved sexual activity within this group of men amid the global COVID-19 health emergency. The patterns were found to vary across global continents and social contexts.

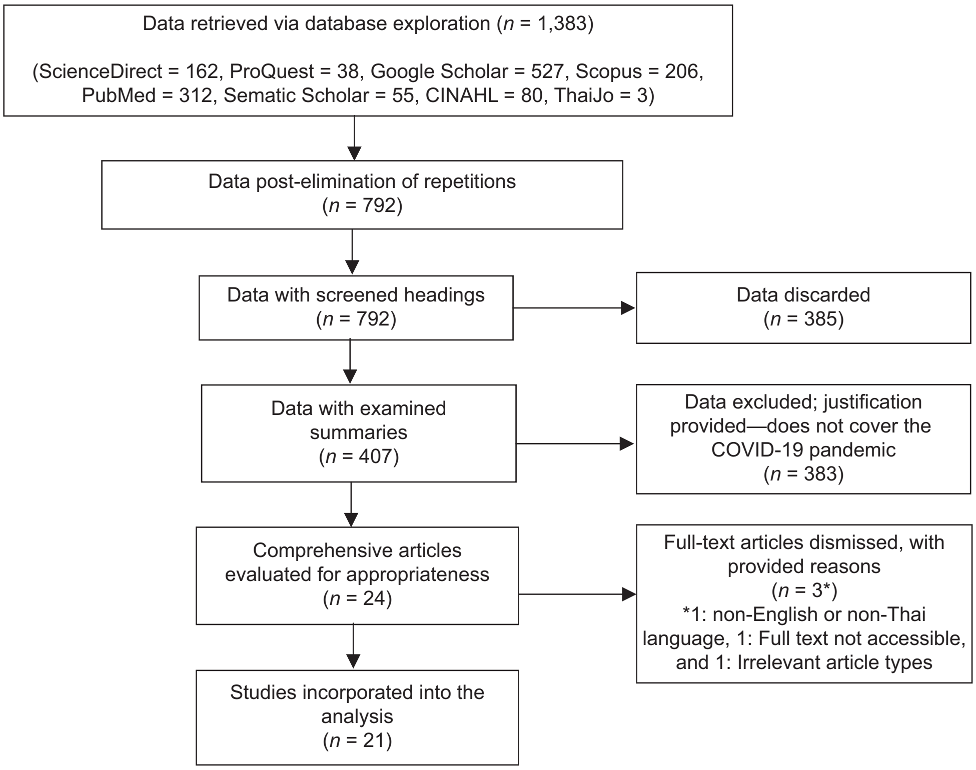

Figure 1. The flowchart depicting the selection process

The continents covered in this review were the USA, Europe, Australia, and China.

Starting with the USA, research by Sanchez *et al.* (2020) showcased an upward trend in substance consumption within the MSM community throughout the COVID-19 health crisis. Ten percentage of the respondents admitted to escalated recreational drug use, and a quarter acknowledged an increase in their alcohol consumption. In particular, younger individuals were discovered to be more inclined to increase their drug and alcohol intake in response to the global epidemic. Contradictorily, Starks *et al.* (2020) reported a marked decline in substance use among sexual minority men in the USA, with marijuana consumption falling from 45.7% before the COVID-19 pandemic to 34.5% during the COVID-19 pandemic. In addition, the use of other illicit drugs dropped dramatically from 22.9% to 11.0% throughout the period. A similar downward trend in drug-involved sexual behavior was reported by Gómez-Castro *et al.* (2022) in Mexico, where 22.6% of participants decreased their recreational drug use during sex throughout the confinement phase. In addition, a Canadian study revealed a significant decrease in alcohol consumption from 81.3% before the COVID-19 pandemic to 73.3% after the pandemic began (Charest, 2021). On the other hand, an intriguing study by Petrova *et al.* (2022) showed a mixed picture in the USA, with an equal number of men from the focus group reporting both an increase and a decrease in stimulant usage during the isolation period, hinting at differing consequences of the pandemic on drug-influenced sexual conduct.

Examining research focused on Brazil and Portugal, research by Sousa *et al.* (2020) pointed out an increased prevalence of drug-facilitated intimate behaviors within the MSM community amid the COVID-19 outbreak. Similarly, a study by Torres *et al.* (2021) in Brazil revealed an upsurge in the intake of recreational drugs during the period of enforced social distancing within the MSM community, as well as the transgender and non-binary communities, with marijuana and cocaine being the most frequently used substances ($p < 0.001$). For instance, 29.7% of participants revealed an increase in alcohol consumption, 49.4% showed an inclination toward increased tobacco consumption during the quarantine measures, and 30.4% were more involved in recreational drug use during the lockdown phase.

Turning to Europe, Chone *et al.* (2021) conducted a study in Portugal during the COVID-19 health crisis, focusing on a cohort of MSM. Hyndman *et al.* (2021) found that COVID-19 guidelines in the United Kingdom influenced drug use among MSM, leading to a greater

Table 1. Overview of characteristics of the included studies (*n*=21)

Characteristics	*n* (%)
Study design	
Cross-sectional study	20 (95.24)
Qualitative study	1 (4.76)
Years of publication	
2020	4 (19.05)
2021	7 (33.33)
2022	6 (28.57)
2023	4 (19.05)
Region (*n*=21)	
Asia and Oceania	7 (33.33)
North America	7 (33.33)
Europe	5 (23.81)
South America	2 (9.53)
Data collecting country*	
United States of America	4 (18.18)
Australia	2 (9.09)
Brazil	2 (9.09)
Canada	2 (9.09)
People's Republic of China	2 (9.09)
Portugal	2 (9.09)
Belgium	1 (4.55)
France	1 (4.55)
Israel	1 (4.55)
Malaysia	1 (4.55)
Mexico	1 (4.55)
the Netherlands	1 (4.55)
Switzerland	1 (4.55)
United Kingdom	1 (4.55)

Note: *One study collected data from both Brazil and Portugal.

likelihood of engaging in drug-facilitated sexual activity (all $p < 0.01$), particularly in London. Furthermore, a study by Roux *et al.* (2022) investigating MSM in France found that 5% of participants engaged in chemsex, while a substantial majority, amounting to 95%, abstained from such practices.

In Asia and Oceania, Chow *et al.* (2021) investigated the sexual behaviors of MSM in Australia during the second COVID-19 lockdown. The study found a decrease in sexual activity and the number of casual partners during the lockdown period. In addition, the majority of participants reported abstaining from chemsex and group sex between May and August. In Israel, Shilo & Mor (2020) found that coronavirus-related social distancing regulations led to a decrease in chemsex and alcohol consumption among MSM, from 31.7% to 18.6% ($p < 0.001$) (95% Cl: 1.3 – 1.9) and form 41.5% to 33.1% ($p < 0.001$) (95% Cl: 0.6 – 1.3), respectively. In Malaysia, Maviglia *et al.* (2022) studied recreational drug use in Malaysian MSM from August to September 2021, revealing that 9.0% of MSM reported involvement in chemsex within the last 6 months. While this prevalence rate was slightly lower than previous findings among Malaysian MSM, it still fell within the range observed among MSM in other regions of Asia.

However, a contrasting report from China by Lyu *et al.* (2022) presented evidence of heightened recreational drug use within the MSM community throughout the COVID-19 pandemic. The study found that 31.82% of participants engaged in recreational drug use in the last 3 months. Among those who reported engaging in chemsex, the proportion increased to 42.16% ($p < 0.007$) (95% Cl: 1.19 – 2.98), indicating a notable increase in recreational drug use among MSM during the COVID-19 pandemic.

In summary, this section reveals diverse trends in sexualized drug use among MSM globally during the pandemic. While some regions, such as the USA and Brazil, saw an increase in substance use, others, such as Canada and Mexico, reported a decline. Europe's findings were mixed. In Asia, contrasting trends were observed, with increases in China and decreases in Israel. These findings indicate that the pandemic's impact on drug use and sexual behaviors among MSM was complex and region-specific, influenced by various social, cultural, and health-related factors.

3.2. Sexual behaviors and drug usage issues among men who had sex with men during the COVID-19 pandemic

The unprecedented global event of COVID-19 has had substantial effects on human activities, primarily due to strict social constraints. These restrictions significantly influenced social and sexual interactions, especially in the context of substance use. It is argued that MSM experienced unique transformations in their sexual conduct and substance use habits as a direct result of these enforced measures. In this study, multinational research endeavors were examined to contribute to the understanding of these marked behavioral shifts once they were summarized.

As already mentioned, one of the prominent consequences of social restrictions during the COVID-19 pandemic was the change in sexual behaviors among MSM. Studies conducted globally, such as those by Sanchez *et al.* (2020) in the USA, Shilo & Mor (2020) in Israel, and Torres *et al.* (2021) in Brazil, observed a considerable decline in the

Table 2. Summary of data mapping, analysis, and synthesis of screening results

Sources	Country	Design	Samples	Trends	Sexual behaviors and drug usage	Mental health issues	Accessibility of health- care services	Health disparities	Digital health technologies	Health- care interventions or measures
Sanchez *et al.* (2020)	USA	Cross-sectional study	1,051 MSM aged older than 15 years	Increased	COVID-19 decreased sexual encounters and app dating and increased drug/alcohol use.	The pandemic intensified mental distress among MSM engaging in chemsex.	N/A	N/A	N/A	Promoting safe sex practices and cultural competency and sensitivity training for health-care providers
Shilo & Mor (2020)	Israel	Cross-sectional study	2,562 MSM aged older than 18 years	Decreased	During the COVID-19 lockdown, some MSM engaging in chemsex increased their use of virtual sexual activities due to reduced partner numbers and sexual frequency.	The pandemic heightened stress among MSM engaged in chemsex, as social restrictions limited casual sex encounters, prompting increased reliance on online sexual platforms.	N/A	N/A	N/A	Promoting safe sex practices and cultural competency and sensitivity training for health-care providers
Sousa *et al.* (2020)	Brazil and Portugal	Cross-sectional study	920 MSM aged 18 – 66 years	Increased	Social restrictions altered MSM chemsex practices, increasing group sex and reducing protective measures.	Pandemic- induced isolation and economic instability heightened mental health issues among MSM engaging in chemsex.	N/A	Misconceptions about protective measures against COVID-19 also contributed to disparities and a need for enhanced health education among MSM.	The pivotal role of digital health technologies and telemedicine in bridging the gap created by the pandemic.	Public health measures should enhance HIV testing and treatment, safe sex practices, and remote health- care access for MSM during the COVID-19.
Starks *et al.* (2020)	USA	Cross-sectional study	910 MSM aged 18 or older	Decreased	Pandemic- related stressors might exacerbate substance use.	N/A	N/A	N/A	N/A	N/A
Card *et al.* (2021)	Canada	Cross-sectional study	376 MSM aged 18 or older	N/A	Social restrictions led to fewer in-person encounters and varied substance use.	The pandemic heightened stress, anxiety, and isolation among MSM engaging in chemsex.	MSM in chemsex struggled to access affordable, available health care and substance treatment during the pandemic.	Decreased harm reduction services, stigma, social isolation, mental health concerns, and lack of customized support.	Digital technologies and telemedicine may substitute traditional services, offering virtual care, counseling, and harm reduction resources.	N/A

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Table 2. *(Continued)*

Sources	Country	Design	Samples	Trends	Sexual behaviors and drug usage	Mental health issues	Accessibility of health- care services	Health disparities	Digital health technologies	Health- care interventions or measures
Charest, (2021)	Canada	Cross-sectional study	423 MSM aged 18 or older	Increased	Social restrictions potentially reduced sexual activities and increased substance use among GBMSM.	The pandemic heightened depression and anxiety rates, notably in the GBMSM community, necessitating mental health support.	N/A	N/A	N/A	N/A
Chone *et al.* (2021)	Portugal	Cross-sectional study	1,301 MSM aged 18 or older	Increased	Isolation duration, partner count, and quarantine behavior linked to increased MSM chemsex.	N/A	N/A	N/A	Digital technologies can affect MSM chemsex behaviors, potentially posing risks but also offering telemedicine interventions.	N/A
Chow *et al.* (2021)	Australia	Cross-sectional study	192 MSM aged 18 or older	Decreased	Decreased casual sex partners, group sex, chemsex, and STI diagnoses due to physical distancing measures.	N/A	Lockdowns affected sexual behavior, but HIV prevention medication access persisted, stressing effective adaptability in crises.	N/A	N/A	N/A
Hyndman *et al.* (2021)	United Kingdom	Cross-sectional study	814 MSM aged 33 – 46 years	Increased	During lockdown, over half surveyed engaged in sex outside of their households; a fifth were involved in chemsex.	The COVID-19 pandemic significantly impacted the mental health of MSM engaging in chemsex, triggering lockdown restriction breaches.	Tailored interventions are needed for MSM to promote safer behaviors amid COVID-19.	The worsening health disparities are caused by the socio-economic effects of COVID-19 restrictions, leading to various mental health issues.	N/A	N/A

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Table 2. ***(Continued)***

Sources	Country	Design	Samples	Trends	Sexual behaviors and drug usage	Mental health issues	Accessibility of health-care services	Health disparities	Digital health technologies	Health-care interventions or measures
Torres *et al.* (2021)	Brazil	Cross-sectional study	3,486 MSM aged older than 18 years	Increased	During social distancing, MSM reported fewer sexual partners and increased use of illicit drugs such as marijuana and cocaine.	Considerable levels of anxiety, isolation, and loneliness among MSM engaging in chemsex due to the pandemic were highlighted.	Significant challenges accessing PrEP and ART refills were highlighted, emphasizing the need for tailored support policies for MSM.	An upswing in illegal substance use among MSM necessitated the formulation of customized social, financial, and mental health assistance strategies amid the pandemic.	N/A	N/A
Reyniers, (2021)	Belgium	Cross-sectional study	694 MSM aged 18 or older	N/A	In the early stages of quarantine, there was a decrease in sexual interactions with casual partners. In addition, some MSM engaged in sexual behaviors influenced by chemsex.	N/A	With the vital need for HIV testing and PrEP follow-up at the forefront, it became even more evident that the management of substance misuse and mental wellness challenges was of crucial importance, as underscored by the emphasis on maintaining access to these sexual health services.	N/A	N/A	N/A

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Table 2. *(Continued)*

Sources	Country	Design	Samples	Trends	Sexual behaviors and drug usage	Mental health issues	Accessibility of health- care services	Health disparities	Digital health technologies	Health- care interventions or measures
Gómez-Castro *et al.* (2022)	Mexico	Cross-sectional study	637 MSM aged 18 or older	Decreased	Sexual behaviors have changed with fewer partners, different PrEP use, and new meeting places, often linked to chemsex.	N/A	The importance of maintaining sexual health services is emphasized, with a proposal for remote access for MSM. However, stigma and discrimination could pose significant challenges for those seeking health- care services.	N/A	N/A	N/A
Xavier Hall *et al.* (2022)	USA	Cross-sectional study	1,873 SGM (sexual gender minority; as male [93.8%]) aged 23 – 30 years	N/A	Social distancing disrupted sexual behaviors among MSM. There were also concerns about a possible rise in methamphetamine consumption among young SGM individuals.	N/A	N/A	N/A	N/A	N/A
Lyu *et al.* (2022)	People's Republic of China	Cross-sectional study	731 MSM aged 18 or older	Increased	60% reported fewer sex partners; reduced casual sex among some MSM with multiple partners, involved in drug use, and suffering from app reliance.	N/A	N/A	N/A	N/A	N/A
Murphy *et al.* (2022)	Australia	Cross-sectional study	826 MSM, average 44.9 years	N/A	N/A	N/A	MSM faced reduced access to HIV prevention services, which suggested potential barriers for those engaged in chemsex.	N/A	N/A	N/A

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Table 2. *(Continued)*

Sources	Country	Design	Samples	Trends	Sexual behaviors and drug usage	Mental health issues	Accessibility of health- care services	Health disparities	Digital health technologies	Health- care interventions or measures
Petrova *et al.* (2022)	USA	Qualitative study	12 MSM aged 25 or older	Both (increased and decreased)	Amid the quarantine period, MSM who were managing their HIV status and were users of stimulants observed shifts in their sexual behavior, their stimulant usage, and their commitment to their ART. These shifts were ascribed to health- related anxieties and issues stemming from the disruption of daily routines.	Participants increased stimulant use during isolation to manage their emotions and loneliness. Stimulants helped users avoid negative feelings and re- live positive experiences, while solitude amplified usage.	N/A	N/A	N/A	N/A
Roux *et al.* (2022)	France	Cross- sectional study	7,195 MSM aged 27 – 44 years	Increased	MSM involved in chemsex were prone to heightened consumption of mind- altering drugs and psychoactive substances amid the initial lockdown in France.	During lockdown, chemsexers, a subgroup of MSM, had more casual partners and fewer stable ones. There was a notable rise in their use of substances like tobacco, alcohol, and mind- altering drugs. The study inferred that the pandemic had magnified both drug misuse and psychological health concerns within this community.	During lockdown, those engaging in chemsex showed a higher tendency toward mental distress and usage of psychotropic medication.	Indicated a surge in health risks among MSM engaging in chemsex, with a significant increase in substance use, psychological distress, and unsafe sexual behaviors. The study suggests that financial strains and feelings of isolation due to the pandemic could have compounded these health issues.	N/A	The research underscores the importance of mental health programs and services aimed at reducing harm to address these difficulties and ensure the health and wellness of this group during the COVID-19 crisis.

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Table 2. ***(Continued)***

Sources	Country	Design	Samples	Trends	Sexual behaviors and drug usage	Mental health issues	Accessibility of health- care services	Health disparities	Digital health technologies	Health- care interventions or measures
Dai *et al.* (2023)	People's Republic of China	Cross- sectional study	1,394 MSM aged 18 or older	N/A	The COVID-19 lockdowns had a detrimental effect on the mental well- being of MSM, leading to long- term depression symptoms and riskier lifestyles. These included sexual behaviors and reduced adherence to preventative measures like PrEP. However, the study didn't specifically focus on how pandemic restrictions directly affected MSM's sexual behaviors.	The pandemic has exacerbated mental health issues among MSM, with a notably higher prevalence of depression symptoms compared to the general population and pre- pandemic levels. The study confirmed this trend to be consistent globally. Addressing these mental health challenges was deemed crucial for improving the well- being of MSM during the pandemic.	Advocated for online- based interventions to support MSM's mental health during the COVID-19 pandemic, emphasizing the benefits of enhanced peer support and psychotherapy. These online methods offered both convenience and compliance with China's epidemic prevention guidelines.	The study revealed a 47.7% prevalence of depression symptoms among HIV- negative/ unknown MSM during the pandemic, a rate higher compared to the general population or data from pre- pandemic MSM studies. Lockdowns exacerbated these mental health issues, potentially leading to riskier sexual behaviors, poor PrEP adherence, and self- harm.	Advocated for online interventions tailored for MSM to mitigate depression symptoms during the COVID-19 pandemic. They suggested that digital platforms were ideal for this purpose due to their convenience and alignment with epidemic control measures in China.	N/A

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Table 2. ***(Continued)***

Sources	Country	Design	Samples	Trends	Sexual behaviors and drug usage	Mental health issues	Accessibility of health- care services	Health disparities	Digital health technologies	Health- care interventions or measures
Maviglia *et al.* (2023)	Malaysia	Cross-sectional study	870 MSM aged 18 or older	Decreased	N/A	N/A	MSM in Malaysia face health-care access challenges due to stigmatization, discrimination, and risky behaviors like chemsex. The study called for tailored health-care strategies, including peer- to- peer HIV prevention and integrated services for drug, sexual, and mental health, to address these specific needs.	This study underscored the health- care challenges faced by MSM in Malaysia, ranging from societal stigmatization and discrimination to heightened health risks like HIV. It called for tailored, integrated health-care services addressing drug use, sexual health, and mental well- being. The study also noted the diverse characteristics within the MSM community, indicating varying health practices and needs.	This study highlighted the potential of digital health technologies and telemedicine to improve health-care access for MSM involved in chemsex. While not detailed, the study suggested these tools could help bypass traditional health-care barriers, connecting the community with LGBT- friendly providers and possibly enhancing prevention and treatment programs.	N/A

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Table 2. ***(Continued)***

Sources	Country	Design	Samples	Trends	Sexual behaviors and drug usage	Mental health issues	Accessibility of health- care services	Health disparities	Digital health technologies	Health- care interventions or measures
de la Court *et al.* (2023)	Netherlands	Cross-sectional study	305 MSM aged 38 – 53 years	N/A	This study showed that COVID-19 restrictions in Amsterdam significantly impacted sexual health- care and behavior among MSM. A notable decline in health- care visits and fluctuating PrEP usage were observed, correlating with varying public restrictions. Those worried about COVID-19 were more likely to reduce PrEP use, while STI rates initially decreased.	N/A	This study found that the COVID-19 pandemic impacted MSM's access to sexual health services in Amsterdam. A 27.2% drop in return visits for care in 2020 was observed, with fluctuations in PrEP use and STI rates corresponding to pandemic restrictions. The study hinted at telehealth as a future solution for PrEP care continuity.	N/A	This study noted a drop in MSM returning for sexual health care in Amsterdam during the COVID-19 pandemic. It emphasized the role of telehealth and digital technologies, particularly for PrEP care, as promising avenues to maintain health-care access during such disruptions.	N/A
Mugglin, *et al.* (2023)	Switzerland	Cross-sectional study	205 MSM aged 18 or older	Decreased	This study found that COVID-19 restrictions significantly impacted public sexual activities among MSM but had less effect on private behaviors like chemsex. While most participants had fewer occasional partners and less public activity, private activities remained stable. Concerns about COVID-19 varied, but many held fears about transmitting the virus.	This study found that nearly half of MSM participants reported decreased sexual satisfaction during the pandemic, with a decline in overall satisfaction from 73% to 57%. Fears related to COVID-19 were prevalent, affecting both individual concerns about possible infections and concerns about transmitting the virus. The study did not fully explore the broader psychological well- being.	N/A	N/A	N/A	N/A

Abbreviations: ART: Antiretroviral therapy; GBMSM: Gay, bisexual, and other men who have sex with men; LGBT: Lesbian, gay, bisexual, and transgender; MSM: Men who have sex with men; PrEP: Pre- exposure prophylaxis; SGM: Sexual and gender minority; STI: Sexual transmitted infection.

number of intimate partners and the frequency of sexual activities during the mandated seclusion. This decrease was primarily attributed to social distancing measures and diminished opportunities for in-person sexual encounters. This observation is supported by multiple international studies, including those conducted in Canada (Card *et al*., 2021; Charest *et al*., 2021), Brazil (Sousa *et al*., 2020), Portugal (Xavier Hall *et al*., 2022), USA (Xavier Hall *et al*., 2021), and China (Lyu *et al*., 2022). Nevertheless, uniform adherence to social restrictions was not observed among all MSM. Research by Hyndman *et al*. (2021) showed that in the United Kingdom, more than 50% of respondents maintained sexual relations with partners not living in their homes during the lockdown period. Furthermore, the nature of sexual interactions also changed. For example, Card *et al*. (2021) reported a rise in virtual or online sexual activity in Canada due to the restrictions. However, not everyone chose this path; some continued to engage in in-person sex despite the infection risks, as found by Hyndman *et al*. (2021).

In parallel with sexual behavior changes, the effects of social restrictions on substance use among MSM have also been complex and varied. For instance, Sanchez *et al*. (2020) and Torres *et al*. (2021) indicated a rise in the consumption of recreational substances such as alcohol, marijuana, and cocaine during times of societal seclusion. In addition, research carried out in France by Roux *et al*. (2022) noted that during the initial lockdown, MSM reported a decrease in sexual activity with stable partners but an increase in involvement with casual partners during mid and end of lockdown. This group also reported a notable escalation in the use of nicotine, alcoholic drinks, and various psychotropic substances. Moreover, they experienced more psychological distress and were more likely to use stress-relieving medication, suggesting that the pandemic might have intensified substance use and mental health issues among MSM chemsexers.

However, the effects varied based on geographical context and personal circumstances. Investigations conducted by Starks *et al*. (2020) and Xavier Hall *et al*. (2022) in the USA and Card *et al*. (2021) in Canada revealed mixed outcomes. While some MSM reported increased substance use due to stress or boredom, others indicated a decrease due to limited access to drugs or harm-reduction services. Group sex and chemsex practices, specifically sexual behaviors among MSM, were also affected in the midst of the COVID-19 pandemic. Sousa *et al*. (2020) in Brazil and Portugal noted an increased tendency for MSM to participate in group sex while engaging in chemsex during the social distancing period. Contrarily, Chow *et al*. (2021) in Australia found that social distancing measures led to a reduction in casual sex partners, group sex meetings, and chemsex activities. While there was an overall decline in these activities, the study also noted a shift toward online platforms for sexual interactions, suggesting a change in how these encounters were facilitated rather than an increase in chemsex itself.

Further research highlights the complex relationships between chemsex, group sex, and difficulties in adhering to social distancing measures among MSM. These studies reveal that MSM engaging in chemsex, often with casual partners, were less likely to follow social isolation guidelines, leading to higher risks of group sex and unprotected sex. In addition, methamphetamine use was associated with an increase in sexual partners and intimate partner violence, complicating the adoption of protective measures. These findings underscore multifaceted challenges in maintaining health safety during the pandemic, pointing to the need for tailored public health strategies and interventions (Sousa *et al*., 2020; Chone *et al*., 2021; Xavier Hall *et al*., 2022).

In summary, the spread of COVID-19 and the resulting social restrictions have undeniably influenced the sexual behaviors and substance use patterns among MSM. Several changes were observed, such as decreases in the number of sexual partners and encounters, varied effects on substance use, and a surge in virtual sexual activity and chemsex.

3.3. Mental and psychological health issues among men who had sex with men engaging in chemsex during the COVID-19 pandemic

The COVID-19 pandemic, with its resulting lockdowns and social restrictions, has had pronounced negative effects on the psychological well-being of MSM engaging in chemsex (Shilo & Mor, 2020). These individuals experienced heightened levels of stress, anxiety, depression, loneliness, and other mental health disorders due to the impact of the pandemic. Coupled with these pervasive impacts, MSM has faced amplified mental health challenges. Multiple studies support this claim, highlighting increased stress levels, anxiety, depression, feelings of loneliness, and potential escalation of substance use. Moreover, the pandemic's social and economic fallout has also played a part in exacerbating underlying mental health vulnerabilities among the MSM community.

Multiple studies have delved into this phenomenon of the pandemic negatively affecting the mental well-being of MSM participating in chemsex, revealing consistent themes. Shilo & Mor (2020) reported heightened stress among MSM engaging in drug-enhanced sex, exacerbated by pandemic-related limitations on casual encounters. Sousa *et al*. (2020) associated isolation, economic struggles, and employment losses faced by MSM with chemsex practices during the COVID-19 pandemic with an increase in anxiety, depression, and other mental health challenges. This observation was reinforced by Charest (2021), who highlighted the elevated prevalence of depression and anxiety among MSM during this period. Moreover, studies by Hyndman *et al*. (2021) and Torres *et al*. (2021) echoed these findings, reporting pervasive feelings of unease, loneliness, and isolation during the isolation period. Adding a comparative dimension, Dai *et al*. (2023) accentuated the exacerbated symptoms of depression among MSM, noting its higher prevalence in comparison to the general population and levels before the pandemic.

The reduction in social interactions during the pandemic had a magnified impact on MSM. As intrinsically social beings, humans rely on interpersonal connections, and the pandemic created a void of solitude and seclusion for many. Dai *et al*. (2023) also accentuated the detrimental mental health implications of enforced social isolation among MSM. Substance use became a coping mechanism for many to navigate the emotional turmoil induced by the pandemic, especially among those who had already used substances before the pandemic, such as MSM previously engaged in chemsex. Building on this, Roux *et al*. (2022) unveiled that MSM engaging in chemsex demonstrated a propensity to increase their usage of psychotropic medications and other substances during lockdowns, with a notable 33% resorting to stress-alleviating drugs.

Moreover, the COVID-19 pandemic has had profound ramifications on the mental health and sexual behaviors of MSM engaged in chemsex. These ramifications are closely tied to fears and perceptions related to COVID-19 and the ensuing changes in their ability to achieve sexual satisfaction. One of the most pervasive concerns among this group was the fear of contracting COVID-19, which not only intensified existing mental health challenges but also shaped sexual behaviors. As many as 34% of participants voiced concerns about contracting COVID-19, highlighting a tangible anxiety over viral transmission. In addition, there was considerable concern about potentially infecting sexual partners; nearly half, or 46%, of those surveyed, were more concerned about transmitting the virus to their partners than acquiring it themselves. Pandemic-related restrictions also led to another layer of stress caused by the fear of facing legal consequences. About 17% of participants felt uneasy about the possibility of breaking COVID-19 guidelines, suggesting that these regulations also acted as a stressor (Mugglin *et al*., 2023). The pandemic differentially affected sexual well-being among MSM engaging in chemsex: 43% experienced diminished sexual gratification, correlating with exacerbated mental health conditions, whereas 38% reported stable gratification levels, and 22% noted enhanced satisfaction, indicating that these disparate outcomes illustrate adaptive responses to pandemic constraints (Mugglin *et al*., 2023).

Investigating the pandemic's mental health repercussions is vital, and understanding how these impacts vary internationally is equally crucial. In Asia, MSM engaging in chemsex reported significantly higher rates of depression and anxiety, exacerbated by societal stigmatization. The pandemic further strained mental health services, intensifying the challenges faced by this group due to societal stigma, leading to heightened stress and isolation. Dai *et al*. (2023) noted an increased prevalence of depression symptoms among MSM in Asia compared to the general population, underscoring the severe impact of stigmatization on their psychological well-being. In addition, Sanchez *et al*. (2020) highlighted that restricted access to health care and public health services hampers the implementation of effective coping strategies for MSM engaging in chemsex, illustrating the compounded difficulties stemming from societal attitudes and health-care barriers.

In summary, the COVID-19 pandemic worsened mental health issues for MSM in chemsex, increasing stress, anxiety, and loneliness amid social and economic upheaval. Studies highlight the rise in psychological distress and substance use, exacerbated by societal stigma and health-care gaps, especially in Asia. While the pandemic affected sexual satisfaction diversely, it underlines the urgent need for targeted mental health support and region-specific interventions to address these challenges among MSM engaging in chemsex, during and after the pandemic.

3.4. Challenges and obstacles to health-care service accessibility for men who had sex with men engaging in chemsex practices during the pandemic

In the wake of the COVID-19 pandemic, MSM engaging in chemsex faced significant health-care challenges, exacerbated by disparities in access to health-care services. Card *et al*. (2021) reported barriers within Canada, where urban areas were better equipped than rural ones to address the health-care needs of MSM engaging in chemsex, highlighting the need for more equitable health-care provision. In Brazil, socioeconomic and cultural factors further complicate access to essential medications such as PrEP and antiretroviral therapy (ART) for MSM, as noted by Reyniers (2021). The pandemic strained Brazil's health infrastructure, leading to reduced services and the closure of specialized clinics, intensifying the challenges for this vulnerable demographic.

The COVID-19 pandemic lockdown and social isolation measures, critical for public health safety, significantly disrupted health-care routines, particularly affecting MSM engaging in chemsex. These measures resulted in reduced access to medical facilities, crucial health check-ups, and prevention services, exacerbating health-care challenges for MSM, who depend on routine screenings and preventive medications. Countries such as Australia and the United Kingdom saw MSM's access to HIV-prevention medications and sexual health services significantly impacted, underscoring the urgent need for adaptive health-care strategies (Murphy *et al*., 2022; Hyndman *et al*., 2021). Reyniers (2021) highlighted the global necessity for public health interventions to specifically address substance misuse and mental health issues within this community, acknowledging the complex interplay of societal, psychological, and cultural factors in effective health-care provision.

Societal perspectives, deeply influenced by cultural, religious, and traditional beliefs, significantly impact health-care access for various communities, particularly for MSM engaging in chemsex. This demographic faces unique challenge, as evidenced in countries such as Malaysia and Mexico, where societal attitudes profoundly affect their health and well-being. In Malaysia, traditional and religious norms lead to intensified scrutiny of the MSM community, making chemsex a clandestine activity. Maviglia *et al*. (2023) reveal that in Malaysia, the stigma surrounding drug use and same-sex relationships not only marginalize MSM but also criminalize their actions, leading to discrimination within health-care settings. This discrimination hinders MSM's access to essential health services, as they fear prejudice from health-care providers.

Similarly, in Mexico, stigmas associated with MSM and chemsex persist, affecting MSM's ability to access health-care services (Gómez-Castro *et al*., 2022). Discrimination in both the public and health-care sectors creates barriers to timely medical assistance for MSM. Countries such as the United Kingdom, Brazil, and Malaysia offer insights into addressing the tailored needs of this community.

In Brazil, efforts are concentrated on enhancing access to vital medications such as PrEP and ART for MSM involved in chemsex, addressing disparities influenced by financial, regional, and sociocultural barriers (Torres *et al*., 2021). The aim is to streamline the availability of these medications by overcoming the root causes that restrict access, including the improvement of distribution networks and ensuring affordability, alongside breaking down cultural barriers that prevent MSM from seeking these essential treatments.

During the COVID-19 pandemic, the Netherlands experienced a notable decline in health-care utilization among the MSM community, attributed to lockdowns and concerns about virus exposure. However, MSM taking daily doses of PrEP exhibited consistent health-care access, underlining the importance of preventive measures in maintaining health routines (de la Court *et al*., 2023).

The COVID-19 pandemic highlighted the critical role of online health platforms in providing continuous care, consultations, and counseling, offering anonymity and reducing stigma for MSM seeking support. Dai *et al*. (2023) emphasized the effectiveness of these digital services in addressing health-care barriers and promoting inclusivity, particularly in mitigating depression symptoms among HIV-negative or unknown-HIV-status MSM in China through peer support and specialized psychotherapy. This shift toward digital health care has emerged as a vital strategy in ensuring health care access for MSM engaged in chemsex, navigating the challenges posed by the pandemic and societal prejudices.

Telehealth is a vital solution for MSM engaging in chemsex, providing online services that overcome societal stigmatization. Telehealth offers convenience, efficiency, and safety, facilitating access to essential health-care services such as PrEP consultations without fear of judgment. Telehealth became especially important during the COVID-19 pandemic when physical health-care access was limited. De la Court *et al*. (2023) highlighted how telehealth ensured continuity of care for the MSM community in Amsterdam, advocating for expanding online health-care provision as a versatile solution during crises. This scenario underscores the importance of developing tailored interventions and strategies that address the specific challenges and needs of MSM engaging in chemsex, including substance use and mental health concerns.

The COVID-19 pandemic has exacerbated health-care challenges for the MSM community, revealing disparities in health-care access, the impact of lockdowns, substance misuse, societal stigmas, and legal obstacles. These issues are deeply intertwined with cultural, legal, and economic factors, making equitable health-care access more complex for this group. However, the rise of telehealth and other technological advancements present new avenues for addressing these challenges. A comprehensive and tailored approach, emphasizing the understanding of MSM's unique needs, peer support, specialized provider training, and supportive policies, is crucial for overcoming these obstacles.

3.5. Health disparity issues faced by men who had sex with men engaging in chemsex practices during the COVID-19 pandemic

Health disparities among people who use drugs during the COVID-19 pandemic encompass differences in health outcomes and access to substance use treatment and harm reduction services (Dunlop *et al*., 2020). MSM engaging in chemsex are particularly vulnerable to these disparities, especially during lockdown phases triggered by the COVID-19 outbreak. Such vulnerabilities can lead to an increased risk of sexually transmitted infections (STIs), mental health issues, substance use disorders, and challenges in accessing health-care services (Dai *et al*.,2023; Hyndman *et al*., 2021; Maviglia *et al*., 2023; Roux *et al*., 2022). These disparities are often influenced by economic inequities, environmental disadvantages, societal stigma, discrimination, and legal or social inequalities faced by MSM (Amundsen *et al*., 2022).

Geographical disparities significantly influence the health outcomes of MSM engaging in chemsex. Research conducted by Sousa *et al*. (2020) sheds light on the distinct chemsex practices and knowledge gaps between Brazil and Portugal. Brazil, for instance, reports higher occurrences of chemsex and fewer prevention efforts, attributed to a prohibitionist climate. This discrepancy is concerning as it leads to higher rates of unprotected sex, multiple sexual partners, and the use of psychoactive substances during sexual encounters. The disparities in health-care infrastructure and the availability of sexual health services between countries such as Brazil and Portugal can significantly affect the accessibility to appropriate care and support for the health needs of MSM engaging in chemsex. Portugal's more robust health-care systems and harm reduction interventions may offer better resources for addressing the health needs of MSM compared to Brazil.

The impact of societal stigma and discrimination on health-care access cannot be overstated. In Brazil, Torres *et al*. (2021) found that drug use among MSM and transgender/non-binary individuals during the pandemic was closely associated with increased stigma and barriers to accessing health care. The stigma surrounding drug use, especially in the context of chemsex, exacerbates discrimination and judgment from health-care providers, thus creating significant obstacles for MSM seeking health-care services. This stigma fosters a climate of fear among MSM, who may be concerned about legal repercussions or mistreatment if they disclose their substance use to health-care providers. Consequently, this fear can deter MSM from seeking necessary help for their drug use or related health issues, leading to avoidance of health-care services critical for their well-being, including HIV prevention, treatment, and care (Torres *et al*., 2021).

In the United Kingdom, Hyndman *et al*. (2021) have highlighted that MSM face significant challenges in accessing health care due to societal stigma and a lack of awareness among health-care providers regarding chemsex practices. This gap in understanding can prevent health-care providers from offering the necessary support or interventions, resulting in further health disparities and leaving MSM without the essential treatment or preventative care they require.

The legal framework in Malaysia further complicates the situation for MSM engaging in chemsex. Maviglia *et al*. (2023) discuss how the criminalization of same-sex relationships and drug use exacerbates stigma and discrimination, placing MSM at risk of legal consequences in addition to societal judgment. The fear of legal repercussions and societal discrimination severely hinders MSM's access to health care, as they may avoid seeking health services due to fear of being reported to authorities or facing discrimination from health-care providers. This avoidance can lead to untreated health issues and perpetuate the cycle of health disparities.

During the pandemic, lockdowns have resulted in an increased reliance on substances among MSM, particularly noted in France by Roux *et al*. (2022). This rise in substance use, likely driven by isolation, stress, and the disruption of normal social and support networks, not only heightens the risk of addiction and health issues related to drug use but also complicates access to health-care services. The pandemic has intensified societal pressures and stigmatization, resulting in significant health disparities for MSM engaging in chemsex. Card *et al*. (2021) provide insights into the discrimination faced by this community, both within society and health-care settings, where stigma related to sexual orientation and substance use behaviors creates substantial barriers to accessing health-care services.

Several determinants influence MSM's ability to access help for substance use issues, including income levels, the frequency of substance use, and health-care provider awareness. Card *et al*. (2021) and Roux *et al*. (2020) note that lower income and more frequent engagement in chemsex can pose additional obstacles for individuals affected by chemsex-related issues. The interplay of financial constraints, the intensity of substance use, and provider biases leads to significant barriers to accessing treatment and support. These barriers are further complicated by societal and health-care-related stigmatization, limiting MSM's access to and utilization of substance use services.

3.6. Digital health technologies and chemsex practices among men who had sex with men during the COVID-19 pandemic

The COVID-19 pandemic posed several challenges in providing traditional health services. With the need to contain the spread of the virus, in-person consultations, therapy sessions, and harm reduction programs were severely disrupted or unavailable (de la Court *et al*., 2023). These challenges made it difficult for vulnerable populations, especially MSM involved in chemsex, to access health-care services, worsening existing health disparities. Chemsex is already linked to health risks, and the pandemic exacerbated these issues. Digital health technologies and telemedicine emerged as critical solutions to address these issues.

In response to the amplified inequalities and ongoing health-care needs brought on by the pandemic, studies by Card *et al*. (2021) and Sousa *et al*. (2020) discuss the pivotal role of digital health technologies and telemedicine in addressing this need. By leveraging digital platforms, health-care providers can offer personalized counseling sessions through video calls or chat. This modality ensures that MSM individuals receive timely psychological support and guidance, specifically addressing the challenges they face, including those related to chemsex practices. Creating virtual support groups through these technologies offers a sense of community and belonging. MSM individuals can share experiences, gain insights from peers, and receive professional advice in a supportive and understanding environment, which is especially crucial during isolation. Digital health platforms facilitate a broad spectrum of health-care services remotely, including consultations and follow-ups, and provide access to a wealth of resources such as harm reduction interventions, health-care information, and ways to navigate health systems effectively.

Recent studies offer further insights and recommendations for enhancing digital health solutions. Dai *et al*. (2023) proposed the integration of digital solutions with peer support and tailored psychotherapy to combat the high incidence of depressive symptoms among MSM exacerbated by the pandemic. Echoing the importance of tailored digital health solutions, Maviglia *et al*. (2023) underlined the benefits of developing technologies designed explicitly for substance-using MSM. These technologies can include mobile applications or online platforms that provide information, resources, and support for substance use and sexual health among MSM.

In addition, a study by de la Court *et al*. (2023) demonstrated how telehealth consultations in Amsterdam, the Netherlands, have preserved access to essential sexual health services, including PrEP for MSM, during the pandemic. By facilitating remote consultations, telehealth platforms remove the necessity for in-person visits, allowing individuals to receive comprehensive guidance on PrEP usage, monitoring, and managing side effects from home. This approach ensures uninterrupted access to PrEP, with health-care providers able to assess needs, issue prescription refills, and conduct follow-up consultations virtually, thereby maintaining continuity of care.

While digital platforms offered significant advantages in health-care delivery, they also posed potential risks. A recent study by Chone *et al*. (2021) explored the inadvertent encouragement of unsafe sexual practices through digital platforms, mainly dating apps. These practices include engaging in group sex, unprotected sex, not using PrEP, and not getting tested for COVID-19 among MSM engaging in chemsex. The availability and accessibility of dating apps may have facilitated more accessible connections between individuals interested in chemsex, potentially increasing the prevalence of this practice. The anonymity and convenience of digital platforms may have reduced inhibitions and led to more impulsive decision-making regarding engaging in chemsex.

The COVID-19 pandemic disrupted health care, significantly affecting MSM engaging in chemsex. Digital health technologies emerged as essential, providing services such as counseling and PrEP access remotely. These solutions addressed specific needs and ensured care continuity during social distancing. However, digital platforms also risked encouraging unsafe sexual practices. Future efforts must focus on improving digital health services to be both accessible and inclusive, carefully balancing the needs and potential risks of this population.

3.7. Health-care interventions for addressing chemsex practices among men who had sex with men during the pandemic

Health-care professionals play a crucial role in addressing sexual behavior and substance use issues in the MSM community. Their responsibility extends beyond treating conditions that arise from these behaviors; they are also tasked with educating and counseling MSM to ensure their health and safety during the challenging times brought about by COVID-19. Cultural competency and sensitivity training for health-care providers is vital in managing chemsex practices among MSM and transgender/non-binary individuals during the pandemic. As emphasized by Sanchez *et al*. (2020) and Shilo & Mor (2020), such training, including workshops on LGBTQ+ health issues and sensitivity sessions, is critical. These programs are designed to educate health-care providers on the unique challenges faced by individuals engaging in chemsex, thereby enhancing care delivery and addressing the complex health-care needs in these unprecedented times.

Furthermore, the pandemic has significantly intensified mental health challenges among MSM, primarily due to heightened stress and isolation. Roux *et al*. (2022) advocated for specialized virtual counseling services, such as cognitive-behavioral therapy, tailored to these pandemic-associated challenges to foster healthier coping mechanisms. Addressing psychological distress and substance abuse, health-care providers offer individual and group therapy sessions through online platforms. Simultaneously, the creation of supportive online environments through virtual support groups, community forums, and social media platforms is emphasized. This initiative enables MSM to share experiences and receive peer support, significantly reducing isolation and enhancing well-being among those engaging in chemsex during the pandemic.

Promoting safe sex practices is crucial in mitigating the risk of STIs and HIV, especially during the pandemic (Sanchez *et al*., 2020; Sousa *et al*., 2020; Shilo & Mor, 2020). Despite the lockdown restrictions, many MSM continue to engage in sexual activities, including chemsex, potentially compromising adherence to safe sex practices. Health-care providers are thus encouraged to creatively adapt by leveraging online platforms or virtual counseling to overcome lockdown measures, ensuring continued access to STI testing while observing social distancing protocols, and facilitating the distribution of condoms and lubricants.

In summary, the COVID-19 pandemic has highlighted the urgent need for health-care interventions designed to manage chemsex practices among MSM. Health-care professionals who have received cultural competency and sensitivity training are crucial in addressing the heightened mental health challenges and risks associated with chemsex. Using virtual platforms for counseling, support groups, and the promotion of safe sex practices, they provide a holistic approach to care. These measures are critical in mitigating the pandemic's effects and demonstrate the importance of adaptability and comprehensive care in safeguarding health and safety.

3.8. Limitations

This review has potential limitations. First, this review is limited by the languages of the articles included, which were restricted to English and Thai. Publications in other languages were not included. Second, the articles finalized for inclusion in this review primarily focused on Asia, Oceania, and North America. Further reviews should aim to cover geographic regions not covered in this review, such as Europe, Africa, and South America. Third, this review did not incorporate grey literature, which could have enriched the findings.

4. Conclusion

The COVID-19 pandemic has significantly influenced chemsex practices among MSM, revealing complex interplays between social isolation, health-care accessibility, and mental health. The pandemic's restrictions have not only persisted but also evolved chemsex activities, exacerbating health risks and highlighting the need for individualized health-care approaches. It is crucial to recognize that no one-size-fits-all solution exists; interventions must be tailored to address the diverse needs within the MSM community. This review emphasizes the importance of comprehensive behavioral health and health-care strategies, including digital health technologies, to provide inclusive and accessible services. Future research should focus on understanding the pandemic's long-term effects on MSM's sexual behaviors and health, considering varying demographics and geographical contexts. Collaborative efforts among health-care providers, policymakers, behavioral scientists, public health specialists, and the MSM community are essential to develop effective, culturally sensitive interventions that address both physical and mental health needs, ensure equitable health-care access, and reduce stigma.

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Conflict of interest

The authors declare they have no competing interests.

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ACCSCIENCE PUBLISHING

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PERSPECTIVE ARTICLE

Immigrants, asylum-seekers, and refugees: Navigating conceptual challenges through multidimensional migration space-time

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Abstract

Migration is a pervasive social, political, and economic experience. Despite its ubiquity, the complexities of migration present challenges for scholars. Ongoing debates revolve around defining central categories that describe and understand human movement. Concepts such as migrant, asylum-seeker, and refugee are fraught with tensions and overlapping characteristics. Disaggregating these categories is complex due to the messy and varied nature of individuals' lived experiences. This complexity prompts scholars to critically examine how these categories are constructed and applied. Considering this, I argue that reconceptualizing migration categories as interconnected positions within a temporally and geographically contingent multidimensional migration space-time allows scholars to better examine the complexities of movement. Moreover, the intricate nature of migration necessitates the construction and reconstruction of adaptable concepts to better understand highly contextual experiences. Therefore, researchers must design research projects that can capture the nuances, tensions, and contradictions inherent in migration experiences, even when these nuances do not align with narrow, instrumentalized definitions used in legal regimes and public policy. While more flexible concepts offer valuable opportunities for deeper insights, there are also significant risks to consider.

Keywords: Migration; Immigrants; Asylum-seekers; Refugees; Mobility

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1. Introduction

Migration is a pervasive social, political, and economic experience. Despite its ubiquity, the complexities of migration present challenges for researchers. Scholars across various disciplines have worked to generate core concepts that capture the essence of migration (Brettell & Hollifield, 2014). There are ongoing debates around defining central categories and concepts to accurately describe and understand the movement of people. Concepts such as migrant, asylum-seeker, and refugee are fraught with tensions and overlapping characteristics (Crawley & Skleparis, 2018; Tsegay, 2023), making the disaggregation of these categories challenging. Studies of migration often "destabilize the rigid division of the world" (Bastia, 2014, p. 238), highlighting the complexity and fluidity of individuals' lived experiences, which underscores the need for scholars to critically examine how migration categories are constructed and used (Crawley & Skleparis, 2018).

This perspective article draws on existing literature that critically examines migration categories, as well as my own previous and ongoing research in the field. My research has explored the lived experiences of individuals who migrated from the Middle East and North Africa (MENA) to the United States (US), revealing the challenges inherent in migration categories. For example, in a previous study of Iraqis who left their country after 2003, I discovered that answering the seemingly simple question, "Who is a refugee?" is not at all straightforward, given the multiple paths individuals take to seek refuge. There are at least three different programs through which the US government grants (or denies) legal statuses to displaced individuals: the United States Refugee Admissions Program, asylum, and the Special Immigrant Visa Program (Keyel, 2023). In an ongoing research project, I have interviewed 14 individuals from the MENA region who migrated to the US. One participant, who identified as Palestinian from Gaza, was born as a temporary resident in Saudi Arabia because her father was a guest worker. She later returned to Gaza as a Palestinian refugee, moved to the US as an international student, and most recently traveled to Canada to claim asylum. This participant's experience, along with those of many others I have interviewed, demonstrate the complicated journeys – literally and figuratively – that unfold across different temporal and geographic locations and span multiple migration categories.

Considering this, I argue that reconceptualizing migration categories as interconnected positions within a multidimensional migration space-time can allow scholars to better examine the complexities of movement. Moreover, the intricacies of migration necessitate the construction and reconstruction of adaptable concepts to understand experiences that are temporally, geographically, culturally, and politically contextual. Therefore, researchers in the field must carefully design research projects that can capture the nuances, tensions, and contradictions in migration, even when these nuances do not align with narrow, instrumentalized definitions used in legal regimes and public policy. Finally, I argue that while more flexible concepts offer opportunities, there are also significant risks to consider.

2. Definitional challenges

Scholars and practitioners have long identified the difficulties in defining and operationalizing important migration categories such as migrant, immigrant, asylum-seeker, and refugee (Anderson & Blinder, 2019; Crawley & Skleparis, 2018; Devanney *et al.*, 2021; Gorodzeisky & Leykin, 2020; Lister, 2013; Tsegay, 2023). Despite extensive study, significant debate remains regarding how to conceptualize migration processes, which are both multifaceted and context-specific (Tsegay, 2023). Common categorizations of migration experiences often oversimplify, assuming that individuals fit into single, mutually exclusive categories (Devanney *et al.*, 2021). However, boundaries between these categories are not as distinct as they may appear (Crawley & Skleparis, 2018). Individuals' self-conceptions of their migration status may evolve with changing material conditions (Tsegay, 2023). These self-perceptions may not align with how states and institutions categorize migrants. Moreover, migration concepts are not static; their meanings are frequently (re) negotiated and (re) defined across different geographic and political contexts (Crawley & Skleparis, 2018).

To further complicate matters, categories such as asylum-seeker and refugee are not only descriptive of particular experiences of displacement but also serve as legal terms with specific meanings and implications for the rights and protections available to certain individuals (Bakewell, 2008). There are ongoing contestations over how these categories should be defined and who is entitled to claim them (Lister, 2013). Recent displacement crises have called into question the adequacy of existing legal definitions, which were initially developed under significantly different political and environmental conditions (Moszynski, 2011). Furthermore, categorization is not a neutral process; it is a political act and one laden with power relations. When a state agent, an international or intergovernmental organization, or a non-governmental organization (NGO) defines someone as a refugee (or denies such status), it has significant consequences for their immediate safety, future security, and opportunities.

In short, the foundational categories in migration studies remain contested (Tsegay, 2023). Given this, moving forward through the chaos requires embracing complexity and uncertainty.

3. Toward a multidimensional migration space-time

In light of the challenges inherent in defining migration categories, it is useful to understand such classifications as positions, unstable and changing, that anyone can occupy to varied degrees (Nail, 2015). These positions carry particular assumptions about how those occupying them are expected to behave (Malkki, 1996). Through processes of movement, displacement, and expulsion, individuals who were previously settled may come to occupy one or more interconnected migration position (Tsegay, 2023).

Migration often entails navigating overlapping and/or contradictory social positions and legal statuses. Migratory journeys may involve multiple stages of varied duration – ranging from a few days to several years or even multiple decades at each destination. These journeys may also be multidirectional, involving leaving, arriving, returning, or staying. Within migration categories, experiences include not only mobility within and across borders but also periods of immobility or "stuckness." For example, an individual may leave their home country and apply for asylum in the US. During this process, they must stay in the US until a decision is made, placing them in a liminal space with no permanent resolution about their ability to stay. Moreover, an individual may occupy roles such as immigrant, asylum-seeker, and/or international student at various times and/or simultaneously. It is complex to determine whether migration qualifies as "voluntary" or "involuntary," as experiences may entail elements of both compulsion and choice.

Some scholars propose viewing different types of migration as a spectrum of experiences (Nail, 2015), while others use two-dimensional, four-quadrant typologies and taxonomies to map a more interconnected field of migration possibilities beyond discreet categories (Delli Paoli and Maddaloni, 2021). Such approaches allow more complex explorations of the conceptual space of migration. As a heuristic approach for the research process, I propose further expanding this spatial metaphor by adding additional dimensions to that conceptual space.

Thus, rather than relying on strictly delimited categories and concepts of migration, we may consider migration as a multidimensional space-time in which socially, politically, temporally, and geographically specific migration positions are located. Each position has fuzzy edges, bleeding into and overlapping with other locations in varied combinations. For example, individuals may shift from being refugees to immigrants to citizens and then back to immigrants as they move along geographic and time axes. Moreover, the definitions and characteristics of asylum, for example, will likely change over time as political regimes create new laws and members of societies advocate for alternatively more open or more restrictive responses to newcomers. Understanding migration in this way is an exercise in stretching our analytic imaginations. We should work to identify how migration positions are entangled with other concepts and experiences in complex ways (Raghuram, 2021). The migration space runs parallel to, intersects with, and collides with class, race, sex/gender, states, borders, technology, governance, and many other concepts, each of which also operates within its own multidimensional space-time.

4. Flexible, adaptable, and contingent concepts

The contingent circumstances and fluidity of positions such as migrant and refugee make it difficult to create a universal or meta-theory of migration (Cameron, 2014; Nail, 2015). Therefore, if we understand migration positions as shifting and contextual within multidimensional space-time, we must (re)construct adaptable concepts to explore this space. We should continuously examine how the boundaries between flexible migration positions blur within specific contexts.

If scholars define migration categories and concepts too narrowly, they limit the possibilities for research participants to explore the complexities, tensions, and contradictions within their own experiences. This restriction might inadvertently constrain how individuals perceive and describe their own migratory experiences. If researchers, typically in positions of relatively greater interpretive power, are predetermining set (and narrow, rigid, and/or binary) migration categories that participants must fit their experiences into, then we may pre-empt or prevent those who migrate from using and/or developing critical concepts to interpret and describe their own experiences. Therefore, adaptable concepts should ideally be co-created with those who migrate (Dahinden *et al.*, 2021) and always open to reconsideration and revision.

Moreover, the power to define individuals and groups matters (Raghuram, 2021). The way we categorize people and their experiences is important and carries material implications for their lives. For example, it is important to disentangle legal definitions and regimes that govern migration statuses (immigrant, asylum-seeker, refugee, etc.) and the conceptual contours of those same categories. Legal definitions cannot capture the full nuance of lived experiences. As such definitions are operationalized by border and immigration authorities, they can impose assumptions on those who migrate and either fulfill or deny rights and protections. Therefore, it is important to remember that policy relevance and conformity are not the ultimate tests of research significance or empirical clarity (Bakewell, 2008).

Migration scholars must carefully design research projects to capture the nuances, tensions, and contradictions in migration experiences. For instance, when enrolling participants for research, it is important to pay close attention to how we create and communicate recruitment materials. There may be situations wherein parsing closely which migration category an individual "fits into" is useful to understand an aspect of migration; however, this may not be productive or necessary in all cases. There is a risk of narrowly defining or communicating participation criteria that force participants to choose an either/or answer to what category they belong to (importantly, at the time of the study). Such situations may exclude those who have complex migration stories and who initially conceive of themselves as occupying only one category (immigrant or refugee). However, if we can open enough interpretive space for them to ponder and define their own lives, they may reframe those experiences as occupying multiple positions (immigrant and refugee) and explore the temporal dynamics of shifting among various categories (international student then asylee).

5. Opportunities and risks

Briefly, I want to highlight both a potential opportunity and a possible risk associated with adopting flexible migration categories. First, we should consider how complicating binary migration categories can help individuals address exclusions and articulate alternative views on migration, belonging, and citizenship. This approach allows for the incorporation of ambiguities and tensions as individuals navigate various positions within a multidimensional migration space-time. Providing opportunities for those who migrate to develop their self-conceptions, rooted in norms of welcoming and justice and sensitive to power dynamics, may provide language around which to articulate demands and build coalitions across communities otherwise assumed to be disparate. For example, given the opportunity to explore their experiences in nuanced ways, those with legal status as refugees in the US may find that they share interests, goals, and experiences with visa lottery winners or recipients of family reunification visas. Moreover, they may not only find grounds for solidarity with those in other migration categories but also with those in the native-born population across other intersecting vectors and dimensions.

Second, while engaging with the complexities of migration through flexible concepts is important, there are risks involved in destabilizing existing categories. Researchers must be careful about how the information we collect and analyze may be instrumentalized by authorities in ways that could harm rather than help people on the move. Existing rights and protections for those seeking asylum and refuge are already inadequate. Broadly speaking, the international refugee regime and national-level governments often require individuals to prove they are either refugees or not, leaving no room for complexity. As a result, states have a particular interest in maintaining binary categorizations of migration to determine who can cross their borders and under what conditions.

In addition to dichotomous conceptions of migration categories, governments, NGOs, and media often understand migration through binary framings of immigrants and refugees as good/bad and deserving/undeserving (Dhaliwal & Forkert, 2016; Raghuram, 2021; Szczepanik, 2016). States and their agents frequently seek to exclude and deny protections to those they deem not to fit into categories, such as asylum-seekers or refugees (Bohmer & Shuman, 2008). Therefore, when seeking to understand the nuances of migrations, we ought to be careful not to portray complexity in ways that could undermine already insufficient protections for those seeking asylum and refuge. Engaging with nuance should be oriented toward opening spaces for newcomers rather than providing grounds on which governments and exclusionary social movements can undermine claims for asylum, refuge, and safety.

6. Conclusion

I want to emphasize that migration scholars (and many others) have long recognized the challenges inherent in categorizing migration to understand the social world. In this perspective article, I have argued that one way to work through those difficulties is using the metaphor of a multidimensional migration space-time to explore the complex breadth of experiences and phenomena that fall under the broad label of migration. I suggest this notion as a heuristic approach through which to engage in the work of destabilizing categories, reflecting on contingent particularities, and considering new possibilities. This process can help us become more comfortable with ambiguity, messiness, and contradiction. The idea is to play in that space throughout the planning, undertaking, and iteration of research projects. Engaging with multidimensional migration space-time can be a part of reflexive practice (Dahinden *et al.*, 2021). This process is method-agnostic and not predefined; many different data collection and analysis strategies can sit alongside it. It could be adopted and adapted to an array of future research projects. Given that migration is a fundamental social, political, and economic experience with important implications for the rights, security, and opportunities of tens of millions of people, it is crucial that we give it the careful attention it deserves.

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RESEARCH ARTICLE

Exploring public opinions on Rohingya refugees residing in India: An empirical study

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Abstract

The Rohingya population is widely acknowledged as one of the most persecuted minority groups worldwide. The ongoing tripartite conflict involving the Rohingya, the Rakhine, and the Myanmar military has resulted in numerous clashes and massacres, leading to forced displacement. Countries such as Bangladesh, Thailand, Malaysia, Indonesia, the Philippines, Pakistan, and India have recorded an influx of Rohingya immigrants. While extensive studies have been conducted on the Rohingya in Myanmar and Bangladesh, there has been a limited scholarly focus on the Rohingya in India. This article aims to fill this gap in the literature. It is important to note that India is neither a signatory to the 1951 Refugee Convention nor the 1967 Protocol, which addresses refugee status and protections, nor does it have a domestic refugee law. Consequently, refugees in India are not officially recognized as a distinct group and lack legal protection against exploitation and abuse. This situation leaves them vulnerable to various forms of mistreatment, including exploitation, violence, and limited access to employment, education, and healthcare. Although the United Nations High Commissioner for Refugees designates the Rohingya as refugees, the current Bharatiya Janata Party government views this stateless community as illegal migrants and a perceived threat to India. This stance raises important questions: (i) How does the Indian population perceive and internalize this interpretation? (ii) What are their attitudes toward the Rohingya, and what policy options do they prefer? To address these inquiries, the authors of this article analyzed data from the Sinophone Borderlands Indo-Pacific Survey, a large-scale online survey organized by one of the authors. In addition, interviews were conducted with Rohingya individuals residing in India to gather firsthand perspectives.

Keywords: India; Rohingya; Refugees; Public opinion; Policy options

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1. Introduction

The Rohingya population is widely recognized as one of the most persecuted minorities globally. The ongoing tripartite conflict involving the Rohingya, the Rakhines, and the Myanmar military has resulted in repeated clashes and massacres over the years, leading to forced displacement both within and outside of Myanmar (Hossain *et al.*, 2020; Ware & Laoutides, 2018). While the historical background of the Rohingya crisis extends far back, encompassing events such as World War II and previous instances of massacres and exodus in 1978, 1991/1992, 2012, and 2016, it was in August 2017 that the Myanmar military initiated a brutal campaign against them. This campaign involved ethnic cleansing and crimes against humanity and exhibited genocidal intent (Human Rights Council, 2019), resulting in one of the world's largest and fastest-growing refugee crises to date.

The Rohingya migration has been documented in several countries, including Bangladesh, Thailand, Malaysia, Indonesia, the Philippines, Saudi Arabia, Pakistan, and India (Adiputera & Missbach, 2021; Hoffstaedter, 2017; Jalil & Hoffstaedter, 2023; Stange *et al.*, 2019). While numerous studies have been conducted on the Rohingya population in Myanmar and Bangladesh, including surveys on public perception, limited research has been conducted on the Rohingya in India (Cheesman, 2017; Dussich, 2018; Mallick, 2020; Milton *et al.*, 2017; Ullah, 2016). This article aims to fill the gap in the existing literature by shedding light on this understudied aspect. Previous scholarly work on the Rohingya has primarily focused on socioeconomic, political, and legal issues. For instance, Madhura Chakraborty's research (2015) examines the socioeconomic aspects of the Rohingya's lives in their settlements within India (Chakraborty, 2015). Parveen (2018) and Sahoo (2017) have addressed India's exclusionary policies toward the Rohingya and how these policies have exacerbated the already dire situation faced by the Rohingya (Parveen, 2018; Sahoo, 2017). To bridge the gap in the literature, the article focuses on the Indian (national) public opinion regarding the Rohingya issue and how state policies influence public opinion regarding refugees.

Governments, as architects of immigration and refugee policies, hold a pivotal role in shaping public attitudes. Scholars such as Entman (2012) and De Vreese (2005) have delved into the intricate ways in which government narratives and framing strategies mold public opinion regarding refugees. These narratives encompass diverse facets, including policy goals, portrayals of refugees, and the perceived consequences of immigration. State policies extend beyond their regulatory function, playing a profound role in constructing public discourse (De Coninck, 2019). Immigrants can be framed either as valuable economic contributors or potential security threats, eliciting distinct public reactions (Iyengar, 1990). Moreover, research conducted by Schweitzer *et al.* (2015) reinforces the idea that both realistic and symbolic threats are integral components of the integrated threat theory. Their work sheds light on the multifaceted nature of prejudice, contributing to a broader comprehension of societal attitudes toward refugees (Schweitzer *et al.*, 2005). In essence, the framing of immigration and refugee issues by government officials has a profound influence on how the public perceives and responds to these policies.

The media emerges as a crucial intermediary in the relationship between state policies and public opinion and also often plays a crucial role in disseminating and reinforcing government messages (Bennett, 1993; Boomgaarden & Vliegenthart, 2009; Esses *et al.*, 2013; Scheufele, 1999). Negative and sensationalized portrayals contribute to the reinforcement of stereotypes, while responsible reporting has the potential to promote empathy (Schuck & de Vreese, 2009).

The Narrative Policy Framework provides a valuable lens for analyzing the intricate relationship between state policies, narrative elements, and public opinion regarding immigrants and refugees (Shanahan *et al.*, 2011). Existing literature demonstrates the importance of considering government narratives, media amplification, and policy feedback in understanding the dynamic interplay that shapes public attitudes.

In the expansive discourse surrounding the influence of state policies on public attitudes toward immigrants and refugees, the majority of research has been predominantly conducted in Western contexts. A notable gap persists in the research landscape, particularly when considering the South Asian region. The narratives, framing strategies, and policy feedback mechanisms that may be prevalent in this region remain largely unexplored, representing a crucial gap in the existing academic understanding. Recognizing this void, our research endeavors to fill this gap.

India is not a signatory to the 1951 Refugee Convention or the 1967 Protocol, which are specifically designed to address the status and issues faced by refugees. In addition, India does not have any domestic refugee laws in place. Consequently, refugees are not officially recognized as a distinct group, and there is a lack of legal protection to safeguard them against exploitation and abuse. This situation leaves refugees vulnerable to various forms of mistreatment, including exploitation, violence, and limited access to employment, education, and healthcare. The treatment of refugees in India tends to be *ad hoc* and varies based on the country's political and security circumstances. While the office of the United Nations High Commissioner for Refugees (UNHCR) recognizes the Rohingya as refugees, according to Indian laws and the policies of the current Bharatiya Janata Party (BJP)-led National Democratic Alliance (NDA) government, this stateless community is considered "foreigners" or "aliens" who have unlawfully/illegally migrated into the country, posing a threat to India's internal security (Dutta, 2017). Rohingyas are subject to the Foreigners Act of 1946, and the Passport (Entry into India) Act of 1929. This raises important questions: (i) How does the Indian population perceive and accept this legal framework? (ii) How do Indians feel about the Rohingya, and what policy option do they favor regarding their status and presence in India?

To address the aforementioned questions, the authors analyzed survey data obtained from the Sinophone Borderlands Indo-Pacific Survey (2022), a large-scale online survey initiated by one of the authors. Only a subset of the data relevant to the objectives of this research is reported in this study, with further details provided in Section 3. The data analysis was carried out using JASP software. In addition to the survey data, one of the authors conducted 50 open-ended and in-depth interviews with Rohingya individuals residing in India in 2021 and 2022. All interviewees were Muslim refugees originating from Myanmar and had been registered with the UNHCR. These interviews, conducted in the Rohingya language through a translator, took place in various settlements across Delhi, Haryana, Hyderabad, Jammu, and Mathura (areas with a notable concentration of Rohingya communities). These interviews employed a semi-structured approach and utilized the snowball sampling method. For this paper, only a selected portion of these interviews is utilized as supplementary evidence to complement the findings derived from the survey data.

This article is organized as follows: following this introduction, which outlines the analytical framework, the situation of the Rohingya in India is described, highlighting the treatment they receive from the Indian government. Subsequently, the perception of the Indian population toward the Rohingya, as well as their policy preference toward these refugees, as revealed through data analysis, is presented. Finally, the conclusion summarizes the key findings of the study.

1.1. The Rohingya in India

India currently hosts a population of over 200,000 refugees, including both mandated and non-mandated individuals, as well as asylum seekers from various countries such as Tibet, Sri Lanka, Somalia, Afghanistan, and Myanmar (UNHCR India, 2022a). As of October 2022, UNHCR India had registered over 48,000 refugees and asylum seekers, with the majority originating from Myanmar and Afghanistan (UNHCR India, 2022b). Among them, approximately 18,000 are Rohingya (Foundation London Story, 2021), although estimates suggest that their total number in the country is much higher, reaching around 40,000 (Human Rights Watch, 2022). The migration of Rohingya individuals to India is typically categorized as irregular due to their stateless status, lack of identification documents, and inability to utilize legal means of transportation. Consequently, the Rohingya are compelled to rely on irregular methods of travel (Abbas & Hemadri, 2022). The majority of them have migrated from Bangladesh after residing there for a certain period, while only a minority have directly fled from Myanmar, using Bangladesh as a transit country *en route* to India (Abbas & Hemadri, 2022).

In India, the Rohingya population is not concentrated in a single region, unlike the situation in Cox Bazar, Bangladesh. Instead, they are dispersed throughout the country. According to UNHCR reports, significant Rohingya populations can be found in Delhi, Haryana, Jammu, and Hyderabad, as well as smaller concentrations in Rajasthan, Punjab, Uttar Pradesh, Karnataka, Tamil Nadu, and Kerala (UNHCR, 2019; 2020). Figure A1 illustrates the population distribution of Rohingyas in India. The Rohingya people live in deplorable conditions within their makeshift settlements, or "unauthorized colonies" (Chaudhury & Samaddar, 2018). Their livelihoods are severely restricted by language barriers and security concerns. They also encounter significant challenges, such as limited access to sanitation facilities, a lack of electricity and clean water, open sewage systems, overcrowded living conditions, unhygienic housing conditions, and inadequate medical care. Moreover, their lack of formal identification hinders their ability to access banking services or secure formal employment.

In contrast, Sri Lankan Tamil refugees experienced more favorable treatment from the Indian government, particularly in Tamil Nadu. Crucial factors such as religious and cultural equality, language, and loyalty played pivotal roles in fostering a strong sense of belonging and ensuring their protection (Refworld, 2010). Sri Lankan refugees received extensive assistance, including shelter, food, and healthcare (Hans, 1993). The state government of Tamil Nadu introduced various programs, such as the Integrated Child Development Scheme, infrastructure development initiatives, and 24-h power supply, along with facilitating access to education and medical facilities (Valatheeswaran & Rajan, 2011). This commitment to the welfare of Sri Lankan Tamil refugees is evident in the allocation of funds, the issuance of identity cards, and the provision of essential documents. However, the circumstances of the Rohingya community reveal a markedly different situation.

In general, the Rohingya engage in daily wage labor, often involving tasks like rag picking or working in construction to earn a living. While the UNHCR and its partner organizations, such as Save the Children (*Bal Raksha Bharat*), Bosco Organization for Social Concern and Operation, Development and Justice Initiative, and Commonwealth Human Rights Initiative, work toward protecting the rights of the Rohingya and ensuring their access to essential social services and humanitarian aid, the situation on the ground remains dire. Given the dire conditions they face, why did the Rohingya people choose to seek refuge in India? As mentioned earlier, a significant number of Rohingya individuals arrived in India from Bangladesh, primarily through the northeastern borders of West Bengal, utilizing various means of transportation such as trains, cars, buses, and even on foot. In addition, some Rohingya refugees undertook perilous journeys by sea using boats. Many reported paying bribes to agents to cross international borders (Rajan, 2022). There were several push factors that compelled them to migrate from Bangladesh to India. These factors included restricted access to essential services such as education and healthcare, limited opportunities for livelihood, insecurity, poverty, and the relocation of Rohingya individuals to the cyclone-prone island of Bhasan Char (Chakraborty, 2015). On the other hand, various pull factors attracted the Rohingya to India, including employment opportunities, peace, access to education and healthcare services, and the prospect of family reunification (Chakraborty, 2015).

According to scholars, the migration of Rohingya individuals to India dates back to the late 1970s, but the numbers significantly increased after violence erupted in Myanmar in 2012 (Chaudhury & Samaddar, 2018). The UNHCR data reveal that in 2015, there were 18,257 individuals from Myanmar, primarily Chin and Rohingya, residing in India. By 2019, this number had risen to 20,973, and by the end of 2022, it had reached 29,052 (UNHCR India). While Chin people had sought refuge in India since the 1970s, the majority of individuals from Myanmar who arrived in India after 2000 were Rohingya. Following the 2017 massacre in Myanmar, a large number of Rohingya fled to Bangladesh before eventually moving on to India.

The Rohingya community, previously unseen, gained visibility in India on April 9, 2012, when approximately 3000 Rohingya individuals, including men, women, and children, staged a months-long protest in front of the UNHCR office in Delhi. Their objective was to demand refugee status based on legal grounds (Perappadan, 2012). At that time, they possessed "asylum seeker cards," which did not hold the same legal weight as official documents. Their aim was to access the socioeconomic and legal support provided by UNHCR. Consequently, Rohingya individuals who applied and underwent the Refugee Status Determination process were granted refugee status and later received long-term visas (LTV) that required annual renewal. These documents not only helped them to acquire legal documents such as the Aadhaar card (a valid proof of identity and address issued by the Unique Identification Authority of India) but also enabled them to access various socioeconomic benefits offered by the state.

Despite the gains described above, India did not offer the desired protections to the Rohingya community. Since the pro-Hindu BJP-led NDA government came to power in 2014, the political landscape has shifted, exacerbating the situation for the Rohingya. Various laws and policies have been implemented, particularly in the legal and social domains. One such policy, introduced by the Union Home Ministry in 2017, halted the renewal of LTV for Rohingya individuals (Kumar, 2018). In addition, the government ordered the confiscation and cancellation of all Aadhaar cards held by the Rohingya (Kumar, 2018). As a result, the Rohingya have been severely disadvantaged, as the lack of official identification documents has deprived them of access to healthcare, education, and financial services. Their rights and documents have been stripped away by the host country, in this case, India, as well as previously by their home country, Myanmar (Rohingyas Temporary Registration Cards, known as the "White Cards," have also been revoked in 2015 before the general elections, effectively disenfranchising them). Consequently, the Rohingya community has been left with no choice but to participate in the informal market, where they are vulnerable to exploitation. Furthermore, in 2017, the government issued orders to identify and deport Rohingya individuals (South China Morning Post, 2018). This process led to a significant number of Rohingya people being arrested and charged with violating the Foreigners Act of 1946 or the Passports (Entry into India) Act of 1929 (Iqbal, 2021). These exclusionary practices not only worsened the situation but also instilled fear. As a result, over 1000 Rohingya individuals fled to Bangladesh to avoid arrest and subsequent deportation (Abbas & Hemadri, 2022).

The exclusionary practices carried out by the Indian state toward the Rohingya community illustrate the three main steps of the securitization of migration theory proposed by the Copenhagen School. The first step involves presenting the Rohingya as a threat to the Indian people, while the second step focuses on convincing the public of the existential danger they pose. Finally, the third step involves legitimizing the implementation of drastic measures by the Indian government (Topulli, 2016). Public attitudes toward refugees can be influenced by various factors. De Coninck (2019) highlights the significance of ethnicity, the economic situation in the refugees' country of origin, and the region they come from in shaping public perceptions (De Coninck, 2019). Negative portrayals of refugees, such as the belief that they threaten the cultural fabric of the host country or impose an economic and social burden, can lead to a shift in public opinion. The literature acknowledges the impact of framing on public perception, with theories such as social identity and group threat offering explanations. Political framing and media play a crucial role in shaping public opinion through communication frames that encourage citizens to think about an issue in a specific way and adopt certain thought patterns (Chong & Druckman, 2007). These frames often depict refugees as involved in criminal activities, labeling them as "intruders." Recent studies have demonstrated that the rise in xenophobia and Islamophobia has resulted in more restrictive state policies toward refugees, as observed in the treatment of the Rohingya community in India (Basavapatna, 2018; Chaudhury & Samaddar, 2018).

The escalating concern of the BJP-led NDA government regarding national security, coupled with its stance on religious matters, has led to a more stringent approach toward the Rohingya refugee population. Consequently, instances of detaining and deporting Rohingya refugees from India have become more frequent. Numerous cases have emerged where Rohingya people have been apprehended under the Foreigner Act of 1946 for attempting to cross the border without valid travel documents. One notable incident took place in March 2021, when Indian authorities detained over 150 Rohingya refugees who were residing in the northern region of Jammu and Kashmir (Singh, 2021). Similarly, in July 2023, authorities in Uttar Pradesh arrested and detained 74 Rohingya individuals, including children and a pregnant woman, from multiple towns and cities within the state (Global Detention Project, 2023). The grounds for their detention were their alleged illegal border crossing.

The first recorded case of Rohingya deportation happened in October 2018, involving the deportation of seven Rohingya individuals to Myanmar (Human Rights Watch, 2018). These individuals had been held in detention at the Silchar central prison in Assam since 2012 on charges of illegal entry. Their return to Myanmar exposed them to potential arbitrary arrest, torture, and even death. Following this, India deported another five Rohingya people to Myanmar in January 2019 and an additional seven in October 2019 as part of a broader government crackdown on illegal immigration (Rahman & Pirzada, 2021). The deportation actions have persisted since then. These actions have faced criticism from human rights organizations and activists who contend that Rohingya refugees are fleeing violence and persecution in their home country and should be offered protection and assistance rather than being subjected to detention and deportation.

As a result of the Indian state's explicit refusal to protect the rights of the Rohingya, they are excluded from legal protection and face another consequence – a lack of support from the general population. Interviews conducted by one of the authors confirm this, revealing that support for the Rohingya among locals is inconsistent. Some individuals, particularly NGO workers, activists, students, and acquaintances, provide support to the Rohingya, while others do not. A Rohingya woman in her fifties from Royal Colony Settlement No. 5, Balapur, Hyderabad, shared her experience, stating, "Locals help sometimes, but not much. Their behavior toward us is generally good. We have a moderate relationship with local people, but in some places, we are viewed with suspicion and hatred" (Personal communication, 2021). Similarly, a Rohingya man in his mid-twenties from Budena Village, Faridabad, Haryana, expressed concerns about discrimination and animosity from some locals: "Sometimes, on our way home from work, they taunt us by referring to us as "people of Burma." They use abusive language, calling us dirty and wild, and tell us to go back to where we came from" (Personal communication, 2021).

The next section delves into the specific perceptions of the Indian population toward the Rohingya and explores their preferred policy options. The focus extends beyond those who have direct contact with the Rohingya to encompass the nation as a whole, presenting data representative of the entire country.

2. Methods

2.1. Data

The data utilized in this article were obtained from the Sinophone Borderlands Indo-Pacific Survey, which is part of a global survey project investigating global perceptions of China and other relevant issues through large-scale representative online surveys conducted in various (selected) regions worldwide. It was conducted in three East Asian countries (Taiwan, South Korea, and Japan), six ASEAN countries (Vietnam, Malaysia, Indonesia, the Philippines, Thailand, and Singapore), Bangladesh, India, Kazakhstan, and Pakistan, and supplemented by samples in Australia and New Zealand. In each of the 15 countries, the survey was conducted with a nationally representative quota sample (minimum n = 1200) for gender, age, and region. Each country received the core set of questions, which focused primarily on perceptions of China, along with specific country-related questions (not necessarily related to China), such as the questions used for this research.

The article focuses on the Indian part of the Sinophone Borderlands Indo-Pacific Survey. The sample collected in India consists of 1146 respondents and is nationally representative in terms of age, gender, and region. However, the data are skewed toward more educated and urban people (as seen in the demographic breakdown below) as these are the groups of the population that can more easily be reached by online surveying, and this also constituted the limitation of this paper. The responses were collected in Hindi and English from participants registered in national online panels by CINT between August and September 2022. Participants were presented with approximately 60 questions, including a set of about a dozen questions specifically added to the Indian version of the survey.

For the purposes of this paper, the authors focused on a subset of questions related to (i) people's sentiments toward the Rohingya, (ii) their willingness to resettle the Rohingya in India, and (iii) their opinions on India's stance toward Rohingya refugees. The first question utilized a 0 – 100 scale, commonly referred to as a "thermometer question," where 0 represents "cold/negative feelings," 50 represents "neutrality," and 100 represents "warm/positive" feelings. The second question employed a 7-point scale, ranging from 1 (most negative answer) to 7 (most positive answer). The third question provided four specific response options, including an "I don't know" option. In addition, the data have been analyzed by disaggregating it based on some of the demographic characteristics, which will be further described in the following section. When applicable, relevant country comparisons have been made using the available data.

2.2. Demographic breakdown

The survey data provided in this article offers a representative representation of the entire population across three demographic factors: gender, age, and region. Table 1 provides a breakdown of the 1146 survey respondents based on the representative demographic factors, as well as education, ethnic identity, language(s) spoken, rural or urban location, religiosity, and political leaning.

In addition, Figure A2 illustrates the geographic distribution of the respondents. Furthermore, the responses to each of the three questions discussed in the previous section were carefully analyzed in relation to some of the aforementioned demographic characteristics. Any noteworthy trends or significant patterns identified during the analysis are reported in the subsequent sections of this paper.

3. Survey results: Indian attitudes toward the Rohingya, their resettlement, and the preferred policy option

3.1. Attitude toward the Rohingya

Comparing the feelings of Indians toward the Rohingya with a few other groups of people (a mix of various ethnicities, nationalities, and religious groups), the results of the survey show that out of the provided groups, Indian people feel the warmest toward the Japanese and the coldest

Table 1. Demographic data about respondents

Category	Sub-category	Percentage
Gender (Nationally representative factor)	Female	44
	Male	56
	Other/No response	0
Education level	Primary	3
	Secondary	14
	Tertiary	83
Age	18 – 25	39
	25 – 34	27
	35 – 44	22
	45 – 54	9
	>55	3
Urban/Rural	Village (up to 10,000 people)	11
	Town (10,000 – 100,000 people)	14
	City (100,000 – 1 million people)	30
	Big city (over 1 million people)	45
Religious identity	Hindu	82
	Muslim	10
	Christian	5
	Buddhist	1
	Other	2
Religiosity (Hinduism)	Never to irregular	17
	Often-daily	83
Religiosity (Islam)	Never to irregular	71
	Often-daily	29
Religiosity (Christianity)	Never to irregular	70
	Often-daily	30
Religiosity (Buddhism)	Never to irregular	71
	Often-daily	29
Political party preference	All India Trinamool Congress (National party [center-left])	5
	Bahujan Samaj Party (National party [center-left])	2
	Bharatiya Janata Party (National party [right-wing])	56
	Communist Party of India (National party [left-wing])	1
	Communist Party of India (Marxist) (national party [left-wing])	1
	Indian National Congress (National party [center to center-left])	11

(Cont'd...)

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

Category	Sub-category	Percentage
	National People's Party (National party [center-left])	1
	Nationalist Congress Party (National party [center])	1
	All India Anna Dravida Munnetra Kazhagam (national party [center-left])	0
	Dravida Munnetra Kazhagam (state party [centre-left])	1
	Telugu Desam Party (state party [center])	2
	Telangana Rashtriya Samiti (state party [center-right])	1
	Rashtriya Janata Dal (state party [center-left])	0
	Shiromani Akali Dal (state party [center-right])	0
	Samajwadi Party (state party [center-left to left])	1
	Shiv Sena (state party [right-wing to far-right])	1
	Other political party	3
	I don't know	9
	I would not vote	4

toward the Chinese, followed by the Rohingya (at the same level as the Uyghurs). Feelings toward the Rohingya in the survey are even colder than toward the Muslims in general. With a mean value of 49 (on a scale from 0 to 100, where 0 means "very cold," 50 means "neutral," and 100 means "very warm feelings"), Indians seem rather cold toward the Rohingya (Figure 1).

While the overall attitude of Indian respondents toward the Rohingya is predominantly cold, further analysis reveals intriguing patterns when considering other characteristics. Age and gender yield more negative responses, indicating that men and older individuals tend to hold more negative perceptions. Men exhibited more negative views than women. Regional differences did not show significant variation in attitudes. However, religion emerges as a strong predictor. Hindu respondents, comprising 82% of the population, tend to harbor cold feelings toward the Rohingya. On the other hand, Muslim and Christian respondents exhibit warmer sentiments. Moreover, the strength of religious devotion, as measured by their religious practices, correlates with the intensity of these feelings.

Furthermore, when examining party preferences based on the question of which party respondents would vote for

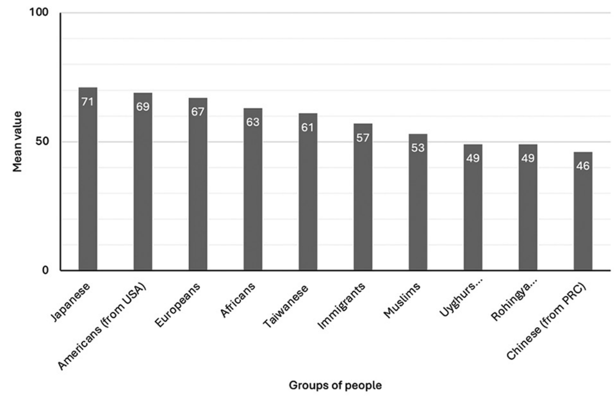

Figure 1. Attitudes of Indians toward other groups of people (a mix of various ethnicities, nationalities, and religious groups), on a scale of 0 – 100, where 0 represents "cold, negative feelings," 50 represents "neutral," and 100 represents "warm, positive feelings." The mean values are presented, ordered from most positive to most negative

if parliamentary elections were held this weekend, it was observed that BJP voters held the coldest feelings toward the Rohingya, with a mean value of 43 on a scale from 0 to 100 (where 0 represents "very cold" feelings and 100 represents "very warm" feelings). Details are provided in Table A1. Conversely, the other two parties that received more than 5% preference among survey respondents (Table A1), namely, the Indian National Congress (INC) and All India Trinamool Congress, displayed relatively warm feelings toward the Rohingya, with mean values of 60 and 63, respectively.

We also conducted a comparison of Indian sentiments toward the Rohingya with those in other Asian countries (Figure A3) that experience Rohingya immigration. The results reveal a clear trend: in countries with the highest influx of Rohingya refugees, namely, Bangladesh, Malaysia, and Thailand, the mean values are the lowest, ranging from 43 to 55, with Malaysia having the lowest score. Before the 1990s, Bangladesh and Malaysia embraced compassionate strategies to tackle the Rohingya crisis, including the establishment of refugee camps, the provision of humanitarian aid, and the recognition of Rohingya refugees (Yesmin, 2016). Humanitarian motives guided their actions, stemming from empathy and the importance of international collaboration (Yesmin, 2016). In contrast, Thailand initially overlooked Rohingya protection while assisting other displaced communities (Chaijaroenwatana & Haque, 2020). Subsequent to the 1990s, policies in these nations converged toward deportation and forceful repatriation, pivoting toward safeguarding national interests and security due to concerns such as political tensions, economic strain, biased media portrayal, cultural differences, security fears, historical context, or government stance (Yesmin, 2016). This transition marked a departure from their earlier benevolent approaches, underscoring a focus on countering socioeconomic and security challenges. Conversely, in countries such as Indonesia, Pakistan, and the Philippines, where the number of Rohingya refugees is relatively small but empathy is higher, the mean values range from 59 to 75. Given India's relatively limited exposure to the Rohingya, with their small numbers and dispersed distribution across the country rather than concentrated in a specific region, one might expect greater empathy. However, the mean value in India is 49, second only to Malaysia in terms of lower levels of empathy.

3.2. Support for resettlement

The survey asked respondents about their support for the resettlement of the Rohingya in India, using a scale of 1 – 7, where 1 represents "definitely no" and 7 represents "definitely yes." The overall mean answer was 4.2, indicating a neutral stance on average. This suggests that the issue of resettling the Rohingya is polarizing, as opinions vary among the respondents. Analyzing the frequency distribution (Figure 2), we find that more people expressed agreement to varying degrees with the resettlement of the Rohingya (combining answers 5, 6, and 7, totaling 55%) compared to those who expressed disagreement to varying degrees (combining answers 1, 2, and 3, totaling 40%). Only 5% of the respondents selected the middle option. This distribution demonstrates that opinions on the matter are diverse, with a notable portion of the population supporting the resettlement of the displaced Rohingya people.

When examining the data in relation to demographic variables, similar patterns emerged as in the previous question. While the region did not show any correlation, there were strong correlations with gender and age. This means that men and older individuals, in general, tend to

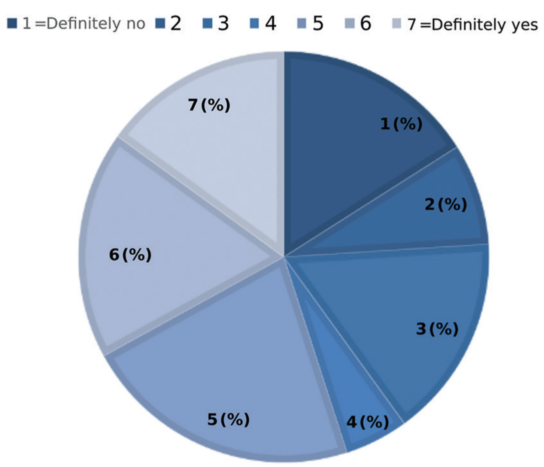

Figure 2. Support for the resettlement of displaced Rohingya people in your country, based on frequencies of responses

be against the resettlement of the Rohingya. Religion also displayed the same pattern as before. Hindus, who make up the majority of the Indian population, are generally opposed to resettlement, while Muslims are in favor. Christians, although to a lesser extent, also show support, with the correlation being strengthened by religious devotion. Furthermore, individuals who hold warm feelings toward the Rohingya (as discussed in the previous section) also demonstrate a higher tendency to support their resettlement. Regarding voter preference, once again, BJP voters (comprising 56% of the respondents) displayed the lowest willingness to resettle the Rohingya in India (Table A2).

After comparing the levels of willingness to resettle the Rohingya in Asian countries where Rohingya migration occurs, India falls in the middle with a mean value of 4.2 (Figure A4). This places India at a similar level to countries such as the Philippines and Thailand. Among the countries surveyed, Indonesians and Pakistanis show the highest willingness to resettle the Rohingya, while Bangladeshis and Malaysians demonstrate the lowest willingness.

3.3. Policy preference

When presented with specific policy options on how to deal with Rohingya refugees, 30% of Indian respondents expressed a preference for intervention to stop the flow of refugees, 20% favored repatriation (sending them back to Myanmar), and another 20% supported providing them with asylum in India (Figure 3). Notably, 29% of surveyed individuals selected the option "I don't know," indicating uncertainty or a lack of a clear stance on the matter.

It is important to note that the survey employed a split ballot question, meaning that approximately half of the respondents (564 individuals) were asked about the Rohingya specifically, while the other half (582 individuals) were asked about refugees from Myanmar in general, considering the influx of people fleeing the country following the military coup in 2021. Comparing the responses of these two groups, no significant differences were found. Both groups exhibited similar preferences, with 19% favoring asylum, 25% preferring repatriation, 30% supporting intervention to stop the flow of refugees, and 26% selecting the "I don't know" option. This suggests that the attitudes of the Indian population toward refugees, whether Rohingya or from Myanmar in general, are not specifically targeted against any particular group but rather reflect a general stance toward refugees as a whole.

Since this question was only asked in India as part of the Sinophone Borderlands Indo-Pacific Survey, comparisons with other countries are not possible. However, when analyzing specific variables, some interesting trends emerge (Table 2). In terms of gender distribution, more women

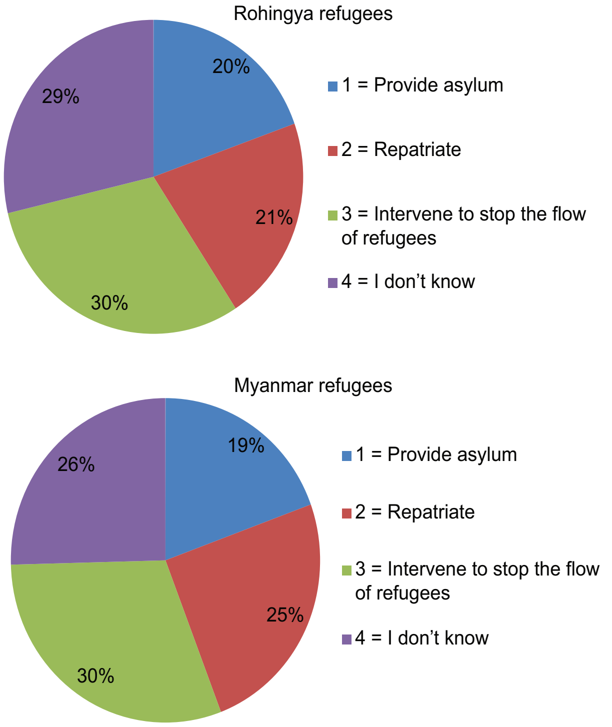

Figure 3. Public opinion on India's position toward the Rohingya and Myanmar refugees

are willing to provide asylum (22%) compared to men (17%). Conversely, more men express a desire to repatriate the Rohingya (24%) compared to women (16%), and a higher percentage of men wish to intervene to stop the flow of refugees (33%) compared to women (26%). Among respondents aged 18 – 25, the most common response was "I don't know" (38%), indicating uncertainty. On the other hand, respondents above 25 years of age were more inclined to choose the option of intervening to stop the flow of refugees.

When examining regional divisions, respondents from Central India were the most inclined to provide asylum (23%), while those from Northeast India expressed the least willingness (6%). Religious identity plays a significant role in preferred policy options. The Hindu population shows a clear preference for intervening to stop the flow of refugees (34%), while Muslims tend to favor providing asylum to the Rohingya (33%). Christians, Buddhists, and individuals of other religions mostly selected the "I don't know" option.

Looking at voters of specific political parties, supporters of the TMC (All India Trinamool Congress) exhibit a preference for providing asylum, while voters of the BJP and INC lean toward intervening to stop the flow of refugees.

4. Discussion

The survey results revealed that Indians generally hold negative views toward the Rohingya, with particularly strong sentiments among old Hindu men. Moreover, supporters of the BJP also tend to harbor negative feelings toward the Rohingya. Conversely, Muslims and Christians demonstrate a greater level of sympathy, particularly when their religious devotion is strong.

In India, both voting preference and religion significantly influence attitudes toward the Rohingya. The BJP, as a dominant political party in the country, influences its supporters to align with their party's or government's stance. Religion also exerts a strong influence: the majority of Indians, including BJP voters, are Hindus and often hold negative perceptions of the Rohingya. In contrast, Muslims and Christians are more likely to have positive views, with Muslims expressing solidarity toward fellow Muslims and Christians exhibiting a general sense of compassion.

India's overall attitude toward the Rohingya aligns with that of other Asian countries where significant Rohingya migration has occurred, although it is less pronounced in India. Several factors contribute to this phenomenon. India's predominantly Hindu population and the current government's affiliation with the RSS (a Hindu nationalist organization known for promoting animosity against Muslims) have contributed to a rise in violence against Muslims, which often goes unpunished.

Furthermore, negative sentiments toward the Rohingya can be attributed to their secondary movements through Bangladesh. India has long faced the challenge of a significant influx of Bangladeshi migrants. The Indian government tends to conflate the issue of Rohingya migration with that of Bangladeshi migrants, viewing both groups as placing a burden on the Indian economy. Consequently, Rohingya individuals are often perceived as migrants rather than refugees, given their extended stay in Bangladesh before arriving in India. Moreover, the government highlights the religious aspect, distinguishing between the acceptance of Hindu migrants from Bangladesh and the less favorable treatment of Muslim migrants. Given these circumstances, it is not surprising that the question of supporting the resettlement of the Rohingya in India is a divisive one. Those who tend to oppose their resettlement are typically men and older individuals. Among party affiliations, BJP supporters exhibit the lowest willingness to allow Rohingya resettlement in India. Similarly, religious affiliation continues to play a significant role, with Hindus leaning against resettlement, Muslims in favor, and Christians, although to a lesser extent, expressing support. In addition, those who hold positive sentiments toward

Table 2. Attitudes toward Rohingya asylum and refugee policies by various demographic and political factors

Demographic/political factor	Category	1=Provide asylum (%)	2=Repatriate (%)	3=Intervene to stop the flow of refugees (%)	4=I don't know (%)
Gender	Women	22	16	26	36
	Men	17	24	33	26
Age	18 – 25	21	23	18	38
	25 – 34	28	23	28	21
	35 – 44	14	18	47	21
	45 – 54	7	15	54	24
	>55	9	23	50	18
Religion	Central India	23	23	14	40
	East India	21	16	39	25
	North India	20	24	29	27
	Northeast India	6	38	19	37
	South India	20	18	28	34
	Western India	18	25	35	23
Religious identity	Hindu	18	21	34	27
	Muslim	33	31	6	31
	Christian	29	13	23	35
	Buddhist	20	20	0	60
	Other	9	9	36	46
Party preference (only showing parties that have >5% preference among the respondents)	All India Trinamool Congress	35	17	26	22
	Bharatiya Janata Party	18	23	36	23
	Indian National Congress	28	22	32	18

the Rohingya are more likely to support their resettlement, which aligns logically.

In comparison to other countries, India occupies a middle ground when it comes to the issue of resettlement. It is important to note that India has a relatively smaller Rohingya population, and thus, public opinion may not be based on personal experiences with the Rohingya themselves but rather influenced by the government's rhetoric. Negative depictions of the Rohingya, including labeling them as illegal and a threat to the security of India, have the potential to alter how the general public perceives them (Chakraborty, 2018). This change in perception is often driven by the framing of the issue by politicians and the media. As an example, consider events like those that took place in December 2019, when Union Home Minister Amit Shah addressed the Lok Sabha by stating that "Rohingyas will never be accepted in India," reiterating that they entered the country through Bangladesh (The Statesman, 2019). Similarly, in July 2023, another leader from the BJP, Himanta Biswa Sarma, expressed concern about Rohingya infiltration, deeming it "alarming" and a threat to the security of the nation (Outlook, 2023). These instances highlight how prominent political figures can influence public discourse by making strong statements regarding the Rohingya, thus contributing to a particular narrative about the Rohingya community and their presence in India.

The role of media and information dissemination also plays a significant role. Media outlets serve as a critical intermediary between the government's stance and public perception. If the media amplifies the government's concerns about security risks or economic burdens associated with refugees, the public is more likely to internalize these viewpoints as their own. Media framing shapes discourse, influencing how people understand and engage with complex issues like refugee crises. The media assumes a pivotal role in shaping public perceptions of contemporary nation states and in fostering a shared understanding. It functions as a platform through which specific nationalist ideologies are promoted, employing the interplay of discourse and ideology to portray refugees and migrants as outsiders within the nation state. An empirical analysis conducted by Awny (2019) focusing on two Indian newspapers, the Times of India and the Hindustan Times, reveals that these platforms tend to frame Rohingyas in India using the "intruder" narrative (Awny, 2019). Mohanty's study (2020) further asserts that visual media plays a role in constructing a negative portrayal of Rohingyas, contributing to the cultivation of a public narrative tied to notions of nationalism (Mohanty, 2020).

Political leaders and media outlets wield substantial influence in molding public sentiment using communication strategies that prompt citizens to consider the matter from a particular perspective and internalize specific thought processes. In essence, these forces shape how people think about refugee-related matters and encourage them to adopt particular viewpoints. The Indian population has adopted the government's interpretation and stance toward the Rohingya (and refugees in general) as their own. Perceiving them as potential threats or dangers (not necessarily physical), the public tends to either support or at least not oppose the government's measures against the Rohingya. It is important to highlight that this sentiment is not directed solely at the Rohingya but extends to refugees in general. The preferred policy option is to intervene to curb the influx of refugees. In line with this approach, India has taken several steps regarding the Rohingya. In 2012, during a visit by then-External Affairs Minister Salman Khurshid to Rakhine State, India announced a relief assistance package of US$1 million for Myanmar (Yhome, 2018). In 2017, India implemented a project called "Operation Insaniyat" in Bangladesh to provide relief assistance to Rohingya refugees (Ferdous, 2021). This operation included multiple rounds of aid, delivering essential supplies such as rice, lentils, milk, raincoats, gumboots, kerosene oil, and kerosene stoves. According to Yhome (2018), Delhi's decision to assist Rohingya refugees carried an underlying intention to discourage their entry into India. In 2018, an agreement between Myanmar and the UN was reached to facilitate the safe and voluntary return of hundreds of thousands of Rohingya refugees, with India contributing by constructing 250 houses for refugees in Rakhine State in preparation for their return (Yhome, 2018).

5. Conclusion

Historically, India has been known as a "safe haven" for refugees. However, in recent decades, India's response to incoming refugees has undergone a transformation. The current political climate has made it more difficult for the Rohingyas to seek asylum in India. The government has implemented various restrictions on their entry and movement, significantly hindering their ability to find safety and security. This contemporary environment not only shapes the policies and laws concerning the Rohingya but also influences public opinion, as the population has largely aligned with the government's stance.

The findings of the survey suggest that the overall perception of the Rohingya among Indians tends to be significantly negative, even more so than the perception of Muslims in general. The stance toward the Rohingya is strongly influenced by both voting preference and religious affiliation. Specifically, individuals who identify as Hindus and support the BJP tend to hold the most negative views toward the Rohingya. On the other hand, Muslims and Christians exhibit more positive views, with Muslims demonstrating a sense of solidarity and Christians expressing compassion toward the Rohingya.

India's overall stance toward the Rohingya reflects patterns seen in other Asian countries with significant Rohingya migration, even though India has not seen a substantial influx of Rohingya refugees. This alignment can be attributed to India's predominantly Hindu population and the rise of violence against Muslims under the current government. The negative sentiments are further fueled by the association of Rohingya migration with the long-standing issue of Bangladeshi migrants, which is viewed as an economic burden by the government. Resettling the Rohingyas in India is divisive, with religious affiliation playing a significant role. Hindus generally oppose resettlement, while Muslims tend to support it. Notably, BJP supporters exhibit the least willingness to accept Rohingya resettlement. Since the Rohingya population in India is relatively small and dispersed, public opinion is more influenced by government rhetoric than by personal experiences with the Rohingya themselves. As a result, the Indian population largely adopts the government's perspective, perceiving the Rohingya as a potential threat. While not actively endorsing government measures against the Rohingya, Indians generally do not oppose them either.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: Kristina Kironska
Investigation: Monika Verma
Methodology: Kristina Kironska
Writing – original draft: All authors
Writing – review & editing: All authors

Ethics approval and consent to participate

The FF UP Research Ethics Panel (FF: Philosophical Faculty; UP: Palacky University Olomouc) reviewed and approved the project under Ref. No. 03/2022 on April 6, 2022. Interviewees provided verbal informed consent to participate in the study. They were fully briefed on the purpose, procedures, and potential risks involved, and their voluntary involvement was confirmed before any data collection.

Consent for publication

Interviewees gave verbal consent for the publication of their data in this study. They were informed that their personal information would remain confidential, and all identifying details would be anonymized in the published results.

Availability of data

Data for this article are derived from the Sinophone Borderlands Indo-Pacific Survey, one of the waves of the large-scale online Sinophone Borderlands Survey (2020 – 2022). It was conducted under the supervision of Richard Q. Turcsanyi, Kristina Kironska, Alfred Gerstl, Monika Arnez, Jiří Čeněk, Julie Chen, Rosalie Chen, Andrew Chubb, Peter Gries, and Tao Wang. The project was convened by one of the authors of the article, Kristina Kironska, in collaboration with colleagues at the Palacky University Olomouc. While some information about the survey project may be accessed here: www.sinofon.cz/surveys, this data is not yet accessible in any repository online for reasons of exclusivity. The data underlying this article will, however, be shared on request.

Further disclosure

Parts of the findings from this article have been presented at the symposium *Centering Southeast Asian Studies in the Social Sciences* at the University of Texas at Austin in February 2024.

The paper, in its earlier version, has been uploaded as a preprint on ResearchGate: https://www.researchgate.net/publication/375239243_Exploring_Public_Opinion_on_the_Rohingya_Refugees_Residing_in_India_An_Empirical_Study (preprint DOI: 10.13140/RG.2.2.27665.61283)

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Appendix

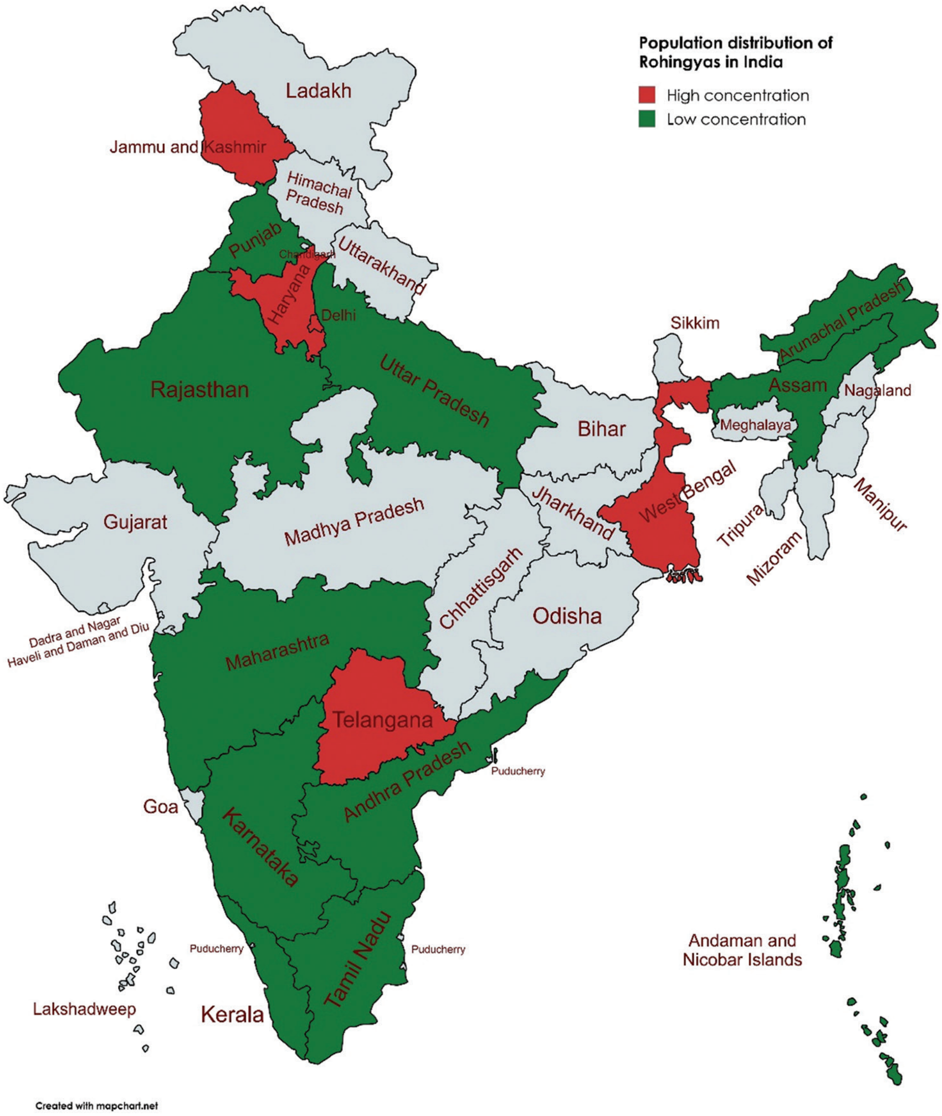

Figure A1. Population distribution of the Rohingyas in India. Image created using MapChart (https://www.mapchart.net/india.html)

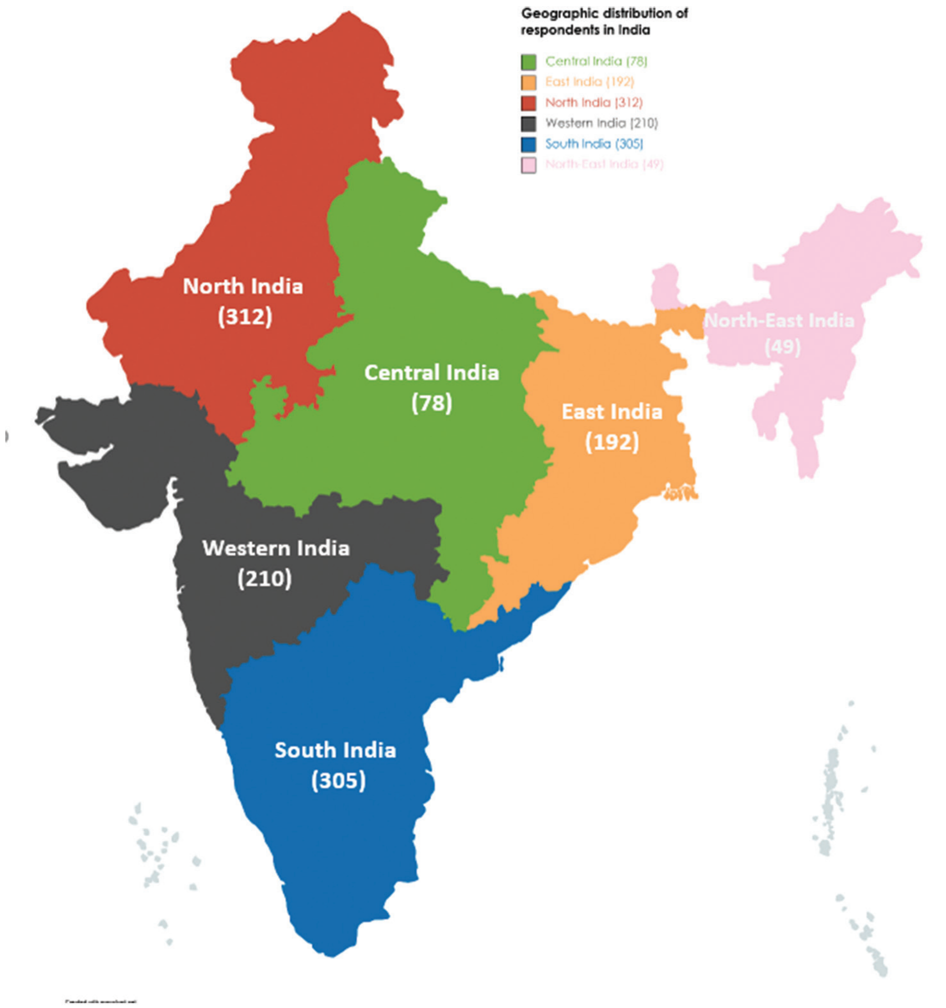

Figure A2. Geographic distribution of survey respondents (nationally representative factor). Image created using MapChart (https://www.mapchart.net/india.html)

Table A1. Attitude toward the Rohingyas by party preference, measured by mean values on a scale from 0 to 100, where 0 represents "coldest" feelings and 100 represents "warmest" feelings. Only parties with more than 5% preference among respondents are shown

Party	Mean value (0 – 100)
Bharatiya Janata Party	43
Indian National Congress	60
All India Trinamool Congress	63

Table A2. Willingness to resettle the Rohingyas in India by party preference, measured by mean values on a scale from 1 to 7, where 1 represents "definitely no" and 7 represents "definitely yes." Only parties with more than 5% preference among respondents are shown

Party	Mean value (1 – 7)
Bharatiya Janata Party	3.9
Indian National Congress	5.0
All India Trinamool Congress	4.9

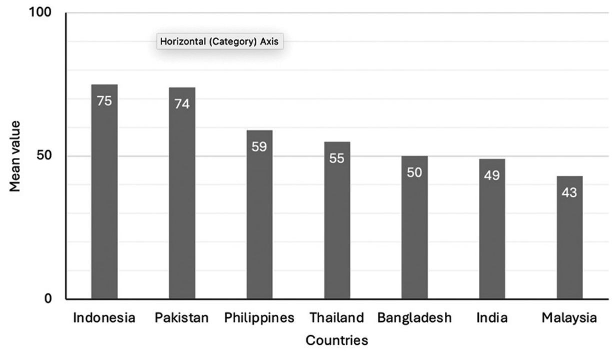

Figure A3. Feelings toward the Rohingyas in various countries, represented by mean scores on a scale from 0 to 100, where 0 represents cold, negative feelings, 50 represents neutral feelings, and 100 represents warm, positive feelings. The data are arranged from the highest to lowest mean score

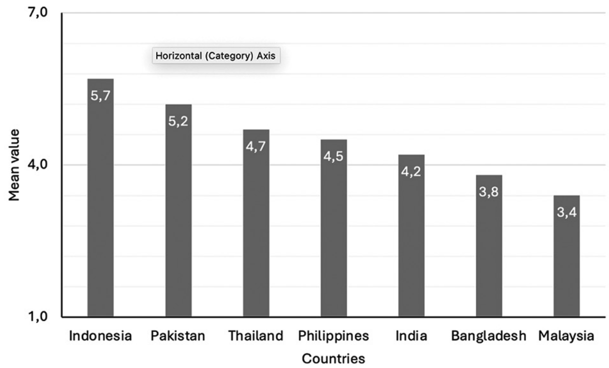

Figure A4. Willingness to resettle the Rohingyas in various countries, measured on a scale from 1 to 7, where 1 represents "definitely no" and 7 represents "definitely yes." The data are arranged from most willing to least willing

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RESEARCH ARTICLE

Migrant traders, social capital, and the politics of local wisdom: A descriptive study of *Warung Madura* networks in Jakarta, Indonesia

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Abstract

This article examines the factors driving the survival and self-reliance of Madurese migrant traders in Jakarta, Indonesia. Specifically, it aims to refine the long-standing argument that minority migrant groups are forced to adapt, become marginalized, and shed their identities. By combining perspectives on social capital and the politics of local wisdom, this mixed-method study provides an in-depth analysis of how Madurese migrant traders establish and develop networks of small grocery stalls, known as "*Warung Madura*," in Jakarta. Our findings reveal that social capital – through strong Madurese ethnic and religious values, norms, networks, and trust among members – is the main driving force behind the success of these traders in Jakarta. Furthermore, strict adherence to local wisdom, specifically Madurese culture and traditional Islamic teachings, significantly contributes to their survival and self-reliance. The results suggest that the survival strategies employed by Madurese migrant traders, based on certain social capital and local wisdom, could serve as a model for the socioeconomic empowerment of urban ethnic migrant groups.

Keywords: Ethnic identity; Local wisdom; Madurese; Migrant traders; Social capital; *Warung Madura*

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1. Introduction

The Madurese ethnic group is one of the largest in Indonesia and has a long history of internal migration (De Jonge, 1995; Husson, 1997; Wekke *et al*., 2019). Their migration destinations range from major cities in Java, such as Jakarta, Surabaya, Bandung, and Yogyakarta, to smaller towns in remote areas of Sumatra, Kalimantan, Sulawesi, and Papua (Husson, 1997; Wekke *et al*., 2019). Poor economic conditions are often the main driving factor of Madurese internal migration (De Jonge, 1995; Husson, 1997), with the barren natural environment of Madura Island compelling many to leave their homeland in search of better livelihoods.

Historically, the internal migration of the Madurese people across Indonesia has occurred since the 13th century AD (Husson, 1997). During the pre-colonial era, this migration was initiated by maritime activities (De Jonge, 1995; Husson, 1997). As skilled sailors, the Madurese people sailed and engaged in trade through maritime routes to neighboring regions. They exported goods such as fish, salt, shrimp paste, and agricultural produce from Madura Island. In return, they imported spices, textiles, fruits, and metals due to local scarcity.

During the colonial era (17 – 19th century), internal migration from Madura Island increased rapidly through the intervention of the Dutch colonial government (De Jonge, 1995; Losoncz & Marlowe, 2020). Driven by the need for cheap labor, the Dutch colonial government actively sent Madurese people, especially to Java, to work on sugar, coffee, and rubber plantations. Madurese plantation workers were highly favored for their reputation as diligent, resilient, and hardworking laborers, even in challenging natural conditions (De Jonge, 1995; Husson, 1997). During this phase, permanent settlements were established in several major cities in Java, such as Surabaya, Jember, Malang, Solo, Semarang, and Pekalongan (De Jonge, 1995; Husson, 1997).

The subsequent phase began in the post-colonial and post-independence eras of the 20th century and continues to the present. During this time, internal migration among the Madurese people increased significantly, with movements extending from Aceh to Papua (De Jonge, 1995; Lücking, 2017). Improved transportation access, economic development in new centers, and growing economic needs encouraged migration, especially among the youth. As a result, Madurese people can now be found in metropolitan cities such as Jakarta, Surabaya, Bandung, Semarang, and Yogyakarta, as well as in Medan, Banjarmasin, Makassar, and Ambon (Wekke *et al*., 2019). In these new locations, they predominantly work in the informal economy, holding jobs as street vendors, satay sellers, motorcycle taxi drivers, pedicab drivers, barbers, scrap collectors, and small grocery stalls (De Jonge, 1995; Wekke *et al*., 2019).

Distinctive Madurese small grocery stalls, known in Indonesian as "*Warung Madura*," started developing in the late 1990s and early 2000s, due to the post-reform era (*Era Reformasi*). Unlike *Warung Batak* (commonly known as "*Warung Ucok*," owned by Batak people from Sumatera) or *Warung Kuningan* (owned by the people of Kuningan, West Java), which do not have specific characteristics, *Warung Madura* is rich in Madurese identity and characteristics. The first *Warung Madura* in Jakarta was opened in the Tanjung Priok area and was owned and managed by migrant traders from Sumenep, Madura. Gradually, these grocery stalls proliferated, reaching smaller towns such as Kebumen and Sidoarjo. Some migrant traders have even managed to own more than ten small grocery stalls, yielding substantial incomes with minimal government assistance.

Previous studies have explained how various migrant ethnic groups in Indonesia have come to dominate certain economic sectors at their migration sites: The Minangkabau in the culinary business sector in many regions of Indonesia (Salazar, 2010; 2016), the Bugis in the small trade sector in Eastern Indonesia (Jannah *et al*., 2021), the Buton in the industrial business sector in Eastern Indonesia (Kadir, 2023), and the Madurese in the informal economy sector in many regions of Indonesia (Wekke *et al*., 2019). However, to the researchers' knowledge, there is no in-depth study specifically discussing the rapid development of small grocery stalls owned by Madurese migrant networks in Jakarta. Furthermore, in contrast to previous studies, none have analyzed the socioeconomic independence of *Warung Madura* from the perspective of social capital and the politics of local wisdom. Specifically, it aimed to refine the classical and common arguments that minority migrant groups tend to be forced to adapt to their new environment amidst various deprivations (Papastergiadis, 2000; Berry, 2005; Portes *et al*., 2005; Deshingkar, 2006).

Amidst the proliferation of large modern minimarket retail chains in Indonesia, such as Indomaret and Alfamart, supported by substantial funding, the existence and dominance of *Warung Madura* and the socioeconomic independence of the migrant traders are intriguing areas for in-depth study. By integrating approaches from economic history, social capital, and the politics of local wisdom, this study aims to provide an in-depth explanation of internal migration, focusing on the crucial roles of social capital and the politics of local wisdom. The study addresses two main questions: first, what are the forms and roles of social capital that enable Madurese grocery stall owners to build socioeconomic independence in their new environment in Jakarta? Second, how does local wisdom – encompassing ethnic values, norms, traditions, customs, and cultural behaviors – play an important role and become a differentiating factor in building the socioeconomic independence of these migrant traders?

2. Methods

To address the research questions, this study employed a mixed-method approach, combining both quantitative and qualitative methods (Mu & Yeung, 2018), conducted from June to October 2023 in Jakarta. In the quantitative phase, data were collected from 200 Madurese grocery stall owners or employees in Greater Jakarta. Of these respondents, more than half were male (110 individuals [55%]), and the rest were female (90 individuals [45%]). Regarding age, 86 (43%), 42 (21%), and 72 (36%) respondents were between 20 – 30, 30 – 40, and 40 – 50 years old, respectively. Meanwhile, 102 (51%), 44 (22%), 38 (19%), and 16 (8%) respondents had completed their education at the high school, junior high school, elementary school, and higher education levels, respectively. This study distributed 200 questionnaires, each containing 30 questions, through face-to-face interviews conducted in the Greater Jakarta area, namely, Jakarta, Bogor, Depok, Tangerang, and Bekasi. The questionnaire responses were then tabulated and analyzed quantitatively.

In the qualitative phase, in-depth interviews were conducted with 25 Madurese grocery stall owners or employees in Greater Jakarta. Informants were methodically distributed across regions, with five participants from each respective area. These semi-structured interviews were conducted informally and face-to-face, using a mixture of Indonesian and the Madurese languages, with an average duration of 1.5 h each. During the interview process, especially when carried out within the stall premises, there were occasional interruptions as the interviewees attended to customers. Furthermore, this study included visits and discussions with officials from the Jakarta Trade and Micro, Small, and Medium Enterprises (MSME) Office to gain insights into the government's contribution to the establishment of unique Madurese small grocery stalls in Jakarta. The recorded interview data were subjected to thematic analysis using the theoretical framework of social capital and local wisdom. The central analysis focused on the most observed topics and themes relevant to the research inquiries (Mu & Yeung, 2018).

To complement the qualitative interview data, a visit was made to the National Library of Indonesia in Jakarta, where newspaper articles, reference literature, analytical findings, and unpublished seminar materials related to the evolution of grocery stall businesses were copied. Even though the availability of academic records or references related to small grocery stalls and *Warung Madura* was limited, the secondary data sourced from the National Library, in the form of newspaper articles, proved to be valuable in offering an overview of the progression of Madurese small grocery stalls over the preceding decade.

The data collection process was greatly facilitated by the fact that the respondents and informants identified the researchers as fellow Madurese. This shared identity allowed for more in-depth discussions, as conversations were conducted in Madurese. In response, the informants readily embraced the research team as "*tretan dhibik*" (a term meaning close friend in Madurese), signifying a sense of friendship. This unique connection might not have developed with outsiders, who would not have been perceived as members of their ethnic group.

3. Results and discussion

3.1. Migrant traders and self-reliance of *Madura Warung* in Greater Jakarta

The sociocultural conditions and distinctive characteristics of the Madurese people have allowed Madurese migrant grocery stall owners to build socioeconomic independence despite the limitations of their new homes.

In many regions of Indonesia and Southeast Asia, Indigenous populations often do not dominate the economic sector (Hefner, 1998; Kadir, 2023; Landa, 2018; Nonini, 2015). In contrast, migrant traders from minority ethnic, racial, or religious groups frequently exert significant influence over the economic sector (Clark *et al*., 2018; Hefner, 1998; Kadir, 2023). In Indonesia, traders from the Chinese minority ethnic group (*Tionghoa*) have long dominated the economic sector in various regions (Hefner, 1998). The dominance has often resulted in social jealousy and violent conflicts between the Indigenous population and the ethnic Chinese minority (Panggabean & Smith, 2011; Rochadi, 2021).

Apart from the Chinese ethnic group, the Minangkabau and Madurese minority ethnic groups are among the migrant traders dominating the economic sector in Indonesia. These groups are known for their resilience and wandering spirit (or *merantau* in Indonesian) in nearly every region of Indonesia. The Madurese people are described as wanderers and migrants, and this is reflected in their proverb to cross the ocean to migrate, "*abhântal ombâ, asapo' angèn*" (on the waves, covered by the wind) (De Jonge, 1995; Husson, 1997; Fatmawati, 2020). The term "*merantau*," which means "migrate," comes from the Malay-Minang language and has become a cultural characteristic of the Minangkabau people (Salazar, 2016; Wekke *et al*., 2019). However, unlike the idea of *merantau* in Minangkabau culture, which connotes "not returning to one's home," the tradition of *merantau* in Madurese culture is often not permanent. Madurese migrants still feel rooted in their homeland, keep in touch with their families, and frequently return to Madura, particularly for the annual Eid celebration. In the Madurese language, there is no equivalent word with the same meaning as *merantau*. The terms used by Madurese are "*ongghe*" (to go up), "*mangkat*" (to depart), and "*andhun*" (to go to sea), carrying the connotation of leaving one's homeland for a temporary period to seek a livelihood in another place. In their new environment, these migrant traders established businesses, accumulated capital, and became socially and economically self-sufficient.

According to Booth (2001), in Indonesia, capital is often brought in by people from outside the local community, unlike in the West. Migrant traders can develop their businesses for two primary reasons: First, their detachment from the Indigenous community grants them greater flexibility, and second, their willingness to engage in debt and credit rotation (Booth, 2021). Their status as outsiders facilitates the process of investing money, offering loans at elevated interest rates, or acquiring goods from residents more efficiently than Indigenous individuals, who are often constrained by kinship ties and societal obligations (Binns & Nel, 1999; Booth, 2021; Henley & Boomgaard, 2009). Through these practices, migrant traders gradually achieve self-sufficiency and come to dominate the economic sector in various regions of Indonesia (Binns & Nel, 1999; Fonchingong & Fonjong, 2002; Mas'udah, 2020). However, as Gregory (1997) points out and as this study confirms, the movement of capital within migrant networks in Indonesia is ultimately dependent on certain types of kinship and sociality. Kinship relations, especially extended family, play a very important role in managing capital in migrant trader networks. The stronger the kinship solidarity, the greater the ability to mobilize and accumulate capital in the migrant trader network.

Most *Warung Madura* in Greater Jakarta is owned by migrant trader networks from Sumenep, the easternmost regency of Madura Island, as shown in Table 1. Out of 200 respondents, 154 (77%), 32 (16%), 10 (5%), and 4 (2%) are from Sumenep, Pamekasan, Sampang, and Bangkalan, respectively. The grocery stall owners often come from the islands of Sumenep, especially Talango Island and Sapudi Island. Even though there are people from Bangkalan, Sampang, or Pamekasan who recently opened grocery stalls in Jakarta, their numbers are smaller compared to those from Sumenep. In the Madurese language, opening a grocery store is commonly referred to as *noko* (derived from *took*, meaning store) or *berung* (derived from *warung*, meaning small grocery stall).

Compared to others, the *Warung Madura* has several distinctive features easily recognizable in terms of the stall's appearance and management. *Warung Madura* is typically located on busy and strategic roadsides. At the front, a *Pertamini* box – a shelf containing retail gasoline in bottles – is often displayed, and the merchandise is neatly arranged in wooden boxes based on their types. Rice is typically presented in a glass case resembling an aquarium, with visible price labels at the forefront for immediate quality assessment by buyers. Furthermore, eggs and cigarettes are placed adjacent to the rice. The cigarettes, available in various brands, are laid flat within the same glass showcase. In the background, a wall-mounted rack holds wooden boxes (approximately 30 × 30 cm), containing a diverse array of items for sale, such as instant noodles, milk, soap, and bottled beverages. The stall's ceiling is adorned with sachet-packaged products such as snacks, coffee, kitchen spices, and shampoo. Additionally, a traditional Madurese machete named "*celurit*," the emblematic weapon of the ethnic group, is often suspended on the rear wall or occasionally on an inner shelf, symbolizing the store's identity and the vigilance of the community.

A distinguishing characteristic of *Warung Madura* is their continuous operation, as they remain open 24 h a day, 7 days a week, without any closure. Due to this uniqueness, there is a humorous saying, "*Warung Madura* only closes on Judgment Day." Regarding the reasons for this continuous operation, respondents provided the following explanations: 94 (47%) cited it as a tradition of Madura grocery stalls in Jakarta; 64 (32%) mentioned it was to increase profit; 12 (6%) attributed it to competition with modern minimarkets; and 30 (15%) gave other reasons (Table 2). The management is carried out independently by the owners or stall keepers, usually, two individuals working in shifts, acting as employees purchasing goods and simultaneously as financial recorders. For efficiency and convenience, owners or employees typically reside within the stalls. Only a few rent or lease nearby houses, while most employees are either relatives of the owners or friends. Most stalls use a profit-sharing system for their employees rather than a fixed monthly salary. In this system, employees share responsibility for the stall's earnings, with higher profits translating to higher income.

Table 1. Origin of *Warung Madura* owners in Jakarta

Regency	Number (*n*)	Percentage
Bangkalan	4	2
Sampang	10	5
Pamekasan	32	16
Sumenep	154	77
Total (*N*)	200	100

Source: Field study questionnaire data (2023).

Table 2. Reasons for *Warung Madura* in Greater Jakarta to operate 24 h

Respondent's answers	Number (*n*)	Percentage
To get more profit	64	32
To be able to compete with modern minimarkets	12	6
It is a habit (Madurese grocery stall tradition)	94	47
Other reason	30	15
Total (*N*)	200	100

Source: Field study questionnaire data (2023).

During this study, Madura grocery stall owners said that they received almost no formal assistance from the government in establishing their businesses. Only very few individuals borrowed money from banks under general business loan schemes rather than government subsidies. The field data report that 89% (or 178) and 11% (or 22) of respondents financed their stalls using the owner's capital and obtained funding from banks or other sources (Table 3). The income generated from the grocery stalls can be considered quite high, where 66 (33%), 34 (17%), 22 (11%), 38 (19%), and 40 (20%) stalls have an income of over IDR 10 million per month, IDR 9 – 10 million per month, IDR 7 – 8 million per month, IDR 5 – 6 million per month, and below IDR 5 million per month, respectively (Table 3). Among these figures, 178 (89%) of the respondents stated that they are living in a state of sufficiency or affluence, while 22 (11%) are managing with modest or inadequate resources. Some studies have found that the socioeconomic self-reliance shown by Madurese migrants is a rare phenomenon, especially in Indonesia, where numerous owners of MSME are seeking financial assistance from the government (Augendra *et al*., 2019; Nel & Binns, 2000; Panjaitan-Drioadisuryo & Cloud, 1999). This study of *Warung Madura* underscores the findings of the previous studies, emphasizing that Madura grocery stall owners are also not interested in borrowing money through credit schemes offered by the Indonesian government.

The Indonesian government has been assisting MSME financing schemes since 2007 under the People's Business Credit (*Kredit Usaha Rakyat* or KUR) program (Augendra *et al*., 2019). However, various obstacles, including complex bureaucracy, relatively high interest rates, and stringent requirements, have limited the utilization of the KUR program. In particular and more importantly, the *Warung Madura* owners intentionally avoid bank loans, including KUR, due to their religious belief that the interest is considered *riba* (usury) (Fatmawati, 2020). *Riba* refers to the practice of collecting interest or additional profits in financial transactions and is prohibited in Islamic teachings (Fatmawati, 2020). This belief is derived from Islamic teachings, which are the majority religion in Madura. Madurese individuals who adhere closely to their religious teachings and the guidance of *kiai* (traditional Islamic scholars) prefer to avoid bank loans, steer clear of *riba*, and establish personal businesses without violating religious beliefs (De Jonge, 1995; Fatmawati, 2020). Mr. Taufiq, one of the informants residing in Jakarta for 6 years, shared the story of obtaining capital to open a small grocery stall in Jakarta:

> *"My stall was funded entirely with my own money, from savings. I opened this stall without taking out a bank loan or anything else, just my savings. Why did I not borrow from the bank? According to my kiai, borrowing money from the bank is haram because of riba, and I've never saved in a bank either. I saved it by myself, collected it at home, and kept it in the closet. Alhamdulillah, after my wedding reception in my village, I was able to amass a substantial amount of money as my capital. After totaling it, I had IDR 53 million, and that is how this stall came into being."*

This small grocery stall business may develop relatively slowly due to limited capital, but for Madurese people, what is more important is that their business brings *barokah* (blessings). The term "*barokah*," derived from the Arabic *barakah*, signifies blessings, sustenance, goodness, or the fortune bestowed by Allah for adhering to His commands and avoiding His prohibitions (Fatmawati, 2020). This finding shows the significant influence of Islamic values in building businesses for Madurese migrant traders. In addition, this finding supports the thesis of previous research that the economic morality of Madurese migrants in Indonesia is slightly different from that of ethnic Chinese (*Tionghoa*), who are known to be driven more by profit motives than religious values (Landa, 2018; Nonini, 2015; Panggabean & Smith, 2011; Rochadi, 2021).

Table 3. Sources of capital and income of *Warung Madura* in Jakarta (per month)

Category	*N*	%
Sources of capital		
Stall owner (fully, 100%)	178	89
Stall owner and bank loan	18	9
Bank loan (bank credit, 100%)	0	0
Other	4	2
Total (*N*)	200	100
Income per month (IDR)		
Below 5 million per month	40	20
5 – 6 million per month	38	19
7 – 8 million per month	22	11
9 – 10 million per month	34	17
Over 10 million per month	66	33
Total (*N*)	200	100

Source: Field study questionnaire data (2023).

3.2. Social capital of *Warung Madura* stalls: values, norms, networks, and trust

The original contribution of this section is to microscopically explain how social capital becomes a critical factor in enabling Madurese migrant traders to achieve socioeconomic self-reliance in Jakarta.

Multiple studies have shown that migrant communities necessitate social capital to sustain their livelihoods in a new location (Adedeji, 2021; Pieterse, 2003; Seferiadis *et al*., 2015; Suyanto *et al*., 2020). Social capital comprises a set of actual or potential resources associated with durable networks of more or less institutionalized relationships characterized by mutual recognition and shared values (Bourdieu, 1986). This can include specific values and norms, social networks, and trust. Similarly, Coleman (1988) understood social capital as a resource within individual relationships that could potentially yield benefits in the form of support, information, control, or other resources. Putnam (1995) adds the variable as a resource within social networks and norms that facilitate cooperation among individuals for mutual benefit.

Social participation, social networks, trust, and reciprocity have shown a positive correlation with the quality of life among migrant workers (Adedeji, 2021; Mohanty *et al*., 2016). In his research in Thailand, Garip (2008) stated that the internal migration process was significantly influenced by the availability of social capital at their destination. Migrants are more inclined to migrate when these resources are more abundant and accessible at the destination. However, while the findings of this study are consistent with Garip's study on the importance of social capital for migrant workers, this article also shows that the social capital of the Madurese migrant stall owners is mainly bound by a common ethnic identity and local wisdom, especially those derived from traditional Islamic teachings.

The availability of social capital is one of the critical factors driving the self-sufficiency of groups of migrant traders from Madura. In his research, Prayitno *et al*. (2014) reported that a sense of togetherness, a sense of belonging, neighborliness, and various other demographic attributes significantly influence the duration of stay for Madurese migrant traders in the city of Malang. Moreover, individuals with higher social capital resources are more engaged in internal migration (Prayitno *et al*., 2014; Sridhar *et al*., 2013; Waters *et al*., 2010). Utomo (2019) also reported that strong social and ethnic networks, accompanied by mutual trust, serve as important resources for the Madurese migrant community in Jakarta. These previous studies are generally consistent with the findings of this present research, which highlight the important role of social capital as one of the keys to the success of Madurese small grocery stall businesses in Jakarta.

Migrant traders who own Madurese small grocery stall businesses in Jakarta make use of social networks mainly in the form of family and community relationships (family, friends, and neighbors) to recruit their employees. A total of 196 (98%) out of 200 respondents indicated that their employees originate from Madura (Table 4). Furthermore, most owners and employees are from the Sumenep Regency, with only a few hailing from Bangkalan, Sampang, and Pamekasan. One of the informants, Mr. Masduki, mentioned that traditionally, individuals from Sumenep were already well-known in grocery stall businesses, while migrants from the other three regencies are more likely to be included in scrap metal businesses, satay stalls, or barbershops, common among Madurese migrants. Moreover, 150 (75%) respondents had family relationships with the owners, and the remaining 50 (25%) were friends or neighbors of the owners (Table 4).

Table 4. Origin of employees and relationship with owners of *Warung Madura* in Jakarta

Category	*N*	%
Origin of employees		
All from Madura	80	40
Some (a few) from Madura	4	2
Some (many) from Madura	116	58
Total (*N*)	200	100
Relationship with owners		
Close family (blood relatives)	90	45
Distant family (not blood relatives)	60	30
Neighbors	18	9
Friends	32	16
Total (*N*)	200	100

Source: Field study questionnaire data (2023).

This study revealed that the relationship between Madurese stall owners and their employees who are not their immediate family, such as Madurese neighbors or friends, creates an artificial but still important bond as one of the modalities of social capital. This artificial "pseudo-family" or fake "political bond" is mainly formed due to trust and reciprocity between the two parties (Gelderblom, 2018). The trust given by the *Warung Madura* owner is often established long before the *Warung Madura* employee is recruited. In addition, the reciprocity factor is also important because both parties feel they need each other and are not disadvantaged. In this context, the concept of bridging social capital can be used to explain how relationships between individuals who come from different groups, classes, or identities can be bridged through trust, shared norms, and a sense of reciprocity between them (Gelderblom, 2018; Sørensen, 2016). In this study, in some cases, even *Warung Madura* employees who do not come from the immediate family can be accepted or considered as part of the immediate family by the *Warung*

Madura owner. This happens when the stall employee is highly trusted, does not violate the trust given by the stall owner, and is able to fit into the values and way of life of the Madurese stall owner's family.

In this study, most employees received job information from the families of Madurese small grocery stall owners. Field data show that 106 respondents (53%) obtained information about job vacancies from their own families, while the remaining 94 (47%) received information from friends or former employers. Typically, stall owners in need of employees contact their families in Madura through mobile phones to find new employees. In this context, the families in Madura spread the job vacancy information and searched to see when the relatives were willing to become stall employees. Moreover, the grocery stall owner would provide the potential employee with all financial support to travel to Jakarta when there is interest. The travel costs would be reimbursed with deductions from the monthly salary. Mrs. Misriyah, one of the informants, emphasized this unique recruitment process:

> *"We prefer something straightforward, something quick, because we need it to be fast. Typically, we just call our family in Sumenep and ask them to help find someone who wants to work in running the stall. It is even better if they are family. The key is that the person is honest, serious about working, performs prayers, and does not engage in misconduct. When you already know the person, it is easier to talk, and there is already trust. If someone is interested, we immediately instruct them to come to Jakarta. They are taught here, and the main thing is that they have to be willing. If there is no money to go to Jakarta, we will pay for it first, and it is not a problem. We will deduct it from their salary later."*

This *Warung Madura* ethnic-cooperation model, based on family relationships and, more importantly, focused on providing convenience (financial support) for potential employees so that these prospective employees have no difficulty starting work at *Warung Madura,* differs significantly from the typical patterns of economic cooperation among migrants' workers in Indonesia. In this context, the findings of this study differ from the findings of Suyanto *et al.* (2020) and Mas'udah (2020), who explained that migrant workers in Indonesia often face many financial difficulties when they want to work, such as being asked to pay high initial fees or being extorted by brokers even before they can work in a new place.

The principle of trust also serves as one of the critical sources of social capital for the existence of the *Warung Madura* network in Jakarta, and this is evident in the recruitment process. A total of 190 (95%) respondents stated that there was no selection process, tests, or interviews to become an employee, as shown in Table 5. There were also no specific administrative requirements related to educational background or certificates of specific skills. Meanwhile, the new employees can start their duties immediately on the 1st day in Jakarta to assist and gain knowledge of grocery store operations. This is due to the pre-existing familial relationships between the owners and new employees.

Table 5. Employee recruitment system at *Warung Madura*

Respondent's answers	Number (*n*)	Percentage
Without employee tests/selection, based on trust	190	95
With employee tests/selection	10	5
Total (*N*)	200	100

Source: Field study questionnaire data (2023).

The similarity in ethnic background, language, and culture is considered important for the Madurese migrant traders. In an unfamiliar land, grocery stall owners prefer to feel safe and secure in their businesses by employing their fellow Madurese (Husson, 1997; Lücking, 2017; Wekke *et al.*, 2019). Furthermore, shared values and norms, including Madurese cultural norms and Islamic religious values, facilitate smooth interactions between the owners and the employees (Lücking, 2017; Fatmawati, 2020). This form of economic cooperation based on ethnic and cultural similarities, also known as an ethnic-based economy, is a characteristic of the Madura grocery stall network in Jakarta. Ethnic-based economic activities can have both positive and negative sides. On the positive side, they can contribute to cultural preservation, community cohesion, and the empowerment of certain ethnic groups. On the negative side, such economic structures can sometimes lead to exclusion, discrimination, or limited opportunities for individuals outside of a specific ethnic group. In the context of *Warung Madura*, the positive side of an ethnic-based economy tends to dominate over the negative side, so that its development does not appear to cause friction with other ethnicities or cultures. Therefore, in this case, an ethnic-based economic system can be productive if it is executed well and carefully.

The important role of social capital in the development of Madurese small grocery stalls in Jakarta can also be observed in their networks of suppliers and the distribution of goods for sale. A total of 196 (98%) respondents obtained their goods from well-recognized agents or distributors (Table 6). This trust-based connection is crucial in assisting *Warung Madura* businesses. In an

Table 6. Origin of merchandise at *Warung Madura* in Jakarta

Respondent's answers	Number (*n*)	Percentage
Center market	2	1
Wholesaler market	2	1
Agent/distributor	196	98
Supermarket/minimarket	0	0
Madura store network	0	0
Other	0	0
Total (*N*)	200	100

Source: Field study questionnaire data (2023).

extensive interview, Mrs. Zahroh, one of the informants, stated that the establishment of trust in their relationships with these agents facilitates the procurement of goods to receive preferential treatment (such as complimentary delivery) and extend payment terms over several days. These minor conveniences prove to be of great assistance to owners in expanding their limited resources and capital. The development of *Warung Madura* may face significant challenges without easy access to merchandise, which is made possible by good relationships and trust with agents and distributors.

In addition to the distribution network through agents, the migrant owners of *Warung Madura* in Jakarta possess another crucial source of social capital, namely, the owners' network organization. In the Greater Jakarta area (Jakarta, Bogor, Depok, Tangerang, and Bekasi), there are more than 1000 Madurese small grocery stalls. To facilitate communication among traders, several Madura grocery stall organizations have been established in Greater Jakarta, such as the *Paguyuban Warung Madura Sumenep* (Sumenep Madura Small Grocery Stall Association), consisting of owners and employees from the Sumenep Regency. This organization holds regular monthly meetings as an opportunity for members to socialize, taking turns hosting meetings in their stalls. Moreover, some grocery stalls regularly organize *arisan* (social fund) and *majelis pengajian* (Al-Qur'an recitation gatherings). "*Arisan*," or in Madurese, is referred to as *to'-oto'*, *remo*, or *sandur*, is a term that refers to a social gathering where a group of people come together periodically, often monthly. The main purpose of *arisan* is for participants to contribute a certain amount of money at each gathering, and one member of the group receives the total collection of money during that meeting.

Meanwhile, a *majelis pengajian* is a gathering where people come together to read and study the Qur'an. These gatherings can take place in mosques, community centers, or even in private homes. They may be led by knowledgeable individuals, such as *kiai*, who guide the participants in reciting and understanding the Quranic verses. These various activities within the organizational network serve to strengthen ethnic-based cooperation among Madura grocery stall owners. In this context, the owners can assist each other, such as by providing support when opening a stall for the 1st time, sharing the latest price information, or even lending money or merchandise to each other. Madurese small grocery stalls have grown rapidly to the present day with the support of social capital resources from this kind of organization and activity.

The concept of reciprocity is useful for analyzing how the socio-economic relationships of these Madurese migrant traders endure. Anthropologically, the concept of reciprocity refers to the practice of exchanging goods, services, or favors between individuals or groups within a society (Chan *et al*., 2019; Phillimore *et al*., 2018). Reciprocity is not only seen as a way to organize economic exchange but also as an important mechanism for building and maintaining social relationships (Chan *et al*., 2019; Kadir *et al*., 2019). This practice of mutual exchange is one of the main ways in which traditional societies organize their socioeconomic relationships. In the context of Madurese migrant traders, the practice of reciprocity can be seen in several patterns of relationships, namely, between stall owners and stall employees, between stall owners and agents or distributors of goods, and between fellow Madurese stall owners.

The practice of reciprocity between stall owners and stall employees occurs in a relatively loose form of reciprocity. This reciprocal relationship based on ethnic similarity and family ties does not expect a strict exchange in return. The stall owner's intention to provide an initial bailout that does not have to be paid immediately and provide free housing and food to stall employees is expected to be rewarded with loyalty, obedience, and long-term good relations from stall employees.

Meanwhile, the practice of reciprocity between stall owners and agents or distributors of goods occurs when stall owners are willing to become long-term regular customers of certain agents or distributors, and in return, the agents or distributors will provide extra services and cheaper prices. In addition to this seemingly purely economic exchange, reciprocity between stall owners and agents or distributors is also a mechanism to maintain social relations because many agents and distributors are also from Madura.

The last reciprocity practice between fellow Madurese stall owners occurs in the form of mutual assistance when someone wants to open a new stall or help when a stall owner is experiencing difficulties. Among fellow Madurese stall owners, they are also accustomed to giving each other information about the prices of goods or even lending goods to each other when needed. This reciprocity practice, once again, is motivated by the desire to maintain social relationships rather than merely economic exchanges among fellow Madurese stall owners. This pattern of reciprocity enables the ethnic-based Madurese grocery stall network to not only survive but also expand.

3.3. ***Warung Madura*** **and the politics of local wisdom**

This section explains how cultural capital in the form of local wisdom is one of the crucial factors enabling migrant entrepreneurs, the owners of *Warung Madura,* to build socioeconomic self-reliance despite living with many limitations in the land of migration.

Local wisdom can be understood as the knowledge, values, traditions, and practices present in a community, acquired through experiences and interactions with the natural and social environment (Devika *et al*., 2020; Kartikawangi, 2017). Local wisdom includes knowledge about nature, natural resources, ecological systems, culture, history, religion, traditional technologies, local food systems, and sustainable ways of living passed down through generations (Kartikawangi, 2017). Furthermore, Kartikawangi (2017) reported that the values of local wisdom held significant meaning in inclusive economic development, sustainable economic, environmental preservation, and cultural diversity conservation. The recognition, respect, and preservation of these values contribute to maintaining cultural identity, enhancing socioeconomic well-being, and sustaining the environment and biodiversity (Kartikawangi, 2017; Wahab *et al*., 2020; Weinreich, 2009).

The values of local wisdom existing in Madura culture play an important role in shaping the distinct characteristics of the socioeconomic self-reliance model among the *Warung Madura* networks in the Jakarta area. Field data indicate that 156 (78%) respondents in this study stated that Madura grocery stalls had unique characteristics, while 44 (22%) respondents stated that Madura grocery stalls do not have certain special characteristics. The unique values of Madura local wisdom manifest in the form of knowledge, values, traditions, and behavioral practices that positively support their socioeconomic self-reliance in the land of migration.

Based on the results of this study, a range of local wisdom values that help shape the socio-economic self-reliance character of the Madura grocery stalls network can be categorized into three main groups: (i) local knowledge derived from traditions, culture (including *ca'-oca'an* or idioms/proverbs) and traditional Islamic teachings; (ii) material culture, which comprises artifacts, goods, equipment, weapons, and distinctive Madurese clothing; and (iii) cultural practices, including distinctive behavioral practices within the Madurese ethnic cultural community.

Local wisdom in the form of local knowledge is apparent in the embodiment of Madurese culture, which highly upholds Islamic values and teachings (Devika *et al*., 2020; Fatmawati, 2020; Wahab *et al*., 2020). This is evident, for instance, in the following expression, which is very popular in Madura: *Abantal sadhat*, *apajung Alla*, *asapo' salawat* (relying on the *syahadat*, or Islamic declaration of faith, seeking God's protection, and being cloaked in *shalawat*, or the practice of invoking blessings and peace upon the Prophet Muhammad). The concrete form of this expression for Madura grocery stall owners is the awareness of the importance of inviting or seeking advice from local Islamic scholars, or *kiai*, when opening a stall, seeking a location, determining the name of the stall, or requesting advice on hiring employees. The importance of Islamic values can also be seen in the preference of Madurese migrant traders when preferring employees of married couples over unmarried employees. This preference arises because the employees must share a small room at the back of the stall, and in Islamic teachings, only a married couple is allowed to share a room. Therefore, the stall owners prefer married couples to adhere to Islamic principles.

The forms of local wisdom that show the resilience (*bilet* in Madurese) of the grocery stall owners can also be found in some local Madurese expressions: *Se atane atana* (those who cultivate the land can cook rice), *Se adhaghang adhaghing* (those who trade can eat meat and live well), *Lebbi begus ghagel ben bengal nyobak ebendingagi tak tao ghagel polanah tak penah nyobak* (it is better to try and fail than fail to try), and the belief that sustenance (or *rezeki* in Indonesian) cannot be exchanged (De Jonge, 1995; Devika *et al*., 2020; Fatmawati, 2020). With these beliefs, Madurese migrants' traders do not hesitate to open small grocery stalls in Jakarta, the capital of Indonesia, far from their hometowns. Some even open grocery stalls adjacent to large modern minimarkets (such as Indomaret or Alfamart), which are supported by substantial capital and extensive marketing networks. These values of local wisdom in the form of distinct Madurese cultural knowledge are one of the driving factors behind the proliferation of *Warung Madura* in the Greater Jakarta area.

Local wisdom values in the form of material culture include the presence of traditional Madura machetes or *celurit* displayed on the walls of stalls, the typical names of the stalls, which include the word "*Madura*" (for example, *Warung Izmil Madura*), the Madurese language spoken by the stall keepers, and the distinctive Madura attire, consisting of a *sarong* and a black *songkok* cap. Regarding the *celurit* displayed on the walls, 44 respondents (22%)

explicitly stated that it was intended as a marker of a distinct identity apart from other non-Madurese grocery stalls. Meanwhile, 140 respondents (70%) indicated that the *celurit* was used as a weapon and for security reasons and the remaining 16 respondents (8%) provided other reasons (simple wall decorations). Most of the respondents stated that these distinctive Madura items were the primary identifiers (trademarks) of small grocery stalls in the Jakarta area owned by Madurese migrants.

The findings related to local wisdom values in the form of cultural or behavioral practices are reflected in several traditions. According to field data, 154 (77%) respondents in this study stated that specific cultural traditions were followed by the grocery stall owners in Jakarta. A unique tradition practiced by the stall owners is *selametan* when intending to open a new grocery stall. "*Selametan*" is a term that refers to a traditional ritual or ceremony conducted to express gratitude, seek blessings, and ensure the well-being of individuals or a community (De Jonge, 1995; Lücking, 2017). This tradition includes inviting family members, neighbors, and traditional religious leaders, or *kiai,* to dine together, pray, and receive God's blessings and sustenance for a blessed life. The importance of adhering to the *selametan* tradition was stated by Mr. Bahruddin, one of the informants, during an in-depth interview:

> *"As Madurese people, we always have our ways. When we have a big plan, like opening this stall, our tradition is to hold a selametan. Why? To ensure it is safe, smooth, as expected and blessed for those with big plans. Even in Jakarta, we still have a selametan, although we invite fewer people compared to what we do in Madura. Here, we invite family members in Jakarta, neighbors from left to right, the local community leader, our kiai, and the neighborhood head. What is important is that we have to have a selametan; it must not be omitted."*

As followers of the *Nahdlatul Ulama* (NU), the largest traditional Islamic organization in Indonesia, in addition to performing the *selametan* tradition, the grocery stall owners also regularly engage in *tahlilan* and *yasinan* activities, held every month, taking turns at their stalls. *Tahlilan* and *yasinan* are traditional Islamic religious activities that include gathering and reciting specific Al-Qur'an prayers. These activities have been passed down through generations, guided by the traditional religious leaders (*kiai*) in Madura (De Jonge, 1995; Lücking, 2017).

The cultural traditions and practices that are related to Islamic teachings (Islam), such as *selametan*, *tahlilan*, or *yasinan*, may seem unrelated to economic activities. Wahab *et al*. (2020) and Rini *et al*. (2023) reported that these traditional practices are counterproductive in modern economic activities as they require considerable costs and take time. However, this study demonstrates that for Madurese people, especially *Warung Madura* owners in Jakarta, these traditions serve as an important cultural capital for the survival of businesses. Even though material profits are not attained, the values of local wisdom in the form of these cultural traditions strengthen the ethical beliefs of the Madurese people to persevere.

The Madura grocery stall owners in Jakarta also embody other common values of local wisdom, such as being polite to guests (*andhâp asor*: Politeness, wisdom, and discretion), respect for customers (*bâburughân beccè*: good manners), mutual assistance and cooperation (*long-nolongi*: mutual help), and a tolerant attitude (*Ajjhâ' nobi'an orèng mon abâ'na ta' endâ' ètobi*: Do not disturb others when you do not want to be disturbed). Furthermore, honesty is an important value in Madurese labor-based economic ethics, as stated by De Jonge (1995) and Noer (2012). In this context, dedication and integrity in business dealings hold considerable esteem. These cultural values and attitudes became part of the Madurese's economic and moral character, which also contributed to the rapid development of *Warung Madura* in Jakarta.

Regarding economic morality as a value of local wisdom for migrant grocery stall owners, Madurese people adhere to labor-based economic morals and not land-based economic morals (Noer, 2012). The labor-centric economic moral framework suggests that Madurese individuals can seek employment in diverse locations, regardless of their native region, and their focus does not revolve around the accumulation of permanent land assets. Noer (2012) also uncovered distinct characteristics within the Madurese community, including a pronounced entrepreneurial spirit and a willingness to take calculated risks (De Jonge, 1995; Lücking, 2017). This boldness is an important component of the labor-based economic moral framework, including the ability to confront uncertainty and take resolute actions toward economic objectives (Kutor *et al*., 2021).

While the findings of this study corroborate with Noer (2012), it also reaffirms that the principles of kinship networks and social solidarity receive profound emphasis in the economic moral code of the Madurese migrant traders. Individuals tend to support and provide opportunities first to family or members of their social network in economic activities (De Jonge, 1995; Noer, 2012). Finally, with the support of these cultural capitals in the form of Madurese local wisdom, Madurese small grocery stall owners have solid social and cultural capital resources to establish social-economic independence in their adopted land.

4. Conclusion

Many studies on migration suggest that minority migrant groups are often forced to give up their identity, are marginalized, and adapt completely when arriving in a new environment. The practice of cultural assimilation and cultural acculturation is often considered the only option in an effort to build social harmony for minority migrant groups. The original contribution of this study was to provide a different perspective on this long-standing argument, using the case study of the *Warung Madura* network in Jakarta, where migrant traders of Madurese small grocery stalls can build social-economic independence in a new land while still being able to maintain their identity as migrants.

The results of this study refined the findings of previous migration studies by emphasizing the crucial relationship between internal migration practices, ethnic-based economics, social capital, and local wisdom (especially Madurese culture and traditional Islamic teachings). First, this study reveals that the survival and independence of the Madurese migrant trader group in Jakarta are strongly influenced by their ability to utilize social capital. The social capital found in this study is mainly in the form of trust and social networks. The study identifies three forms of trust: (i) trust between stall owners and stall employees; (ii) trust between stall owners and goods' agents or distributors; and (iii) trust between fellow stall owners. In each case, the principle of reciprocity becomes an important mechanism to bind not only the economic relationships but, more importantly, the social relationships. Furthermore, trust is also the main foundation for the formation of a strong and independent social network among Madurese stalls in Jakarta.

Second, Madurese local wisdom significantly influences the network of *Warung Madura* in Jakarta. This study identifies three main categories of local wisdom that contribute to the socio-economic independence of the *Warung Madura* network: (i) traditional customs: local cultural elements (including *ca'-oca'an* or idioms/proverbs) and teachings from traditional Islamic religion; (ii) material culture: this includes Madurese artifacts, goods, tools, weapons, and clothing; and (iii) cultural practices: this refers to typical behavioral practices within the Madurese ethnic cultural community.

The strategy of socioeconomic independence based on social capital and local wisdom applied by the owners of *Warung Madura* in Jakarta has the potential to be developed as a model of socioeconomic empowerment for migrant groups in Indonesia and elsewhere. At present, the presence of *Warung Madura* is not limited to the Jabodetabek area. They also appear in many other cities and towns, especially on the island of Java. The results of this study can provide hope that certain social capital-based survival strategies and local wisdom practiced by Madurese migrant traders can be developed as a model for the socioeconomic empowerment of urban ethnic migrant groups, especially in developing countries such as Indonesia.

Finally, this study has a few limitations. First, the data does not encompass the perspectives of all Madurese stall owners in Jakarta. Not all *Warung Madura* owners live in Jakarta; some continue to live on Madura Island and monitor their businesses remotely. In addition, the quantitative data collected in this study are limited and could be expanded, not only to the owners and employees of *Warung Madura* but also to the consumers of *Warung Madura*. Future studies should cover these data more broadly, including informants who live in the new migration location and in the migrants' home areas, as well as the consumers of *Warung Madura*. This approach would add more perspectives and depth so that the findings could enrich the study of the socioeconomic dynamics of urban migrant minority groups in Indonesia.

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Conflict of interest

The authors declare no conflicts of interest.

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Ethics approval and consent to participate

Ethical approval for this study is obtained from the Ethics Committee, Institute for Research and Community

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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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RESEARCH ARTICLE

Impact of rural-urban migration on indirect child mortality estimation in Kenya

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Abstract

When estimating child mortality rates using the indirect method, it is assumed that all reported births and deaths occurred in the place where the mothers resided at the time of the survey. However, the migration of women can result in transferring data about deceased children from one place to another. In many developing countries, substantial migration happens between rural and urban regions, where child mortality disparities are significant. This migration creates challenges as child mortality estimates for rural and urban areas computed under the assumption of non-migration are likely to be erroneous. Our study pooled data from six Kenya Demographic and Health Surveys between 1989 and 2014. The study aimed to establish statistical evidence of the impact of rural-urban migration on indirect child mortality estimates. Our findings indicate that the inclusion of deceased children born to women who migrated from rural to urban regions led to a significant overestimation of infant, one-to-four, and under-five mortality rates in urban areas. On average, the overestimation of infant mortality rates ranged from 2.5% to 21.7%, while one-to-four mortality rate overestimation ranged from 4.0% to 41.2%. The average overestimation of under five mortality rate was between 3.0% and 26.8%. Based on these results, future indirect estimates of child mortality for rural and urban regions should be adjusted to account for the impacts of migration between these areas. Furthermore, it is essential to consider re-estimating trends of child mortality for rural and urban regions in Kenya to better understand the timing of mortality convergence between these regions.

Keywords: Child mortality rate; Brass indirect method; Migration; Rural region; Urban region; Migration impact; Kenya

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1. Introduction

Estimating child mortality rates is crucial for understanding public health trends and implementing effective interventions. Broadly, there are two methods used for estimating child mortality rates: The direct method and the indirect method. The indirect method for estimating child mortality was pioneered by Brass & Coale (1968) following Brass's seminal works in 1964. The Brass indirect method is popular in developing countries because many of them lack reliable vital registration data. This method can produce fairly accurate estimates with low-cost summary birth history data readily available from surveys and censuses. The Brass equation is given by Equation I:

$$q(x) = k(i)D(i) \tag{I}$$

where $D(i)$ is the proportion of children dead among children ever born to women of age group i, and $k(i)$ is the translation scale factor based on the average parity of women of age group i. Essentially, the Brass indirect method requires the application of a model fertility and child mortality pattern (United Nations, 1983).

Using a theoretical model, Arthur & Stoto (1983), demonstrated that despite the popularity of the Brass indirect method, child mortality estimates obtained using this method are prone to errors. The model consists of three populations: The actual population targeted to estimate the child mortality rates, the survey population consisting of women selected for the interview, and the artificial or model population chosen for the simulation of the translation of the ratio k. In this model, the corresponding mortality rates associated with these populations and their respective density functions representing the number of children (dead or alive) born to women of age x are summarized in Table 1.

Using the model functions, D(i) is given by Equation II:

$$D(i) = \int c(x)q_s(x)dx \tag{II}$$

and k is estimated by Equation III:

$$k = q^*(x)\ / \int c^*(x)^*(x)dx \tag{III}$$

Then, the probability of dying between birth and age x, denoted as $\pi(x)$, can be expressed as Equation IV:

$$\pi\ (x) = [q^*(x)\ /\ \int c^*(x)q^*(x)dx]\ \int c_s(x)q_s(x)dx \tag{IV}$$

The estimate $\pi\ (x)$ can be written as Equation V:

$$\pi\ (x) = [q^*(x) / \int c^*(x)q^*(x)dx]\ D(i) \tag{V}$$

From Equation IV, there are two possible sources of errors that can make the estimated probability of dying before age x different from that of the actual population. One is when the survey population differs from the actual population, causing the functions $c_s(x)$ and $q_s(x)$ to differ from the functions $c(x)$ and $q(x)$, respectively. The other source of error in the estimate of mortality occurs when the model chosen does not match the actual study population, resulting in differences between the functions $c^*(x)$ and $q^*(x)$, and the functions $c(x)$ and $q(x)$, respectively.

Now, suppose the model chosen for the estimation of $\pi\ (x)$ correctly represents the actual Population; but the $D(i)$ deviates by δ due to a deviation in the proportion of children dead. Then, the differential estimate, $\delta(x)$, caused by the deviation of the proportion of children dead,

δD(i), is given by Equation VI:

$$\delta\ \pi\ (x) = [q(x)\ /\ \int\ c(x)q(x)dx]\ D(i) \tag{VI}$$

In terms of proportional error, we have Equation VII

$$\delta\ \pi(x)/q(x) = [\delta Di/\int\ c(x)q(x)dx] = \delta D(i)/D(i) \tag{VII}$$

From Equation VII, we find that the proportional error in the estimate is the same as the proportional error in Di.

In this study, we extend this concept by considering the error in child mortality estimates $q(x)$ due to variation in Di caused by migration. The Brass indirect method assumes that the population whose child mortality rates are being estimated is close to migration or that there is no mortality difference among regions exchanging populations through migration (Schmertmann & Sawyer, 1996). However, the migration of women across different geographical regions within a country is a common phenomenon. When migrant women provide information about their deceased children at the time of the survey, they do not provide the geographical location where the death occurred. During the analysis of child mortality, the reported deceased children are assumed to have died in the mother's current place of residence. In this case, the deaths of children born to migrant women that occurred before the mother migrated to the current place of residence are misclassified by their geographical place of occurrence. If the migrating segment of the women's population has a different mortality regime from the recipient population, the child mortality estimates for the recipient regions will be inaccurate. This, in turn, affects the accuracy of the child mortality estimates in these regions. Several studies have also pointed out the need to account for migration when computing sub-national child mortality rates (Bocquier *et al.*, 2011; Otieno Onyango *et al.*, 2011; Schmertmann & Sawyer, 1996).

In our study, we sought to determine whether there is any statistical impact on indirect child mortality estimates

Table 1. Model functions for error analysis in indirect child mortality estimation

Function	Definitions
$q(x)$	Probability of dying between birth and age x in the actual population
$c(x)$	Density of children at age x of mothers aged x in the actual population
$q_s(x)$	Probability of dying before age x for children in the survey population
$c_s(x)$	Density of children at age x in the survey population at the time of survey
$q^*(x)$	Probability of dying before age x in the model population
$c^*(x)$	Density of children at age x of mothers aged x in the model population

Note: Adopted from Arthur & Stoto (1983).

due to rural and urban migration in Kenya. We focused on rural and urban regions primarily because of the relatively high prevalence of rural-to-urban migration in Kenya, driven by a high rate of urbanization. According to the United Nations (2019), the urban population in Kenya increased by 4.36% between 2010 and 2015 and was projected to increase by 4.23% between 2015 and 2020. Numerous studies have also highlighted disparities in child mortality between rural and urban regions or among various population segments defined by rural-urban migration status (Bocquier *et al.*, 2011; Brockerhoff, 1994; Issaka *et al.*, 2017; United Nations, 2019; Yaya *et al.*, 2019). According to Schmertmann & Sawyer (1996), the migration of women between regions with different mortality regimes can lead to erroneous child mortality estimates in those regions.

2. Data and methods

2.1. Data sources

The data used in this study were pooled from six Kenya Demographic and Health Surveys (KDHS) carried out between 1989 and 2014. The KDHS are national surveys that collect data for monitoring and evaluating the impact of various demographic and health programs. The KDHS datasets include data on birth history, age of women and children, previous place of residence, and duration of stay in the current place. Pooling estimates from several surveys and was necessary because a single survey produces a set of seven mortality estimates, which would not be sufficient for a statistical comparison. Several studies have used a similar approach of data pooling to estimate child mortality rates or to construct models that, in turn, use summary birth history data to estimate child mortality indirectly (Ayele *et al.*, 2016; Hallett *et al.*, 2010; Verhulst, 2016; Walker *et al.*, 2012; Yadava & Tiwari, 2003).

The Demographic and Health Survey data are available in the Statistical Package for the Social Sciences (IBM, 2020).

2.2. Migration status classification

Our focus was on two types of officially categorized residential regions: Rural and urban regions. These regions are mutually exclusive and exhaustive, and every cluster sampled for the survey belongs to either of the two regions. During surveys, women were asked to state their previous place of residence, categorized as either rural or urban. Based on current and previous place of residence, women fell into one of the four migration statuses:

(i) Urban non-migrants: Women who either never moved from their current urban residence or moved from one urban area to another.

(ii) Rural non-migrants: Women who always resided in their current rural areas or moved from one rural area to another.

(iii) Urban-to-rural migrants: Women who moved from an urban region after some birth experience and resided in a rural region during the survey date.

(iv) Rural-to-urban migrants: Women who moved from rural areas after some birth experience and were living in an urban area at the time of the survey.

2.3. Estimation of child mortality rates

In our investigation, we focused on three age-specific mortality rates in childhood, namely infant mortality, one-to-four mortality, and under-five mortality rates. The infant mortality rate is the probability of dying before the first birthday, expressed as the number of children who die before age one per 1000 live births in a given year. The one-to-four mortality rate is the probability of dying between the first and fifth birthdays, computed as the number of children who die after 1 year but before their fifth birthday among 1000 children who survived to the first birthday. The under-five mortality rate measures the probability of a child dying before the fifth birthday, expressed as the number of children who die before reaching age five among 1000 live births (Etikan *et al.*, 2019; KNBS & ICF Macro, 2015).

Since the indirect method uses summary birth history data, the full birth history data from KDHS were summarized into two variables: The total number of live births and the number of surviving classified by the mothers' age group. The age of the women, which is normally taken as the proxy measure of exposure (Arthur & Stoto, 1983; Bangura *et al.*, 2016; Rajaratnam *et al.*, 2010), was classified into seven 5-year age groups: 15 – 19, 20 – 24, 25 – 29, 30 – 34, 35 – 39, 40 – 44, and 45 – 49.

There are four models used for indirect child mortality estimation: The North model, the South model, the East model, and the West model. Each of these estimation models produces seven estimates for each of the three child mortality rates: The infant mortality rate, the child mortality rate, and the under–five mortality rate. These rates were computed using the QFIVE program (United Nations, 2013). The program generates the estimates using Trussell's regression equations, which are based on the Coale and Demeny model life tables (Coale & Demeny, 1966) or using the Palloni-Heligman equations based on the United Nations life table models (United Nations, 1983). Estimates based on Trussell's model were preferred because it is the third generation of Brass variant models with higher flexibility. Trussell's equations fit empirical data better and are less affected by random errors, which are common in data from small areas, such as rural or urban regions within a country. In addition, Trussell's regression equations are derived from a two parameter model, as opposed to Palloni-Heligman equations, which are derived from one parameter model. For the choice of the estimation model, we proposed the use of the mean standard error of under-five mortality based on six sets of estimates of the non-migrant population. This was done after omitting estimates associated with women aged 15 – 19 years because they are highly erratic (Neupert *et al.*, 2019). The model with the least mean standard error was considered to produce less erratic and more consistent trends in mortality estimates. Mortality estimates from non-migrant women were considered because they were not affected by the deaths of children that occurred in another region.

2.4. Analysis procedure

Our study focused on establishing the impact of migration on indirect estimates of child mortality from a statistical perspective. To describe this impact, we computed two sets of child mortality estimates per region: those based on deceased children born to all women interviewed in the region r, denoted as ${}_xq^*$r, and those based on deceased children born to non-migrant women, denoted as ${}_xq_r$. Since death is a rare occurrence, there were few cases of children reported dead born to migrant women when classified by their mothers' 5-year age group. When the number of dead children is few, the mortality estimates have large variances, making the estimates less robust. For this reason, mortality estimates from both in-migrant and out-migrant women were not considered for analysis. The mortality estimates from non-migrant women described the mortality levels of a given region if the assumption of closed migration holds. On the other hand, the estimates from combined women provide child mortality levels when the assumption is violated due to migration from regions with different levels of mortality regimes.

The difference between the two mortality rates, expressed as a percentage of the mortality rate of deceased children born to non-migrant women, is the relative percent effect due to migration. Thus, the child mortality estimate effect due to migration, ℓ, is given by Equation VIII:

$$\ell = [({}_xq^*_r - {}_xq_r)/{}_xq_r] \times 100 \tag{VIII}$$

Next, we assessed whether the effect or differences in child mortality estimates were significant when describing the child mortality of any of the two regions. Implicitly, the effect is significant if the two sets of mortality estimates are statistically different. For statistical evidence, we used a pairwise t-test to examine if the estimates computed using the data from non-migrant women were different from those computed using data from both in-migrant women and non-migrant women. During comparisons of the two sets of mortality estimates, the estimates from the non-migrant population were assumed to optimally describe the mortality for each of the two regions.

3. Results

Tables 2 and 3 show the infant (${}_1q_0$), one-to-four (${}_4q_1$), and under-five (${}_5q_0$) mortality rates based on the North life table model. This model provided estimates with the least mean standard error of under-five mortality, as described in Section 2.3. The mortality estimates computed using data from non-migrant women are given in the column labeled "non-migrant mortality estimate", while the mortality estimates computed using both non-migrant and in-migrant women are given in the column labeled "combined mortality estimate". The column labeled "% Diff" includes the relative percent difference in mortality estimates for various age groups due to the inclusion of deceased children born to in-migrant women. Except for urban mortality estimates from the 1993 survey, the overall effect of migration was an overestimation of the rates in both regions.

We now answer the question of whether the observed overestimation of childhood mortality is statistically significant. In other words, we examine if the inclusion of deceased children born to in-migrant women altered the child mortality estimates in the recipient region. Specifically, we tested the hypothesis that "There is no significant difference in child mortality estimates computed using data from non-migrant women and from combined data of non-migrant and in-migrant women." To do this, we compared the estimates under the NME and CME columns of Tables 2 and 3 using a paired sample t-test. The results of this test are presented in Table 4. These results indicate that in the urban region, all three child mortality rates obtained using data from non-migrant and in-migrant women combined were statistically higher compared to those obtained using data from non-migrant women ($p = 0.02$). This statistical significance means that the inclusion of deceased children born to rural-to-urban migrant women led to an overestimation of the infant, child, and under-five mortality rates in the urban region. On the other hand, there was no sufficient evidence to conclude that urban-to-rural migrant women altered any of the three child mortality estimates in the rural region ($p > 0.05$).

4. Discussion

A major issue associated with including in-migrant women in the computation of child mortality for any region is the

Table 2. Child mortality estimates and their percent difference for an urban region

Survey year	Age	$_1q_0$			$_4q_1$			$_5q_0$		
		NME	CME	% Diff	NME	CME	% Diff	NME	CME	% Diff
1989	20 – 24	51.6	56.4	+9.3	26.8	30.9	+15.3	77.0	85.6	+11.2
	25 – 29	50.7	50.9	+0.4	26.1	26.3	+0.8	75.5	75.9	+0.5
	30 – 34	55.1	53.7	−2.5	29.8	28.6	−4.0	83.3	80.7	−3.1
	35 – 39	65.2	67.9	+4.1	38.4	40.8	+6.3	101.0	105.9	+4.9
	40 – 44	58.8	58.0	−1.4	32.9	32.2	−2.1	89.7	88.4	−1.4
	45 – 49	60.5	63.4	+4.8	34.3	36.9	+7.6	92.7	97.9	+5.6
		Mean difference		+2.5	Mean difference		+4.0	Mean difference		+3.0
1993	20 – 24	58.8	59.5	+1.2	32.9	33.6	+2.1	89.7	91.1	+1.6
	25 – 29	58.5	61.3	+4.8	32.7	35.1	+7.3	89.3	94.3	+5.6
	30 – 34	62.3	55.0	−11.7	35.9	29.7	−17.3	96.0	83.1	−13.4
	35 – 39	54.6	52.0	−4.8	29.4	27.2	−7.5	82.4	77.8	−5.6
	40 – 44	54.7	55.4	+1.3	29.5	30.1	+2.0	82.6	83.9	+1.6
	45 – 49	56.2	57.3	+2.0	30.8	31.6	+2.6	85.3	87.1	+2.1
		Mean difference		−1.2	Mean difference		−1.8	Mean difference		−1.4
1998	20 – 24	68.1	71.4	+4.8	40.9	43.8	+7.1	106.2	112.1	+5.6
	25 – 29	52.0	59.1	+13.7	27.2	33.2	+22.1	77.7	90.3	+16.2
	30 – 34	32.3	41.6	+28.8	11.4	18.6	+63.2	43.3	59.4	+37.2
	35 – 39	45.3	49.9	+10.2	21.6	25.4	+17.6	65.9	74.0	+12.3
	40 – 44	40.9	50.4	+23.2	18.0	25.8	+43.3	58.2	74.9	+28.7
	45 – 49	56.0	66.4	+18.6	30.6	39.5	+29.1	84.8	103.3	+21.8
		Mean difference		+16.6	Mean difference		+30.4	Mean difference		+20.3
2003	20 – 24	56.2	80.5	+43.2	30.7	52.2	+70.0	85.1	128.5	+51.0
	25 – 29	62.1	71.5	+15.1	35.7	44.0	+23.2	95.6	112.3	+17.5
	30 – 34	67.5	68.3	+1.2	40.4	41.1	+1.7	105.1	106.6	+1.4
	35 – 39	57.7	58.7	+1.7	32.0	32.8	+2.5	87.9	89.6	+1.9
	40 – 44	68.9	67.6	−1.9	41.6	40.5	−2.6	107.7	105.3	−2.2
	45 – 49	68.2	77.1	+13.0	41.0	48.9	+19.3	106.4	122.2	+14.8
		Mean difference		+12.1	Mean difference		+19.0	Mean difference		+14.1
2008/9	20 – 24	49.5	51.4	+3.8	25.1	26.7	+6.4	73.4	76.7	+4.5
	25 – 29	47.3	58.3	+23.3	23.3	32.5	+39.5	69.5	88.9	+27.9
	30 – 34	45.6	49.3	+8.1	21.9	24.9	+13.7	66.5	73.0	+9.8
	35 – 39	55.0	67.6	+22.9	29.7	40.5	+36.4	83.1	105.4	+26.8
	40 – 44	35.4	50.4	+42.4	13.6	25.9	+90.4	48.6	75.1	+54.5
	45 – 49	36.6	47.4	+29.5	14.5	23.3	+60.7	50.6	69.6	+37.5
		Mean difference		+21.7	Mean difference		+41.2	Mean difference		+26.8
2014	20 – 24	39.2	39.4	+0.5	16.6	16.8	+1.2	55.1	55.5	+0.7
	25 – 29	36.5	38.7	+6.0	14.5	16.2	+11.7	50.5	54.2	+7.3
	30 – 34	40.6	42.9	+5.7	17.7	19.6	+10.7	57.6	61.6	+6.9
	35 – 39	43.5	45.6	+4.8	20.2	21.9	+8.4	62.8	66.5	+5.9
	40 – 44	55.0	51.9	−5.6	29.7	27.1	−8.8	83.1	77.7	−6.5
	45 – 49	52.1	56.8	+9.0	27.3	31.3	+14.7	77.9	86.3	+10.8
		Mean difference		+3.4	Mean difference		+6.3	Mean difference		+4.2

Notes: (i) NME refers to the mortality estimate obtained from non-migrant women, and CME refers to the mortality estimate obtained from non-migrant women and in-migrant women combined. (ii) $_1q_0$, $_4q_1$, and $_5q_0$ refer to infant mortality, one-to-four mortality rate, and under-five mortality rate, respectively. (iii) % Diff is the difference between mortality estimate of non-migrant women and combined women expressed as a percent of mortality estimates of non-migrant.

Abbreviations: NME: Non-migrant mortality estimate; CME: Combined mortality estimate.

Table 3. Child mortality estimates and their percent difference for a rural region

Survey year	Age	$_1q_0$			$_4q_1$			$_5q_0$		
		NME	CME	% Diff	NME	CME	% Diff	NME	CME	% Diff
1989	20 – 24	73.9	76.7	+3.8	46.1	48.6	+5.4	116.6	121.6	+4.3
	25 – 29	63.1	62.4	−1.1	36.6	36.0	−1.6	97.5	96.1	−1.4
	30 – 34	66.0	65.9	−0.2	39.1	39.0	−0.3	102.5	102.3	−0.2
	35 – 39	65.6	64.5	−1.7	38.7	37.8	−2.3	101.7	99.8	−1.9
	40 – 44	70.8	70.4	−0.6	43.3	43.0	−0.7	111.0	110.4	−0.5
	45 – 49	70.0	69.9	−0.1	42.6	42.5	−0.2	109.7	109.5	−0.2
		Mean difference		0.0	Mean difference		+0.1	Mean difference		0.0
1993	20 – 24	73.7	72.8	−1.2	45.8	45.1	+5.4	116.1	114.6	−1.3
	25 – 29	62.7	62.5	−0.3	36.3	36.1	−1.6	96.7	96.4	−0.3
	30 – 34	69.7	69.4	−0.4	42.3	42.1	−0.3	109.1	108.6	−0.5
	35 – 39	68.2	69.8	+2.3	41.0	42.4	−2.3	106.4	109.3	+2.7
	40 – 44	69.5	70.0	+0.7	42.2	42.6	−0.7	108.8	109.6	+0.7
	45 – 49	70.0	70.3	+0.4	42.6	42.9	−0.2	109.6	110.2	+0.5
		Mean difference		+0.3	Mean difference		+0.1	Mean difference		+0.3
1998	20 – 24	72.9	76.4	+4.8	45.1	48.3	+7.1	114.7	121.0	+5.5
	25 – 29	68.9	67.9	−1.5	41.6	40.7	−2.2	107.6	105.8	−1.7
	30 – 34	73.2	73.0	−0.3	45.4	45.2	−0.4	115.3	114.9	−0.3
	35 – 39	60.0	59.6	−0.7	34.0	33.6	−1.2	92.0	91.2	−0.9
	40 – 44	70.8	69.9	−1.3	43.3	42.5	−1.8	111.0	109.5	−1.4
	45 – 49	76.6	75.9	−0.9	48.5	47.9	−1.2	121.4	120.1	−1.1
		Mean difference		0.0	Mean difference		+0.1	Mean difference		0.0
2003	20 – 24	76.9	77.2	+0.4	48.8	49.1	+0.6	122.0	122.5	+0.4
	25 – 29	69.8	71.1	+1.9	42.4	43.6	+2.8	109.3	111.6	+2.1
	30 – 34	65.9	67.4	+2.3	39.0	40.3	+3.3	102.4	105.1	+2.6
	35 – 39	80.8	80.3	−0.6	52.4	52.0	−0.8	129.0	128.1	−0.7
	40 – 44	58.5	59.0	+0.9	32.7	33.1	+1.2	89.3	90.2	+1.0
	45 – 49	72.0	73.9	+2.6	44.4	46.1	+3.8	113.3	116.6	+2.9
		Mean difference		+1.3	Mean difference		+1.8	Mean difference		+1.4
2008/9	20 – 24	65.2	64.7	−0.8	38.4	38.0	−1.0	101.1	100.2	−0.9
	25 – 29	53.2	56.6	+6.4	28.2	31.0	+9.9	79.9	85.8	+7.4
	30 – 34	53.1	53.8	+1.3	28.2	28.7	+1.8	79.8	80.9	+1.4
	35 – 39	53.9	54.7	+1.5	28.8	29.5	+2.4	81.1	82.6	+1.8
	40 – 44	63.4	61.9	−2.4	36.9	35.5	−3.8	97.9	95.2	−2.8
	45 – 49	62.3	62.7	+0.6	35.9	36.2	+0.8	95.9	96.6	+0.7
		Mean difference		+1.1	Mean difference		+1.5	Mean difference		+1.3
2014	20 – 24	41.4	41.8	+1.0	18.4	18.7	+1.6	59.0	59.8	+1.4
	25 – 29	41.0	41.7	+1.7	18.1	18.7	+3.3	58.3	59.6	+2.2
	30 – 34	43.2	43.9	+1.6	19.9	20.4	+2.5	62.2	63.4	+1.9
	35 – 39	49.4	49.1	−0.6	25.0	24.8	−0.8	73.1	72.6	−0.7
	40 – 44	48.4	49.7	+2.7	24.2	25.3	+4.5	71.4	73.8	+3.4
	45 – 49	52.0	51.3	−1.3	27.2	26.6	−2.2	77.9	76.6	−1.7
		Mean difference		+0.9	Mean difference		+1.5	Mean difference		+1.1

Notes: (i) NME refers to the mortality estimates obtained from non-migrant women, and CME refers to the mortality estimates obtained from non-migrant women and in-migrant women combined. (ii) $_1q_0$, $_4q_1$, and $_5q_0$ refer to infant mortality, one-to-four mortality rate, and under-five mortality rate, respectively. (iii) % Diff is the difference between mortality estimate of non-migrant women and combined women expressed as a percent of mortality estimates of non-migrant.

Abbreviations: NME: Non-migrant mortality estimate; CME: Combined mortality estimate.

Table 4. Paired sample t-test results between NME and CME for urban and rural regions

Child mortality rate	Mean (NME minus CME)	Std. error	*p*-value
Urban region			
$_1q_0$	−4.292	1.009	0.002
$_4q_1$	−3.63	0.864	0.002
$_5q_0$	−7.600	1.787	0.002
Rural region			
$_1q_0$	−0.336	0.201	0.106
$_4q_1$	−0.292	0.175	0.111
$_5q_0$	−0.597	0.356	0.106

Notes: (i) $_1q_1$, $_4q_1$, and $_5q_0$ refer to infant mortality, one-to-four mortality rate, and under-five mortality rate, respectively. (ii) NME refers to the mortality estimates obtained from non-migrant women, and CME refers to the mortality estimates obtained from non-migrant women and in-migrant women combined. (iii) The mean for each indicator was estimated from 36 rates (six surveys with six age groups each [age group 15 – 19 was dropped due to the very small number of women who had a child in this group]).
Abbreviations: NME: Non-migrant mortality estimate; CME: Combined mortality estimate.

presence of two sets of mortality data: One for children who died in the migrated women's previous place of residence and another for children who died in their current place of residence. In the survey data from Kenya, the date of death of a child is usually provided in months and years, while the date of migration is given in years. This discrepancy makes it challenging to determine the geographical region where some children of migrant women died. Furthermore, the Brass indirect technique typically requires a large number of births and deaths because estimates from small samples are highly susceptible to random errors. Consequently, we were not able to compute mortality estimates for children born to migrant women alone due to the limited number of deceased children born to this group. To address these challenges, our analysis compared mortality estimates for deceased children born to in-migrant and non-migrant women combined with those born to non-migrant women. The difference between the two estimates was attributed to migration.

The results of the pairwise *t*-test demonstrate that migration led to an overestimation of the infant, child, and under-five mortality rates in both rural and urban regions. This impact was significant in the urban region but not in the rural region. Overestimation of mortality rates in the urban region suggests that rural-to-urban migrant women had experienced relatively higher mortality in the rural region before migrating compared to urban non-migrant women. Evidence to support this explanation comes from earlier studies in Kenya that suggest child mortality was higher in rural regions compared to urban regions before the 2010s (Kimani-Murage *et al.*, 2014; Kenya National Bureau of Statistics (KNBS), & International Classification Function (ICF), Macro, 2015). Previous studies from other countries also indicate a significant rural-urban gap in child mortality, with urban areas enjoying some advantages over rural regions (Bocquier *et al.*, 2011; Brockerhoff, 1994; Issaka *et al.*, 2017; Yaya *et al.*, 2019). Factors such as access to and utilization of health services, including immunization, the use of oral rehydration therapy for diarrhea treatment, and the provision of healthcare services by professionals in urban areas, are cited as key contributors to the rural-urban child mortality gaps (Govindasamy *et al.*, 1993).

Ideally, if the rural region were experiencing a higher mortality rate than the urban region, we would expect an underestimation in the rural region due to urban-to-rural migrant women (Schmertmann & Sawyer, 1996). On the contrary, our study demonstrates that the migration of women from urban to rural regions led to a slight overestimation of infant, child, and under-five mortality rates in the rural region. This slight overestimation of child mortality rates in rural regions due to deceased children born to migrant women from urban regions suggests the possibility of return migrants with higher mortality experiences. Previous studies have shown that many migrants from rural to urban regions often end up living in deplorable conditions, such as slums with inadequate social services (Madise *et al.*, 2003; Van De Poel *et al.*, 2007). After failing to realize their economic dreams in urban regions, these individuals return to their original rural regions. Our results concur with the study by Andersson & Drefahl (2017), which reveals that return migrants usually have elevated mortality. Moreover, our study aligns with the study by Otieno Onyango *et al.* (2011), which shows that children born to migrant mothers have a higher risk of mortality than those born to non-migrant women. Supporting evidence also comes from Issaka *et al.* (2017), who, by pooling data from 27 sub-Saharan African countries, showed elevated under-five mortality for rural non-migrant (by 40%), rural-to-urban migrants (by 43%), and urban-to-rural migrants (by 20%) in comparison to urban non-migrants.

We also noted some anomalies in the results of the 1993 survey. These results indicate an underestimation of child mortality rates in urban regions. This discrepancy can be attributed to the structural adjustment program implemented in Kenya during the early 1990s, which prompted a significant urban-to-rural migration due to economic hardships in urban areas (Government of Kenya, 1996). Our findings have several implications for both programming and monitoring. First, there is an impact on the estimation of rural-urban child mortality disparities. The results presented in Table 4 reveal that child mortality rates in the urban region were overestimated, indicating that the child mortality disparities between rural and urban regions in Kenya were larger than previously estimated. Second, the findings have implications for analyzing child mortality trends in rural and urban regions. For example, some studies in Kenya (Kenya National Bureau of Statistics (KNBS), & International Classification Function (ICF), Macro, 2015; Kimani-Murage *et al.*, 2014) suggest that urban advantage in child survival disappeared in favor of rural regions between the late 2000s and early 2010s. However, these studies did not account for the impact of rural-urban migration, which could distort the child mortality estimates and, consequently, the direction and extent of child mortality disparities between the two regions. Although child survival in rural Kenya has made notable improvements, one must then question whether the documented timing of convergence in child mortality between rural and urban regions in these studies is real or merely an artifact of estimation procedures. Evidence from this study indicates that the latter is true. This finding calls for a re-estimation of trends in child mortality rates in the two regions for better policy direction.

The major strength of this study lies in empirically establishing how migration altered child mortality estimates in the urban region of Kenya from a statistical point of view, a point that has not been addressed previously. By pooling data from several surveys, we obtained sufficient estimates, which enabled us to carry out meaningful statistical comparisons. However, the study had some limitations that could have affected the accuracy of rural and urban child mortality estimates. First, the study exclusively focused on recent migration between rural and urban areas without accounting for circular migration, a common occurrence among short-distance migrants. Second, it was assumed that women often stay with their children in the same place of residence. However, sometimes, women in urban areas may send their children to live with their relatives in rural areas to reduce the cost of living. These children are included when computing child mortality in the region where the mother resides, which can lead to errors in estimating child mortality due to a reduction in the proportion of deceased children in that region. In addition, data quality issues such as underreporting of deceased children can affect the mortality estimates. However, evidence from KDHS reports indicates that errors such as omissions of births and deaths are not severe (KNBS, 2015).

5. Conclusion

This study statistically affirmed that the inclusion of mortality information from children born to women who migrated from rural to urban areas in Kenya between the late 1980s and early 2010s led to an overestimation of child mortality rates in urban regions. This overestimation occurred because, during this period, child survival in rural regions was significantly lower than in urban areas. The period is also characterized by a persistently high rate of rural-to-urban migration, leading to a situation where children who died in rural regions were reported by migrant women as if they had died in urban regions. Our study highlights the necessity for the re-estimation of child mortality trends in both rural and urban areas, considering the impact of migration. This adjustment would provide a better understanding of the effectiveness of various interventions aimed at increasing child survival. It would also facilitate a meaningful comparison of child mortality between rural and urban regions. In addition, future studies could explore migration within specific determinants of child mortality, such as changes in economic status.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: Alfred Kathare, Titus Agwanda
Formal analysis: Alfred M. Kathare
Investigation: All authors
Methodology: Alfred M. Kathare
Writing – original draft: Alfred M. Kathare
Writing – review & editing: Titus O. Agwanda, Kimani Murungaru
All the authors have read this manuscript and approved the version for publication.

Ethics approval and consent to participate

The KDHS data used in this study is from the MEASURE DHS repository. The data analysis in this study was, therefore, performed under the original consent provided under ICR Macro.

Consent for publication

This research article is published under the original ethical approvals and consents of participation provided during the original data collection by ICR Macro.

Availability of data

The original data used in this study are available from the MEASURE DHS repository. It can be accessed through https://dhsprogram.com/data/.

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ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Long-term impact of mortality on population age structures

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Abstract

In this study, we tested the hypothesis that mortality has a greater influence than fertility on shaping population age structures in the long run and that recent mortality rates provide a satisfactory initial approximation for describing observed age structures in most empirical cases. In the theoretical part of this article, we elucidate a potential fallacy in the line of reasoning based on simulations and counterfactuals frequently used to attribute population aging to low fertility rates. The alternative view that we propose leads us to hypothesize that age structures conform, albeit not exclusively, to a standard derived from survival conditions: the age structure of a stationary population within a given period. We tested this hypothesis on all countries, using the data from the United Nations database (1951 – 2021) and specifically on 10 European countries using the data from the Human Mortality Database (1860 – 2019). The empirical results indicate that current survival conditions sufficiently explain a significant portion of the observed age structure across all examined countries and epochs. However, deviations from this underlying, long-term (mortality-driven) path exist, which our approach cannot fully explain. This is where the role of fertility arguably becomes more prominent. Several implications arise from our findings, including the debate on the relative role of fertility and mortality in shaping age structures in the long run, the theoretical meaning and practical use of cross-sectional life tables, and the notion and measure of demographic dividends.

Keywords: Age structure; Aging; Stationary population; Mortality; Fertility; Index of dissimilarity

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1. Introduction

This article focuses on the determinants of population age structures and their evolution, with special regard to population aging. In this field, there is a significant divide between expert opinions, as shown in the excerpt below:

> "Why are populations of rich countries so much older today than they were a century or two ago?... Is the main driver falling mortality and lengthening life, or is it falling birth rates and slowing population growth? Common sense suggests that longer life is responsible for population aging, but decades ago, the work of demographers such as Coale (1956; 1957) and Keyfitz (1975) persuaded us that, in fact, fertility decline was more important. More recently, a new wave of demographic analysis suggests that mortality decline is the main demographic source of continuing population

aging. Here we... consider this possibility, but reject it." (Lee & Zhou, 2017, p.285-287)

Ignoring migration, which is indeed a minor force in this case, population aging may depend primarily on low fertility or low mortality. To assess which is the case, two main types of analysis have been proposed in the literature: (i) simulations/counterfactuals and (ii) empirical (decomposition) analysis. Simulations and counterfactuals, introduced by Coale in 1956 and subsequently adopted by various scholars such as Bengtsson & Scott (2005; 2010), remain a valid, possibly even the best approach to the topic (Lee & Zhou, 2017).

Simulations are typically done in four steps: (i) A population of the past is selected as a starting point (e.g., Sweden in 1860); (ii) one of its two demographic "behaviors" (e.g., fertility) is artificially kept constant, while the other (mortality) is, also artificially, forced to follow its observed historical path; (iii) after some time, three age structures are compared: the two observed ones, at the start and the end of the simulation period, and the hypothetical final one, obtained through simulation; and (iv) based on the distance between these age structures, conclusions are drawn on the relative structural impact of the two processes, fertility and mortality. The conclusion invariably drawn is that "equivalent changes" in fertility and mortality (equivalent in terms of the resulting growth rate, for instance) do not affect age structures in the same way: the former weighs considerably more than the latter. While this line of reasoning is correct to answer questions of the type "if … then …", it does not necessarily lead to valid conclusions when it comes to interpreting reality because it assumes that the conditions grouped in the premise (the "if") may in fact materialize, which may be questionable (e.g., Fernandes *et al.*, 2023; Murphy, 2017; 2021). In addition, the outcomes of counterfactuals and simulations depend heavily on the initial conditions, that is, on the starting date, which is arbitrary (Murphy, 2017).

One alternative to simulations is the decomposition analysis launched by Preston *et al.* (1989) and later applied by several other scholars (e.g., Caselli & Vallin, 1990; Fernandes *et al.*, 2023; Murphy, 2017; Preston & Stokes, 2012). In more recent studies, the typical steps are as follows: (i) selecting a synthetic indicator of the age structure, often the average age, A_t; (ii) observing its changes over time alongside fertility, mortality, and migration indicators (birth, death, and mortality rates, respectively); and (iii) evaluating factors (fertility, mortality, or migration) with the greatest influence on the variation of A_t. The typical conclusion of these studies is nuanced (Fernandes *et al.*, 2023): the influence of declining fertility was stronger in the past but lesser in recent times, when the role of mortality has started to emerge, occasionally becoming prevalent, especially where the survival rate is high (Murphy, 2017; Preston *et al.*, 1989; Preston & Stokes, 2012). In all cases, migration was consistently found to be irrelevant.

We join the debate on the determinants of age structures advancing the hypothesis that survival is the main driving force at play, not just in recent times or developed countries, and that recent survival suffices to "explain" most of the dependent variable, the observed age distribution, at any point in time. To test our hypothesis, we compare two age structures, the observed and the "standard" one, the latter being the age structure of the stationary population associated with recent survival conditions. The comparison is conducted systematically for all the countries and periods for which reliable data are available. In Section 1.1, we outline our hypotheses in detail and the indicators used to corroborate them. In Section 2, we specify our sources and describe how we treated the data therein. In Section 3, we present our results, beginning with the case of China, considering all world countries over a relatively short period (1951 – 2021), and subsequently, we focus on a small group of countries with long time series data dating back to 1860. Section 4 discusses the theoretical and practical implications of our findings. Section 5 is devoted to the conclusions that can be derived from this study.

1.1. Hypothesis and indicators

Our hypothesis is that mortality (its level, not its variation) is the prevailing force that shapes population age structures. This hypothesis derives from the classical interpretation of the demographic transition, according to which the old demographic equilibrium (*ancien régime*), characterized by high birth and death rates, crumbled under the pressure of declining mortality, a process that started towards the end of the 18th century in Europe (Davis, 1963; Dyson, 2010; Kirk, 1996). In this interpretation, mortality is the leading force in the complex interplay of demographic variables; everything else adapts more or less rapidly to the constraints imposed by changing survival conditions. If this is true, mortality should also "explain" the age structure.

To test this expectation, (i) we ignore fertility and migration; (ii) we focus exclusively on mortality (or better, on its complement, survival, and in particular on the years of life lived, or L_x series, of a life table); (iii) we further restrict our attention to *recent* survival (i.e., we consider only a life table calculated either in the same year *t,* in which the population age structure is observed or in a preceding year, as close to *t* as possible); and (iv) we measure what share of the observed age structure

(P_x – population by age) can be "explained" using only the L_x series. A close correspondence between reality and model predictions (i.e., a high share of the population correctly classified by age, based only on a recent life table) is, in our interpretation, consistent with our claim that mortality is the most relevant force at play in shaping age structures.

To develop our approach, we introduce some notations. We denote vectors using bold font and define $\mathbf{P}_t = P_{x,t}$ and $\mathbf{L}_t = L_{x,t}$, as the population and years of life lived at age x at time t (where $\mathbf{L}_t$, signifies the period ending in year t). The $\mathbf{L}_t$ series, which depends exclusively on the current survival (or mortality) conditions, can also be interpreted as the stationary population associated with the life table of period t. Both $\mathbf{P}_t$ and $\mathbf{L}_t$ encompass a dimensional element that is to be eliminated, focusing exclusively on structures. This can be achieved by dividing both series by their corresponding totals (Equation I):

$$\boldsymbol{c}_t = c_{x,t} = \frac{P_{x,t}}{\sum_x P_{x,t}} \text{ and } \boldsymbol{c}_t^* = c_{x,t}^* = \frac{L_{x,t}}{\sum_x L_{x,t}} \quad \text{(I)}$$

where the asterisk denotes the stationary case, which we interpret as the standard of reference in the remainder of this article. Both $\boldsymbol{c}_t$ and $\boldsymbol{c}_t^*$ represent age structures at time t $\left(\sum c_x = \sum c_x^* = 1\right)$, corresponding to the observed and stationary population, respectively.

As per the weak ergodicity theorem (Lopez, 1961), in all populations, the age structure that can be observed at instant t, denoted as $\mathbf{c}_t$, depends on a very long history of survival ($\boldsymbol{c}_t^*, \boldsymbol{c}_{t-1}^*, \ldots$), fertility ($\boldsymbol{F}_t$, $\boldsymbol{F}_{t-1}$,…), and migration ($\boldsymbol{M}_t$, $\boldsymbol{M}_{t-1}$,…) from periods ending in t, t-1,…

$$\boldsymbol{c}_t = f(\boldsymbol{c}_t^*, \boldsymbol{F}_t, \boldsymbol{M}_t; \boldsymbol{c}_{t-1}^* \boldsymbol{F}_{t-1}, \boldsymbol{M}_{t-1}; \ldots) \quad \text{(II)}$$

with recent years weighing more than remote ones. In this article, we argue that mortality is the main force at play in the long run. To prove our assertion, we simplify Equation II considerably, proposing Equation III:

$$\boldsymbol{c}_t \approx \boldsymbol{c}_t^* \quad \text{(III)}$$

The equation implies that by ignoring fertility, migration, and also past mortality; we can achieve a fairly good approximation of reality.

Age structures are multidimensional, making comparisons difficult, especially over time, which can be considered an additional dimension of the problem. We circumvent this difficulty by transforming both age structures, $\boldsymbol{c}_t$ and $\boldsymbol{c}_t^*$, into one-dimensional indicators, such as the old-age dependency index (OADI) (Equation IV):

$$OADI = \frac{P_{65+}}{P_{15-64}}; \; OADI^* = \frac{L_{65+}}{L_{15-64}} \quad \text{(IV)}$$

or the average age of the population, A (Equation V):

$$A = \sum x c_x; A^* = \sum x c_x^* \quad \text{(V)}$$

In both cases, the purpose is to compare the evolution of the asterisked indicator (which follows our hypothesis of Equation III and is assumed to be the driving force) with that of the corresponding non-asterisked empirically observed indicator. In practice, given the consistent behavior of these indicators (along with others not shown here), as discussed in Section 3.1, the focus will only be on one of them, the average age (A).

If our hypothesis holds, i.e., if Equation III is a reasonable approximation of the more complex reality represented by Equation II, what we expect to find with these indicators is exemplified in Figure 1. Figure 1A predicts that the evolution of the two indicators (same indicator but calculated separately on the stationary and the observed population) will be approximately the same, i.e., that their time paths will remain relatively close to each other. Figure 1B conveys the same message, but now time is implicit in the succession of observations (from left to right, denoting improved survival), and each point is expected to lie not far from the bisector, representing a theoretical case where the two indicators, standard and observed, possess identical values.

Comparing the standard and the observed population in this way has one disadvantage: it is difficult to evaluate the degree of approximation introduced by our hypothesis (Equation III) because there is no conventionally accepted "confidence interval" within which the distance between the two indicators should normally fall. Another minor drawback is the risk of "compensation": two age distributions may occasionally result in similar synthetic indicators (e.g., almost the same average age) even if the original distributions differ. To circumvent both shortcomings, we computed the index of the dissimilarity, ID (Equation VI), which provides the proportion of units of either distribution that should be moved to a different age groups to make the two distributions identical.

$$ID = \frac{1}{2} \sum_x \left| c_x - c_x^* \right| \quad \text{(VI)}$$

In our case, without loss of generality, we assume that the $\boldsymbol{c}_t^*$ series, derived from the stationary age structure, acts as a standard and that only the units in $\mathbf{c}_t$ can and must be relocated, so that, ultimately, $\boldsymbol{c}_t = \boldsymbol{c}_t^*$. ID ranges from 0,

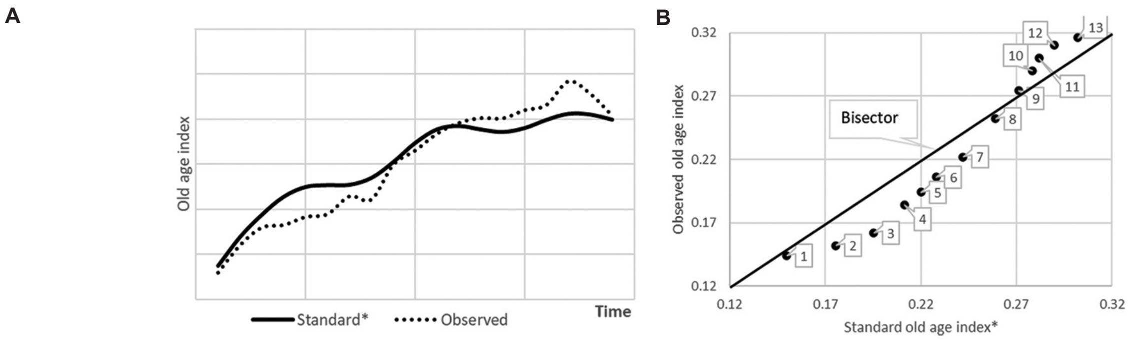

Figure 1. (A and B) Illustrative example of the evolution of a structural indicator (e.g., an old age index) calculated on the standard* and on the observed population in the same periode.

Notes: The numerical values in Figure 1B have the only purpose of highlighting that as time passes (from the first to the last observation, a total of 13 of them), the indicator evolves, e.g., because of population aging. The continuous lines represent the bisector of the figure; all data points would lie on the bisector if the observed age structure coincides with the standard at all times. (*) means a standard indicator is calculated on the L_x series of the life table of the same period.

when the two distributions are identical, to 1, when they never overlap. For instance, if ID = 15%, the compared distributions overlap by 85%, which means that 85% of the units in $\mathbf{c}_t$, are correctly classified into their respective age groups, assuming that c_t^* is the appropriate standard.

2. Data sources and data organization

We obtained our data from two renowned sources: the Human Mortality Database (HMD), available at https://www.mortality.org/, and the database of the World Population Prospects 2022, accessible at https://population.un.org/wpp/(United Nations, 2022). Both are freely accessible, with a large set of well-controlled data from different countries and epochs. To minimize data-related issues:

(i) For the United Nations (UN) case, the analysis was restricted to relatively large countries (each with a population of at least 1 million people in all the years between 1951 and 2021) to reduce the influence of random variations. We also excluded two countries, Cambodia and North Korea, due to exceptionally high mortality during the wars of 1976 and 1951, respectively. This left us with 131 countries (and, separately analyzed, six regions: Africa, Asia, Europe, Latin America and the Caribbean, Northern America, and Oceania), each observed 15 times at 5-year intervals from 1951 to 2021.

(ii) For the HMD case, the analysis was focused on relatively recent data (post-1860), aiming at countries with the longest possible series: Belgium, Denmark, Finland, France, Italy, Norway, the Netherlands, Spain, Sweden, and Switzerland. This selection strikes a reasonable compromise between data quality (generally very high in the HMD, but somewhat lower for very remote years), length of series, and sample size.

In both cases, we used the two series of data presented above, $\mathbf{P}_t$ and $\mathbf{L}_t$, and transformed them into relative values, c_t and c_t^*, respectively. Age was consistently grouped into 5-year intervals: x = 0–4; 5–9;…, 95–99; 100+. However, time t was treated slightly differently in the two cases: (i) for UN data, $\mathbf{P}_t$ and $\mathbf{L}_t$ referred to the population of specific years, spaced by 5 years. We selected those ending in 1 and 6 (1951, 1956,…, 2021), resulting in 15 observations for each country or region; (ii) for HMD data, both $\mathbf{P}_t$ and $\mathbf{L}_t$ represented averages over 5-year intervals (e.g., t = 1860–64; 1865–69;…). This provided a total of 32 potential observations for each country, except that not all of them were present at all times (see Section 3.3). We decided to work in 5-year intervals with both datasets, partly to preserve symmetry with age groups and partly because the phenomena that we observe (changes in the age structure) are not sufficiently dynamic to justify an analysis using a single calendar year.

3. Results

3.1. China as an example

To clarify the issue, our approach, and our measures, China was considered as an example. China served as a good candidate owing to its large population and rapid demographic transition, starting in the second half of the 20th century. This was believed to counter our hypothesis because its abrupt fertility decline has greatly affected its age structure in the recent past and to this day. Only for the Chinese case (not for the global analysis of the next sub-sections, referred to as all world countries), we extended our analysis to 2051 using UN projections (medium variant). With a limited margin of uncertainty, this permitted us to better appreciate the long-term consequences of such an accelerated demographic transition.

Figure 2 presents the evolution of two synthetic indicators of age structure: the average age of the Chinese population, *A* (panels on the left), and the OADI (panels on the right). Both indices were calculated twice: first on the observed population (or projected one, for the years 2026 – 2051) and then on the standard (stationary) population of the same period. Both indices are presented twice: as a time series (top panels) and as a scatter diagram (bottom panels). In the latter case, the bisector is drawn; it represents the theoretical case when the two indexes (observed and standard) give the same result.

A few insights can be learned from this example. First, both structural measures convey the same message, and in the following sections, only the average age (A) is utilized. Second, the scatter point representation (bottom panels) saves space, which is useful when the dataset increases (this type of representation is used in the next sections). With the omission of tags (for reasons of space), the time dimension is lost, but it can be imagined as a rightward movement because as time passes, survival conditions improve, and this makes the standard (stationary) population older. Based on our hypothesis, this is the main driving force behind population aging, and this is precisely the third aspect that emerges from the Chinese example: empirical data evolved more or less in accordance with our expectations. In the Chinese case, to be sure, the difference between model predictions and observed data is larger than in Figure 1, but the general tendency is the same: there is an underlying "normal" value for each chosen indicator (the standard one, with an asterisk). Shocks may, and usually do, hit populations, driving the age structure and its indicators away from their usual shape and levels: be it a war, demographic transition, or economic crisis. In the following years, however, the effects of these shocks tend to be reabsorbed, and little by little, things tend to get back to normal. However, the standard has changed because it is determined by the constantly evolving survival conditions.

The same conclusions emerged from the analysis of the dissimilarity (ID) index. Firstly, it should be noted that it is always low: 23% in the worst year (1976), 16% on average over the past 70 years (1951 – 2021), and likely to be even lower in the future (12%; 2026 – 2051; Figure 3). This means that the share of Chinese who are classified correctly by age (5-year age groups) using the corresponding stationary population (i.e., assuming that current mortality is the only force at play) is about 84% on average and never below 77%, even in the worst year. This means that all other factors combined (previous mortality, fertility, and migration) compete to explain only about 16% of the Chinese age structure on average.

Figure 4 displays the observed and standard (stationary) Chinese age structures in selected years. At all times, the effects of past waves of fertility (high until the 1960s and

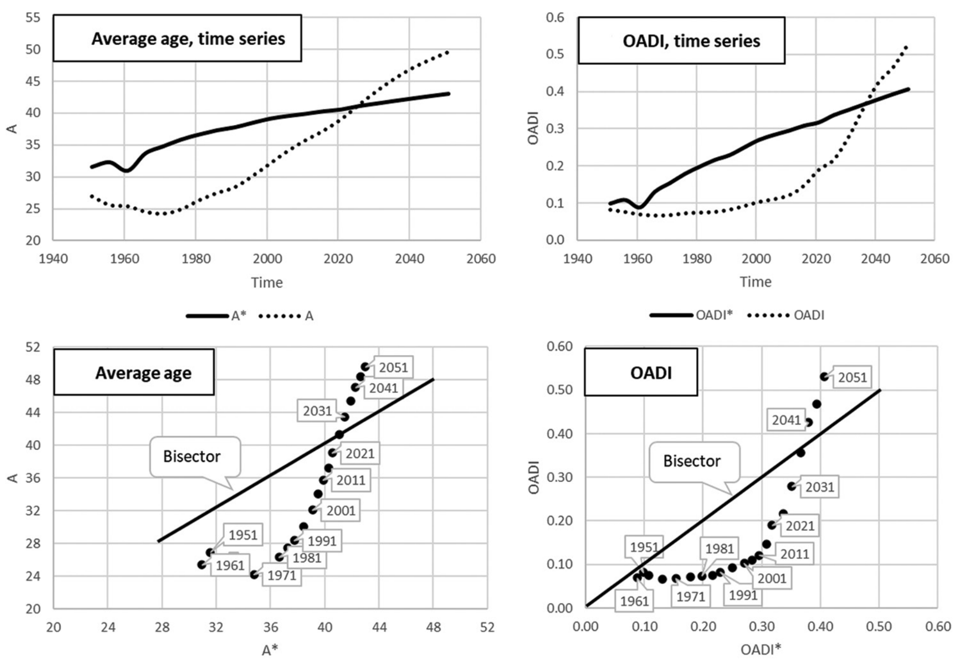

Figure 2. Structural indicators of the observed (or projected) population and the standard (stationary) population (*) of China, 1951 – 2051 (United Nations (2022).

Note: Standard values [*] are calculated for the stationary population. Abbreviations: A: Average age of population (Equation V); OADI: Old-age dependency index (Equation IV).

very low nowadays) are clearly visible. Yet, despite these rather extreme variations, current survival conditions, as expressed by the L_x series, "explain" a large share of the observed age structure, at least 78% in the worst year (1981), and much more in periods of more gradual change.

3.2. Results for all world countries (1951 – 2021)

In this section, not just China but all world countries with at least one million inhabitants were considered. Figure 5 (left panel) reveals the association between the standard average age (A*) of the corresponding stationary population and the observed average age (A). Quadratic interpolation provided an insight into how the relationship has evolved for different values of A*, or, in practice, over time, because higher values of A* correspond to better survival conditions. Most countries went through their demographic transition in the period under observation (1951 – 2021), and this explains why most of the observed points are under the bisector, which means that populations are younger than they "should" be if mortality were the only force at play. However, the results also suggest that this "unbalanced" phase is temporary: the distance from the bisector increased at first (until A* reaches approximately 36 years, corresponding to a life expectancy [e_0] of approximately 60 years) but tends to decrease over time. The points can be imagined as "moving" rightward (toward better survival conditions), forming a sort of wave that oscillates around the bisector, where A = A*.

The same tendency, with less "noise," emerges in the right panel of Figure 5, displaying world regions. In both cases, the underlying pattern seems to be the same as that observed in China (Figure 2) and is hypothesized in our model (Figure 1). Most of the data points in Figure 5 fall below the bisector, but this is due to the demographic peculiarities of the observation period. As good demographic data are generally available only for the recent past, in most cases after the beginning of the demographic transition, the bulk of the information that we get refers to the "first wave" of the scheme of Figure 1 (right panel), where the data points are below the bisector. In Figure 5 and the following sections, we do not include projections for the future because their validity may be questioned, even when they come from authoritative institutions, and because, in all cases, projections cannot be treated as observations. Had these projected data points been plotted in Figure 5, the resulting scheme would have been even closer to that shown for China (Figure 2, bottom panels), with data points both above and below the bisector.

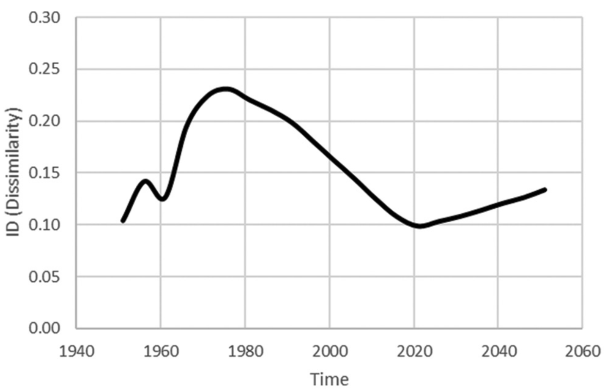

Figure 3. Index of dissimilarity (ID) between the standard (stationary) and the actual age structure (China, 1951 – 2021) (United Nations, 2022). Note: The formula for the ID index is given in Equation VI.

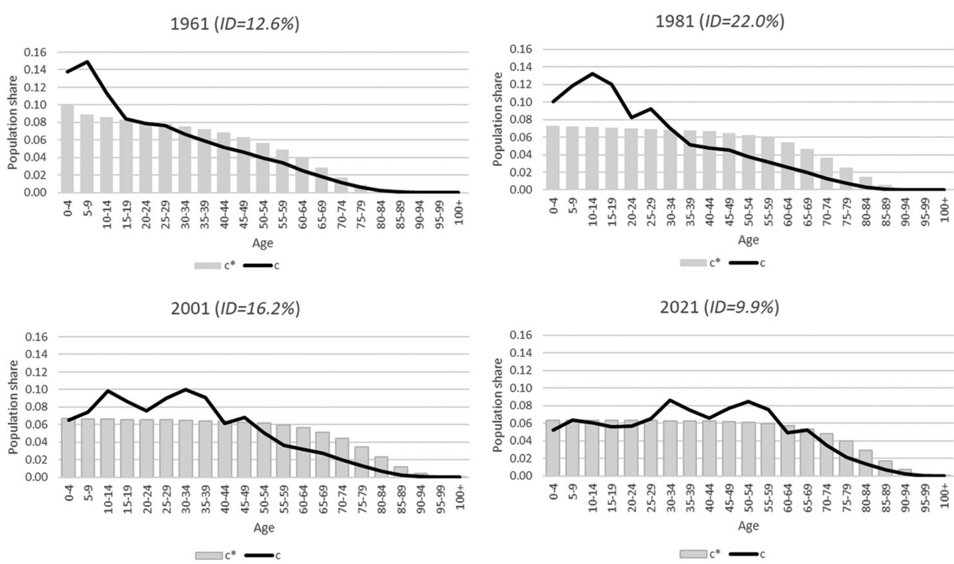

Figure 4. Observed (c) and standard stationary (c*) age structures in China for selected years (United Nations, 2022).
Abbreviation: ID: Index of dissimilarity.

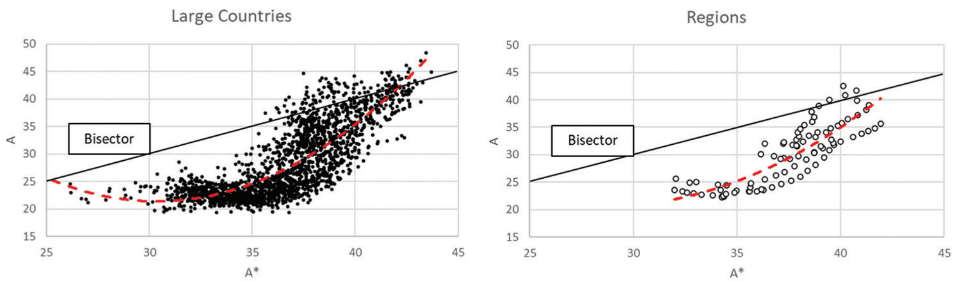

Figure 5. Observed (A) and standard, or stationary (A*) average age, by countries and regions, from 1951 to 2021 (United Nations, 2022).
Notes: There were 131 countries, only those with at least one million inhabitants, excluding Cambodia and North Korea, because of their high mortality during the war years (1967 – 1975 and 1950 – 1953, respectively). There are six regions: Africa, Asia, Europe, Latin America and the Caribbean, Northern America, and Oceania. In both panels, each case was observed 15 times: in 1951, 1956,…, 2021. If our predictions were 100% accurate, the age structure of the observed populations would coincide with that of their standard (the stationary population), and all data points would lie on the bisector. The quadratic interpolation (dotted red line) gives the general tendency of the scatter and suggests that points may indeed be moving in waves around the bisector, as survival conditions improve.

The share of the population that is misallocated (by 5-year age group) using our approach is presented in Figure 6. On average, this share is below 18% and never exceeded 36%. This means that using only information on recent mortality, age structures can be described with a modest margin of error: they are 82% correct on average, and at least 64% correct in the worst case. Similar to previous observations, using regions instead of individual countries reduces random variations and improves the precision of the model estimates: ID declines to 15% on average, with a peak of only 25%. In both cases, the parabolic interpolation suggests that after reaching a peak when e_0 is close to 55/60 years (i.e., in the midst of the demographic transition), ID tends to decline and return to the extremely small values observed before the transition started.

3.3. Results for 10 countries in the HMD

The same results, but with closer adherence to model predictions, emerge with reference to a different period (starting in 1860) and a different set of countries: the developed countries included in the HMD, of which we took the 10 with the longest time series available (Figure 7). As in the case of Figure 5, the initial phase of the demographic transition breaks the (presumed) original equilibrium (i.e., drives the points to the right, far from the bisector); however, once the process matures, the cloud of points tends to converge towards the bisector, where A = A*, as predicted by the model.

The share of misclassified individuals is less than 9% on average and never above 16% (Figure 8). Once again, a quadratic interpolation provides insight into how things evolve over time, suggesting that the worst case for our model is when A* is about 36 years (e_0 is close to 55/60 years), i.e., in the middle of the demographic transition. Even then, however, the explicatory power of recent mortality (i.e., its capability of predicting the shape of the age distribution) is remarkably high, and only a small fraction of individuals fall into an age group different from that predicted by our model.

4. Discussion

The main result of this paper is that the hypothesis that we set out at the beginning, and in Equation III, that current survival conditions determine a large share of the observed age structures, seems to hold remarkably well. Not surprisingly, the model performs worse in the most turbulent phases of the demographic transition, but even these cases fit well with the general pattern that we sketched in our initial hypothesis. The observed age structures tend to resemble those of their corresponding standard (the stationary population), with occasional shocks, such as the demographic transition, that drive the observed age structure away from its expected shape (the stationary case). However, after the shock is absorbed, the standard shape tends to resurface.

This holds in all the cases that we could investigate with our datasets: The HMD and the UN database, both including several countries in different epochs and conditions. Incidentally, this result is consistent with the dynamic analysis that we conducted elsewhere on the same topic, proving that the observed age structures "move" over time following the evolution of the L_x series (De Santis & Salinari, 2023). It is worth noting that our analysis included only the observed or estimated data up to 2021. If we had included population forecasts, as demonstrated by Fernandes *et al.* (2023), for instance, using UN (2022) demographic projections until the year 2100, the results, although not reported here, would have been even better, with a closer correspondence between (forecasted) reality and (forecasted) stationary populations (the L_x series of predicted life tables).

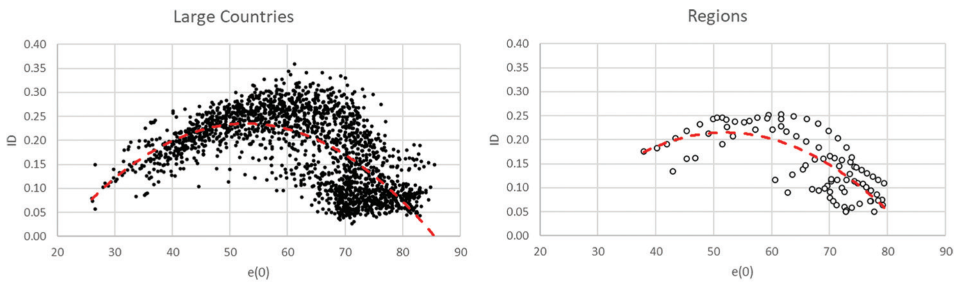

Figure 6. Index of dissimilarity (ID) by average length of life (e_0) across various countries and regions, from 1951 to 2021 (United Nations, 2022).
Notes: There are 131 countries that only include those with at least 1 million inhabitants, excluding Cambodia and North Korea because of their high mortality during the war years (1967 – 1975 and 1950 – 1953, respectively). Regions are six: Africa, Asia, Europe, Latin America and the Caribbean, Northern America, and Oceania. In both panels, each case is observed 15 times, corresponding to the years 1951, 1956,…, 2021. The quadratic interpolation (dotted red line) provides the general tendency of the scatter and suggests that data points may indeed tend to return to their initial low values (ID close to zero) after the distortions in the age structure caused by the demographic transition have been absorbed.

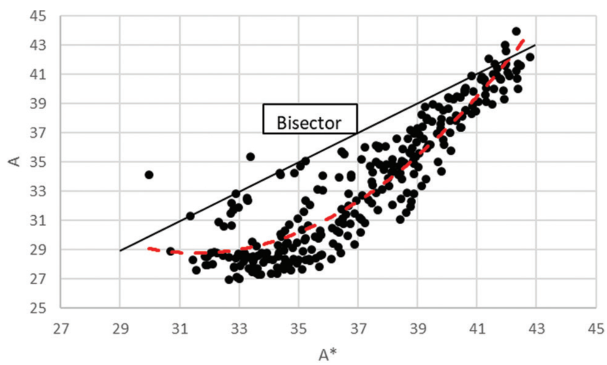

Figure 7. Observed (A) and standard, or stationary (A*) average age, in selected developed countries (circa 1860 to 2019) (Human Mortality Database).
Notes: The countries (with the chosen starting year) are Belgium (1920), Denmark (1860), Finland (1880), France (1860), Italy (1875), the Netherlands (1860), Norway (1860), Spain (1910), Sweden (1860), and Switzerland (1880). If our predictions were 100% accurate, the age structure of the observed populations would coincide with that of their standard (the stationary population), and all dots would lie on the bisector. The quadratic interpolation (dotted red line) gives the general tendency of the scatter, and suggests that points may indeed be moving in waves around the bisector, as survival conditions improve.

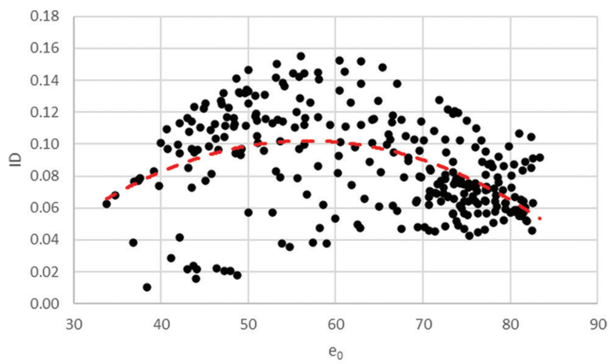

Figure 8. Index of dissimilarity (ID) by average length of life (e_0) in selected developed countries (circa 1860 to 2019) (Human Mortality Database).
Notes: Countries (with the starting year chosen for this analysis, or earliest available) are: Belgium (1920), Denmark (1860), Finland (1880), France (1860), Italy (1875), the Netherlands (1860), Norway 1860), Spain (1910), Sweden (1860), and Switzerland (1880). The quadratic interpolation (dotted red line) gives the general tendency of the scatter, and suggests that data points may indeed tend to get back to their initial low values (ID close to zero) after the shocks caused by the demographic transition have been absorbed.

After all, the reason we can observe individuals living up to 40 years, for instance (which is not the case for mosquitoes), but not to the age of 1000 (as it happens with sequoias), is that human mortality has certain characteristics, which translate into and shape population age structures. These mortality characteristics do not remain constant over time, but their evolution is typically gradual, which explains why even the use of just one piece of mortality information – a recent cross-sectional life table – is generally sufficient to provide a good approximation of reality. The incipient second demographic transition will probably trigger a new cycle of declining and aging populations. These phases cause waves in the age structures of the affected countries. Our prediction is that the cycle will repeat itself: standard and observed age structures will temporarily diverge, but the former will still be capable of "explaining" a large share of the latter, and the latter will eventually converge on the former after some years.

Mortality is slow and steady, and this is how it eventually "wins the race" (gradually shaping the age structure). It erodes its base (a birth cohort) gradually but consistently over several years, never stopping, and always in the same direction, like a water drop gradually hollowing a stone. Other forces, such as fertility and migration, are frequently stronger, more variable, and more clearly visible in the short run, but are less consistent in strength and direction; therefore, their structural effects tend to diminish over time. For this reason, our model is not very effective in predicting short-term changes in age structures, and analyses of the determinants of such changes (and notably those on the causes of population aging) may result in the opposite conclusion that fertility matters more than mortality. In the simplest terms, these analyses involve regressions of the following type (Equation VII):

$$\Delta \boldsymbol{c} = f\left(\Delta \boldsymbol{c}^{*}, \Delta \boldsymbol{F}, \Delta \boldsymbol{M}, \varepsilon\right) \qquad \text{(VII)}$$

where the deltas indicate variations, and ε is the error term. In Equation VII, a variation in the age structure **Δc** is thought to be caused by variations in survival, fertility, and migration (**Δc***, **ΔF**, and **ΔM**, respectively), and a decomposition analysis of some sort will attempt to assess the relative role of each of these forces. Short-term variations in survival, however, are generally modest and may even be non-existent; in Equation VII, this may well result in a lesser role estimated for survival in determining population aging. However, if our hypothesis is correct, this is nonetheless consistent with the predominant role of survival in shaping population age structures in the long run.

This should help explain why several demographers, following Coale (1956; 1957), tend to think that it is mainly fertility that causes population aging (Bengtsson & Scott, 2005; 2010; Keyfits, 1975; Lee & Zhou, 2017), although exceptions for developed countries have been frequently noted (Fernandes *et al.*, 2023; Murphy, 2017; Preston *et al.*, 1989; Preston & Stokes, 2012). As mentioned, our claim is that mortality is the main driver of the shape of age pyramids in the long term, although its action is slow and may remain in the background, especially in times of rapid change, such as demographic transition.

Our findings may influence the debate regarding the advantages and disadvantages of cross-sectional life tables. Some demographers (e.g., Borgan & Keilman (2019) and Keilman (2019) are skeptical about their theoretical and practical utility and argue that they are likely to convey biased results in periods of mortality change (i.e., almost always). Our study indicates that they are useful both in theory and practice.

In the same spirit, our findings may prompt demographers to reconsider the notion and measurement of "demographic bonus" or "dividend." Until now, to the best of our knowledge, the "window of opportunity" has been defined in terms of improvement over the recent past. For example, Lee & Mason (2010) call it a "phase of … three to five decades … [when] support ratios rise well above their pre-transition levels", while Crombach & Smits (2022) describe it as "a period in which the working-age population is large and the dependent population … is small." Our proposition is that a comparison should be made with the standard (stationary) age structure. In this sense, a demographic dividend (or the "first demographic dividend," in Lee and Mason's words) can be considered present as long as the observed age structure is "better" than that of the corresponding stationary population. In Figure 2, for instance, the old age dependency index of China (OADI, right panels) started to worsen (i.e., to increase) since the 1980s and is currently undergoing rapid deterioration. However, until approximately 2036, the observed OADI in China will be lower than its standard equivalent OADI*. In our interpretation, this means that until then, China will still benefit from a demographic bonus, although this will become a bit smaller every year.

The question may be asked in more general terms: When looking at the age structure of a population, what should observers expect to find and against what implicit standard do they asses the current situation? Our answer is that (excluding exceptional cases, such as an ongoing war), the best possible expectation should be based on the stationary age structure of the period. All relevant aspects of the observed age structure (peaks and troughs, larger or smaller bases, etc.) can be better appreciated compared to this standard.

Our findings clarify some of the issues behind the frequently re-surfacing question, "Are immigrants substitutes for births?" (United Nations, 2000). Those who reject this notion typically take some observed structural index (e.g., the OADI or its reciprocal, the support ratio) and simulate the number of immigrants needed to preserve that value forever—frequently, but not surprisingly, arriving at implausibly high values (e.g., Coleman [2008]). In light of our findings, this question appears to be misleading. The data points outside the bisector (e.g., Figure 5), suggest that the demographic structure is biased (i.e., far from its standard) and that this situation will not last: things will eventually get back to "normal." Only standard-consistent structural targets can be pursued in the long term, and, with this more modest target in mind, simulations (not shown here) indicate that immigrants can be quantitative substitutes for births unless fertility drops to extremely low levels.

Finally, it is noteworthy that due to mortality changes, all target values move over time (notably the OADI of Figure 2 [right panel]), unless improvements in survival are neutralized by offsetting adjustments in threshold ages, such as higher retirement ages. In other words, policy measures of this type, while adopted under the pressure of circumstances (budget imbalances in pension systems) and wearily defended by reluctant policymakers, may find theoretical support in our approach, which is consistent with the evolution of the underlying standard (stationary) age structure.

The approach we suggest here is extremely simple: it can be regarded as the static version of the dynamic and considerably more complex model we recently proposed to analyze the combined evolution of the two age structures, the stationary and the observed ones (De Santis & Salinari, 2023). Precisely because of its simplicity, our model has its limitations, and, in particular, it cannot adequately describe all empirical cases (all countries in all years). What it indicates is the likely direction of future changes: An empirical age structure that is far from its stationary counterpart will likely tend to get closer to it in the future. The force of attraction exerted by the stationary age structure on the observed one is small but persistent; in the short run, other forces, and especially fertility variations, may affect the observed age structure in a much stronger way (which explains occasional cases of poor fit with its stationary counterpart). In the long run, the prevailing role of survival emerges.

5. Conclusion

Age structures evolve over time, under the influence of fertility, mortality, and migration. Demographers have long debated the relative role played by each of these forces, focusing in particular on the variations of the age structure or any of its possible synthetic indicators (average age, OADI, etc.). The conclusion has frequently been that fertility is the main driving force of change, although with exceptions among mature populations, where mortality matters more. In this paper, we focus on the shape of the age structure and we show how close it is to that of the corresponding stationary population; therefore, we conclude that mortality (or, better yet, its complement: survival) plays a significant role in shaping age structures.

We reached this conclusion by combining data from several countries over several periods. Although there are variations and exceptions, the general scheme seems to hold: observed age structures tend to follow the path traced by their standards, that is, the corresponding stationary populations.

This finding has both theoretical and practical implications. Theoretically, this study contributes to the debate on the relative importance of the forces that drive population aging. Our interpretation is that, in the long run, due to its relatively modest but consistent and persistent action, mortality matters more than anything else, and that recent mortality is generally enough to "explain" a large fraction of the observed age distribution of any population at any time.

Regarding practical implications, our findings may be relevant, especially in the pension debate. Most pension arrangements adjust their parameters based on recent life tables and survival conditions. Our findings suggest that this practice is correct and should be more widespread.

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The authors declare no conflict of interest.

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The data used in this study are accessible to the public.

Further disclosure

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RESEARCH ARTICLE

Navigating planetary human entanglements through climate change-induced human mobility in Zimbabwe: An Afrocentric perspective from the global south

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Abstract

The central question of the 21st century revolves around increasing human entanglement. Humans are finding it increasingly difficult to survive in the changing environment caused by climate-induced disasters such as floods, droughts, storms, and heat waves. In Zimbabwe, this has led to the emergence of human mobility as an adaptation strategy, with individuals (indigenous and local) relocating to areas offering more favorable economic and environmental conditions. This study employed Afrocentric theoretical lenses to describe how both slow and sudden-onset climatic catastrophic events have affected the agro-economic livelihoods of the indigenous Ndau people, forcing them to seek better living conditions and safety. As an Afrocentric study, this research examines how historical and cultural factors influence the Ndau people's mobility decisions. It employed the philosophical sagacity interview method and talking cycles to collect data from seven wards in Chimanimani, Zimbabwe. The findings reveal that the impacts of climate change – both gradual and abrupt – have increased in frequency, intensity, duration, and location. The Ndau people have suffered frequent cyclones, storms, and heavy rainfall, leading to landslides and floods. These conditions have driven both short-term and long-term climate-induced mobility. Individuals moved locally and regionally to find livelihood opportunities and their decisions were most influenced by historical and cultural ties through kinship. The study advocates for enhancing communities' preparedness and adaptability to reduce vulnerabilities. It highlights the importance of strong governance, resilience strategies, environmental protections, economic diversification, and social support to mitigate disasters; prevent unwanted displacement; and manage emigration. Furthermore, European narratives often dominate discussions of African climate-related agro-migration, even though most of these migrants move within their own countries and regions. As a consequence, this study aims to amplify African narratives on human mobility and climate change adaptation.

Keywords: Climate change; Mobility; Adaptation; Afrocentricity; Migration; Africa

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1. Introduction

The central question of the 21st century revolves around increasing human entanglement (Moyo & Ndlovu-Gatsheni, 2022). Humans are increasingly struggling to survive in changing environments caused by climate-induced disasters such as floods, droughts, storms, and heat waves. As a result, human mobility has emerged as an adaptation strategy to climate change for both indigenous and local people in Zimbabwe (Maganga & Suso, 2022; Oakes *et al.*, 2020). This shift has prompted individuals to relocate to areas with more favorable economic and environmental conditions (Locke, 2009; Nyahunda *et al.,* 2021), which aligns with the notion that climate change impacts are global, with sub-Saharan Africa being one of the most severely affected regions (Serdeczny *et al*., 2017). The negative effects of climate change have led to increased migration in Africa, driven by both gradual and sudden-onset events such as desertification, deforestation, rising sea levels, droughts, water scarcity, and floods. Over the past few decades, these events have intensified in frequency and severity. By 2050, climate change is projected to prompt 1.2 million people to move across national borders within the African continent (Leal Filho *et al*., 2022; Simpson & Rosengaertner, 2023). This represents 10% of all cross-border migrations but is only a small fraction of the expected climate migration in Africa (Amakrane *et al*., 2023). In the next 30 years, up to 5% of Africa's population, potentially 113 million people could be displaced within their home countries due to climate impacts (Amakrane *et al*., 2023; Simpson & Rosengaertner, 2023). Most climate-related human mobility occurs within countries or between neighboring countries rather than toward distant high-income countries (International Organization for Migration, 2022). In 2021 alone, the Internal Displacement Monitoring Centre reported 2.6 million new internal displacements in sub-Saharan Africa due to disasters (International Organization for Migration [IOM], 2022). The World Bank's Groundswell Report II projects that, without significant climate and development interventions, climate change could contribute to the migration of more than 105 million people within their own countries in Africa due to water stress, reduced crop productivity, and rising sea levels (World Bank, 2021).

This study uses two Afrocentric tenets – historicity and culture – to trace how climate change and climate-related disasters have jeopardized the agro-lives of people in Chimanimani, Zimbabwe, leading to internal and regional migration. To understand the current patterns of African migration, it is crucial to explore its historical context. Human mobility in Africa has a long history and is a key driver for the resilience of communities (Nyahunda *et al*., 2021). As part of the 2063 African Union (AU) Agenda and the Global Compact for Migration objectives, there is now recognition that migration can become a development enabler, a strategy to improve sustainable livelihoods and a way to adapt to environmental pressures and climate change (IOM, 2022). The Intergovernmental Panel on Climate Change (IPCC) (2018) has highlighted that migration is an important and potentially effective climate change adaptation strategy in Africa and is considered in adaptation planning. Similarly, the recently launched AU Climate Change and Resilient Development Strategy and Action Plan (2022 – 2032) acknowledges that movement or migration is an adaptation strategy employed by hundreds of millions of people, both in response to negative stimuli and as a means of seeking a better life, and that there may be a considerable role for governments in normalizing and facilitating the movement of people (United Nations Economic Commission for Africa, 2022).

Zimbabwe is used as a case study to explain climate-induced migration in Southern Africa. The country has long been affected by climate change, with impacts manifesting through droughts, erratic temperatures, floods, cyclones, heat waves, wildfires, water source desiccation, and the spread of disease-causing pathogens (Bhatasara, 2015; Muchena & Iglesias, 1995; Nyahunda & Tirivangasi, 2021a; Unganai, 1996). Meteorological records show that Zimbabwe is already experiencing climate variations (Dube & Phiri, 2013; Gwatida *et al*., 2023). For instance, an increase in average temperatures by 2°C is projected to reduce Zimbabwe's wetlands from 9% to 2.5%, while a 4°C rise would reduce the summer water surplus zones to <2% (Manyeruke *et al*., 2013). The climate variation reports reveal that droughts occurred every 10 years during the 1960s, 1970s, and 1980s. However, the frequency of droughts and dry spells has increased to every 4 – 5 years, and by the late 1990s, they were occurring every 3 years. Since 2000, the situation has worsened, with successive droughts impacting the country in 2002 – 2003, 2004 – 2005, and 2007 – 2008 (Manyeruke *et al*., 2013).

A recent study by Afrobarometer notes that every six in 10 Zimbabweans report experiencing worsening droughts, highlighting the urgent need for government action. In response, the Zimbabwean government has declared a national disaster due to the impact of these droughts on farming activities. With millions facing hunger, there is an urgent call for over US$2 billion in aid to ensure sufficient food supplies (Afrobarometer, 2024). The latest Afrobarometer survey in Zimbabwe, conducted in 2022, indicates that the proportion of citizens experiencing more severe droughts has almost doubled since 2017. While climate change is still an unknown concept to more than half of Zimbabweans, those who are aware of it overwhelmingly report that climate change is worsening their lives (Afrobarometer, 2024).

The country is projected to experience a progressive reduction in precipitation, rising temperatures, more volatile weather events, and increasingly unpredictable seasons (Government of Zimbabwe, 2022). In terms of human mobility and climate change, Zimbabwe is likely to be affected in several ways. First, there has been an increase in people moving out of the country, with personal remittances received in Zimbabwe accounting for 8% of the total GDP. However, the government noted that the direct impacts of climate change in the host country of the migrant worker (e.g., South Africa) may lead to economic disruptions for those receiving remittances and the macro-economy (Government of Zimbabwe, 2022). Second, the country depends on imported cereals. Zimbabwe has a negative trade balance for food products. Being dependent on food imports from abroad, Zimbabwe is exposed to climate-related disruptions in the availability, price, or quality of food products. Third, Zimbabwe currently hosts 9000 refugees. Although its net migration rate is negative (there is more emigration than immigration), the number of refugees has doubled since 2010, which may be a consequence of slow-onset migration due to ecosystem degradation or major environmental events. Climate impacts in other countries may lead to an increase in push factors to emigrate to Zimbabwe (Government of Zimbabwe, 2022).

Despite this, only a scant amount of scientific literature exists concerning the impact of climate change on human mobility in Zimbabwe. As such, this study seeks to fill that gap. The paper will begin by explaining the theoretical position on how climate change and climate-related disasters influence people in Zimbabwe, resulting in internal and regional migration. The second section will discuss climate-induced human mobility in Southern Africa. The third section will discuss the methodology, followed by the fourth section, which will present and discuss the results related to short- and long-term human mobility in Zimbabwe. The paper will conclude with a summary of the findings.

1.1. Afrocentric theoretical position on human mobility and climate change

This paper started by addressing a theoretical void in the field of social, vulnerability, resilience, and adaptation (SVRA) studies. According to a study conducted by Kuhlicke *et al.* (2023), a significant proportion of research papers in the fields of psychology, sociology, geography, and mathematics that investigate various natural hazards such as floods, droughts, landslides, storm surges, wildfires, tsunamis, storms, and volcano eruptions does not explicitly incorporate theoretical frameworks in their investigations. Significantly, the use of SVRA and its associated principles is employed to effectively mitigate the risks posed by natural hazards and facilitate the process of adapting to climate change. The researcher employed the Afrocentric theoretical framework to examine the phenomenon of climate-induced mobility of people in Zimbabwe, a nation located in southern Africa and sharing borders with Mozambique, South Africa, and Zambia. The concept of Afrocentricity emerged as a theoretical framework for understanding knowledge in the year 1980, originating from the philosophical ideas of Molefi Kete Asante. According to Asante (2003), Afrocentricity is characterized as a cognitive framework and behavioral approach that prioritizes African interests, values, and views. To accomplish this objective, Afrocentricity theory relies on the notion of Njia, which is delineated as the communal manifestation of the Afrocentric perspective rooted in the historical encounters of individuals of African descent (Asante, 2003). The Afrocentric theory acknowledges the imperative of scrutinizing the cultures and histories of Africa from their respective centers or geographical contexts. In summary, according to Asante (1990), the theory asserts that African individuals are proactive, fundamental, and key actors in shaping their historical narratives. The idea is situated within the context of the African experience. Specifically, Afrocentrists argue that individuals of African descent, similar to individuals of other racial backgrounds, frequently engage in questioning various aspects of life. When faced with challenging problems, individuals tend to have a natural inclination to inquire and seek resolutions.

According to Hunter (1983), Afrocentricity is proposed as a theoretical framework aimed at effecting social transformation, specifically targeting black individuals residing on both the African continent and the diaspora. The imperative is for individuals of African descent to cultivate a robust sense of self, historical awareness, and cultural appreciation to effectively address the challenges that persist in their contemporary and future circumstances. In the present era, individuals of African descent are confronted with inquiries concerning the phenomenon of climate change and its impact on human migration within the African continent. In addressing these two global concerns, an Afrocentric scientist, akin to a traditional African healer who protects society from malevolent influences, analyzes prevailing situations, identifies potential avenues for resolution, and proposes strategies for resolution. The Afrocentrist focuses on collecting factual information, verifying data, and rigorously examining interpretations of both individuals and subjects in the study of human behavior (Asante, 2002).

In the context of the current period characterized by climate change and its detrimental impacts on both human beings and the natural world, the process of de-emphasizing indigenous knowledge systems presents noteworthy perspectives for effectively addressing sustainable transformation and fostering resilience that aligns with cultural norms and ecological rejuvenation. Climate change adaptation programs that are centered on Africa place indigenous peoples within the context of their social, spiritual, and cultural frameworks. Nyong *et al.* (2007) note that the production of Afrocentric indigenous knowledge is important not only for building inclusive resilience but also for promoting alternative Afrocentric epistemologies for understanding and making sense of our global reality. In this particular instance, the utilization of Afrocentric theory serves to offer a perspective on the phenomenon of climate-induced human movement in Zimbabwe. The determinations of human migration are shaped by the collective historical and cultural experiences of indigenous populations. The occurrence of climatic disasters, whether they manifest gradually or abruptly, can have a significant impact on the various drivers of migration, including social, cultural, political, and economic factors. As a result, the capacity of individuals to engage in movement may change. The effects of climate change worsen and hasten these factors in intricate ways. An increasing number of individuals may find themselves lacking the necessary resources to engage in migration, resulting in their immobility or confinement in hazardous situations. Some individuals may feel forced to engage in more frequent, extensive, or permanent migration to access natural resources and secure economic opportunities.

The Afrocentric principles, specifically historicity and culture, are utilized throughout the paper to elucidate the factors that contribute to climate-induced migration. Afrocentricity affirms, rejuvenates, establishes, and sustains the existence and experiences of African individuals and communities concerning climate change and human mobility in this context.

1.2. Climate-induced mobilities in Southern Africa

The researcher applied the Afrocentricity tenet of historicity to dig relevant literature on climate-induced mobility in Africa to obtain insight into how climate change has affected people's mobility decisions. Africa is one of the most vulnerable regions to climate change and climate variability due to its vast semi-arid areas, high reliance on rainfed agriculture (only 5% of the cultivated area is under irrigation, compared to the global average of 21%), and low adaptive capacity (FAO, 2016; Tirivangasi *et al.*, 2021b). Due to its high vulnerability, Africa will be more impacted by climate change than affluent nations and regions and those located at higher latitudes (Guillaumont & Simonet, 2011).

Most of Southern Africa is classified as a semi-arid region with a high spatial variation in precipitation. However, climatic conditions range from extremely arid regions in the southwest to humid subtropical regions in the northeast (Spear *et al.*, 2015). In its most recent report, the IPCC disclosed that the Southern African Development Community region had experienced an increase in average temperature over the past several decades. During the same time frame, it has experienced below-average precipitation and variations in the onset, cessation, and intensity of rainfall. In addition, Southern Africa has experienced an increase in extreme rainfall events and the frequency of dry periods, resulting in more severe droughts (IPCC, 2014; Jury, 2013). Forecasts indicate that more variable precipitation and a rise in the frequency and severity of extreme events such as droughts and floods can be anticipated in the future (IPCC, 2014). Consequently, climate change has increased the mobility of people in Southern Africa. Mobility is essential for people to adapt to and contend with increasingly severe climate impacts. Historically, millions of individuals, families, and entire communities have utilized relocation as a coping mechanism for climatic events and stresses. This is especially true for farmers and pastoralists, whose livelihoods rely significantly on natural resources that have been impacted by climate change. In light of this, climate mobility refers to the movement of individuals in response to abrupt or gradual climate impacts. It occurs within and across national borders; involves varying degrees of constraints, agency, and vulnerability; and includes both forced displacement and migration and voluntary relocation. Climate mobility can be temporary, recurrent, or permanent and occurs over various distances.

Pastoralists in north-western and north-central Namibia and the Kalahari Desert of Botswana have employed seasonal migration as a coping strategy in response to rainfall variability in Botswana and Namibia. Due to the arid climate, sandy soils, and savannah ecosystems, pastoral agriculture and livestock husbandry are the primary sources of income (Spear *et al.*, 2015). In the arid Kunene region of north-western Namibia, Ovahimba cattle farmers frequently relocate their livestock in quest of better grazing. In addition, pastoralists in the Kalahari region of Botswana use livestock mobility to respond to variable precipitation (World Bank, 2013). Temporary migration as a means of subsistence is an essential characteristic of these pastoralists and exemplifies an effective survival strategy. Zimbabwe, Mozambique, Namibia, and South Africa were affected by the El Niño climate cycle, which decreased precipitation and increased temperatures in Southern Africa (Bilak *et al.*, 2016). El Niño is frequently accompanied by the opposite weather phenomenon, El Niño, which develops later in the climate cycle and brings significant precipitation to the same regions severely impacted by El Niño. Flooding is a typical consequence (United Nations Office for the Coordination of Humanitarian Affairs, 2016). Mozambique, Namibia, and Zimbabwe experienced severe flooding in 2017 as a result of El Niño-induced drought in Southern Africa as well as tropical cyclones Dineo and Idai (Tirivangasi *et al.*, 2021b). This has resulted in the displacement of thousands of individuals.

In addition, significant portions of Southern Africa's arid and semi-arid regions are prone to and have recently experienced severe droughts (Tirivangasi, 2018). This has significant effects on both food and water security. The severe drought in Southern Africa has resulted in millions of people experiencing extreme starvation (Sengupta & Andreoni, 2024). The El Niño-induced calamity is causing severe devastation in communities across multiple countries, destroying crops and livestock, and causing a significant increase in food costs. Approximately 20 million individuals in southern Africa are currently experiencing what the United Nations refer to as acute hunger, resulting from one of the most severe droughts in over 40 years. The phenomenon causes crops to wither, devastates cattle populations and, following a prolonged period of elevated food costs due to pandemics and conflicts, significantly increases the cost of corn, which is the primary agricultural product in the area. In 2024, Malawi, Zambia, and Zimbabwe have each officially proclaimed a state of national emergency. The citation is from Sengupta and Andreoni's work published in 2024. The IPCC Special Report on Global Warming of 1.5°C (Hoegh-Guldberg *et al.*, 2018) designated Southern Africa as a region very vulnerable to the impacts of climate change. The region has water stress as a result of natural droughts, an increasing population, and the industrial aspirations of an emerging economy. This is compounded by the region's warm temperature and distinct wet-dry seasonal patterns (Rouault *et al.*, 2024). Under low mitigation emission scenarios, Southern Africa would probably experience significant increases in temperature and a high possibility of decreased rainfall (Hoegh-Guldberg *et al.*, 2018; Lee *et al.*, 2021). This justifies its classification as a climate change hotspot since the ability to adapt to these changes will be severely constrained.

2. Methods

This study is grounded in the theoretical framework of Afrocentricity. The ethos of Afrocentricity means "placing African ideals at the center of any analysis that involves African culture and behavior" (Asante, 1998, p. 2). It would be inconsistent and a lack of ingenuity to use Afrocentricity as a theoretical perspective and then select a non-Afrocentric research methodology. In selecting the methodology for this study, the researchers focused on congruence, ensuring that the theoretical perspective, epistemology, and methodological tools were fully aligned. This study adopted an Afrocentric methodology to answer the research question on climate-induced mobility in Chimanimani, Zimbabwe. Asante (1990) identifies three main positive aspects of an Afrocentric methodology. First, it recognizes cultural pluralism without pursuing any hegemony over other methods. Instead, it emphasizes grounding the study of African phenomena and events in the cultural voice of the African people. It advocates for cultural immersion, the indigenization of investigative tools and methods, and the interpretation of research data from an indigenous African perspective. While it does not claim supremacy nor reject other methods, it advocates for challenging and reassessing these methods. Asante notes, "The Afrocentric methodology rejects the notion that a certain discipline has all the tools needed to analyze phenomena. However, it stresses that these methods should be challenged" (Asante, 1990, p. 31).

The second positive facet of an Afrocentric methodology is its comprehensive approach, encompassing all aspects of life. It pays attention to the social, historical, cultural, political, economic, and psychological spheres of life. In that, it allows researchers to investigate any field of their choice from an Afrocentric perspective. For instance, in our study of climate change, one needs to understand the role played by communal beliefs in various ways. A researcher must demonstrate an understanding of the African beliefs on how to adapt to the adverse effects of climate change. The final positive aspect addresses epistemological issues, including language, myths, dance, music, and art. These elements reveal the African experience to the whole world. The researcher must be familiar with the history, language, philosophy, and myths of the people being researched. Without cultural immersion, researchers risk losing ethical values and may end up conducting research devoid of meaningful context (Asante, 1990).

Given the characteristics of Afrocentric research methodology, it is the most suitable approach for examining community perceptions of climate change and its impact on human mobility in Zimbabwe. As noted in the following sections, the Ndau people are an indigenous group in Zimbabwe with distinct cultural practices and traditions. In this Afrocentric research, importance is placed on the customs, beliefs, motifs, and values of African people. This focus on African cultural elements forms the basis for applying an African methodology.

2.1. The research site

This study was conducted in Chimanimani District, located in the southeastern highlands of Manicaland, Zimbabwe. The region is predominantly inhabited by the Ndau people, an indigenous group. As an Afrocentric study, the researchers utilized historicity and culture to understand how the Ndau people perceive and adapt to the impacts of climate change in Zimbabwe. Through the utilization of the Afrocentric tenets, one can understand the people, language, cosmologies, kinship system, cultural practices, and religion. "Location, as a core element of the Afrocentric functional paradigm, serves as a pivotal research tenet, providing a foundation for examining the cultural, philosophical, and historical aspects of human expression, collectively understood as culture (Monteiro-Ferreira, 2010, p. 44)."

The researcher traces the history of the Ndau people from their original settlement to the present. By highlighting and describing who they are as people, their language, cosmic beliefs, kinship system, cultural practices, and religion, the study distinguishes the Ndau as a unique indigenous group within the larger Shona community. Although the Shona people are also indigenous, the Ndau have been marginalized and often viewed as part of the broader Shona group. To understand their experiences of climate change accurately, it is essential to consider their distinct perspectives. The Chimanimani area is also inhabited by other people who do not belong to the Ndau-speaking clan; this is due to resettlement programs, employment, and marriage issues that influence internal migration in the region. This study will not include individuals from other ethnic groups, as they are not Ndau natives. Instead, the focus will be on the indigenous Ndau people of the district, most of whom reside in rural areas.

The origins of the Ndau people are complex and lack a singular explanation, as current genealogies were documented by anthropologists and historians who are not Ndau descendants (Hlatshwayo, 2017). The history and the genealogy of the Ndau can be traced back to the Bantu-speaking people of West Africa, approximately 4000 years ago. This implies that the Ndau have not always been in Chimanimani. Instead, like other tribes of Southern Africa, they migrated as Bantu people from West Africa. The Ndau are related to Hungwe and Rozvi groups that invaded pre-colonial Zimbabwe. The Hungwe were the earliest Bantu people to settle in the current Zimbabwe, arriving around 700 – 800 AD. The Hungwe lineage is identified by the totems named after the birds and aquatic animals. The association with water was an attribution to their greatest ancestor, *Dzivaguru*, which means the great pool. Other totems from the members of the Hungwe family are *Garwe* or *Ngwena* (crocodile), *Bonga* or *Mvuu* (hippo), and *Mheta* (water python). These totems are also found among the Ndau people, supporting the notion that the Ndau are indeed Bantu in origin.

The Ndau people, like other African groups, are highly religious people who believe in God, popularly known as *Mwari*, the supreme being (Mapuranga, 2010). The Ndau people perceived religion as their way of creating and maintaining their relationship with their God through their ancestors (Mtapuri & Mazengwa, 2013). As a form of worship, the Ndau people perform ceremonies to appease the ancestral and territorial spirits. The Ndau people and other Zimbabwean indigenous people believe that the spirits have a great influence on their well-being. They believe that the dead are in a state of consciousness, such that they can intervene in human affairs. It is believed that the ancestors can influence a lot of things in people's lives, ranging from fertility, rain, good health, and protection from physical and mystical danger to curing illness. The Ndau people believed serious misfortunes, such as prolonged sickness, death, lack of rain, or persistent ravaging of fields by wild animals, demanded extraordinary solutions, even when the cause of death or sickness was because of external influences. The Ndau would consult spirit mediums when a bad misfortune had happened. They would perform the ritual ceremonies to appease these spirits.

The Ndau indigenous cultural beliefs, practices, and knowledge systems can be a solution to climatic problems related to climate change. The Ndau respect the water bodies and forest resources as they believe that they are sacred places inhabited by spiritual forces. Taringa (2006) believed that the respect instigated by the indigenous African religion toward the water bodies and forest resources is due to the fear of the wrath of ancestral spirits, who are the custodians of the environment. The Ndau people view climate change through a religious sociocultural and religious perspective. Taringa (2006) notes that for the Ndau people, behind the physical environment lie some ancestral and territorial spirits that govern how humanity deals with fauna and flora. It is through the Afrocentric perspective that this study will be able to understand the changing climate and its impact on health and adaptation practices. It is through the Afrocentric historicity and cultural lenses that this study investigated the influence of climate-induced disasters on Ndau people's mobility decisions.

Geographically, Chimanimani district (where the Ndau people are located), as shown in Figure 1, is one of the regions that receive rainfall of up to 1400 mm per year (Chingombe & Musarandega, 2021), and most of the specialized crops are grown in this place. The farmers in the area grow crops such as potatoes, bananas, mangoes,

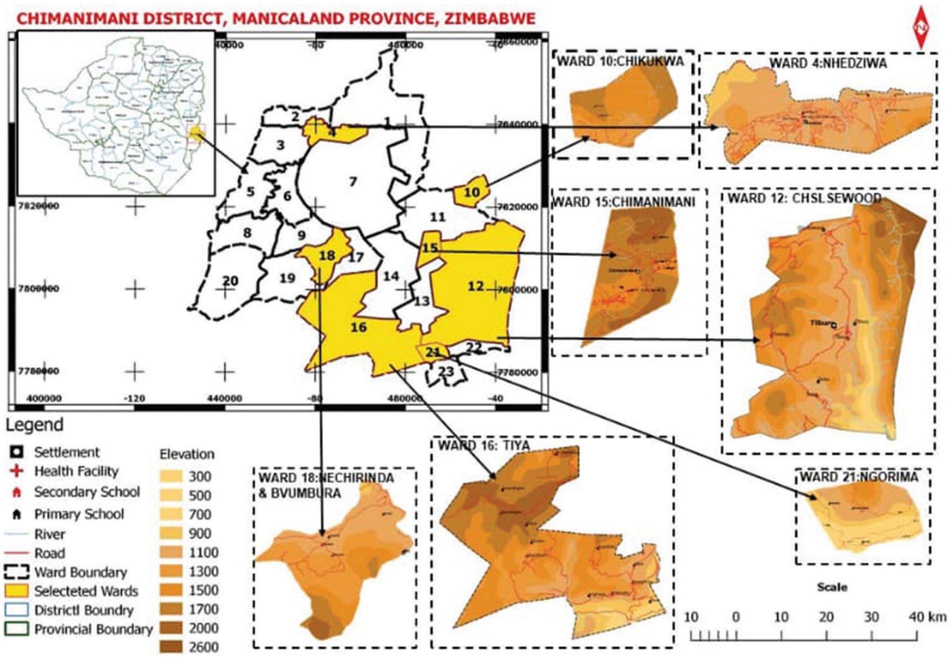

Figure 1. Study area in Chimanimani, Manicaland Province of Zimbabwe
Source: Elevation data provided by Geoanalytics and Allied Services, Zimbabwe.

sugarcane, and maize production, and plantations focus on tea, coffee, and timber. According to Mutandwa *et al.* (2019), the district has a total area of 3450.14 square kilometers and a population of approximately 134,939. It is the smallest district in Manicaland, with high, rugged terrain rising to 600 m above the sea level. The district, which consists of 23 wards and is mainly rural, as noted above, relies heavily on farming for livelihoods. The region, like most other areas in Southern Africa, has been affected by climate change, which disturbed its ecosystem. The area is prone to tropical cyclones as it lies in the overland path of the cyclones from Mozambique and the Indian Ocean (Department of Civil Protection, 2013). The topography is extremely rugged, with ranges of peaks and ravines that cause resistance to the movement of tropical cyclones. The region has recently suffered from the effects of Cyclone Idai; on March 15, 2019, Chimanimani and eight other districts experienced unprecedented destruction of property, human life, and the general way of life (Government of Zimbabwe, 2016). Settlements were destroyed, and roads and communication were rendered useless as the infrastructure suffered huge damage. The impact of the cyclone was mostly attributed to the moving landslides.

2.2. Selection of interview participants and data collection

Chimanimani district was identified as the study population, and seven wards were purposefully selected: Ward 10 (Chikukwa), Ward 4 (Nhedziwa), Ward 12 (Charleswood), Ward 15 (Chimanimani), Ward 16 (Tiya), Ward 18 (Nechirinda and Bvumbura), and Ward 21 (Ngorima), as shown in Figure 1. The researcher's utilized criterion purposive sampling to select participants, which allows for the use of judgment in selecting key informants. The Afrocentric protagonist Pellerin (2012) argues that Afrocentric researchers must remain aware of the agency of African people and must take care to involve a proportionate sample size. The researcher purposively selected seven village heads (*Sabhuku*), four senior non-governmental organizations (NGO) officers working on resilience, and 84 community household heads, resulting in a total of 95 participants.

The researcher employed the philosophical sagacity interview method. This is an indigenous interview method that engages the wisdom and traditions of people (Emagalit, 2001). From this perspective, the theory of knowledge and questions about knowledge can be found in the wisdom and beliefs of wise elders of the communities who have not been schooled in the formal education system (Kaphagawani & Malherbe, 2000). This is an important epistemological assumption, given that most post-colonial Indigenous thought systems have not been documented. Methods based on philosophical sagacity enable researchers to consult a large body of knowledge from the sages that are not available in the written literature. Mkabela (2005) describes these sages as elders and members of cultural committees and suggests that they should be included in the research process. Weber-Pillwax (2001) adds that the sages, the elders, members of cultural committees, or any identified key informant should play an important role in critiquing the written literature about research. In this study, the sages are chosen as the key informants; these include seven village heads and two senior NGO officers working on resilience. These are the custodians of knowledge among the Ndau people in Chimanimani. The philosophical sagacity interview method was used to gather the perceptions of these groups on climate change and indigenous adaptation practices in all seven wards of Chimanimani selected for this study.

Second, the researcher adopted talking cycles, also known as the conversational or discursive method (Mthembu, 2021). This approach is similar to Western focus group discussions. One of the disadvantages of the Western-based focus group interview technique is that members do not necessarily have equal opportunity to be heard. Talking circles are based on the idea of participants' respect for each other and are an example of a focus group method derived from post-colonial Indigenous worldviews. In African contexts and among indigenous peoples, there are many occasions when people form a circle. It could be around the fireplace, during celebrations when they form circles to sing, or in games when children form circles to play (Mthembu, 2011). On each of these occasions, a person is given a chance to speak uninterrupted. This method symbolizes and encourages the sharing of ideas, mutual respect, togetherness, and ongoing compassion and love for one another. The circle also symbolizes the equality of members in the circle. A common practice in talking circles is that a sacred object, a feather, a shield, a stone, a basket, or a spoon is passed around from speaker to speaker. This method was used to collect data among the community household heads. Three groups consisting of six family heads per group were divided equally among the two genders. During the group conversations, the researcher gathered historical and cultural narratives on climate change adaptation and the perception of community members on the changing climate. The researcher and his team of assistants organized two talking cycles that were held in each ward, and a total of 84 participants participated in the study. Data were collected until saturation was reached, a situation whereby the same themes kept recurring with no further new data emerging.

2.3. Data analysis

Data analysis was based on reflexive thematic content analysis with an Afrocentric perspective on the data material. An Afrocentric scholar, Pellerin (2012) notes that data processing should be conducted without compromising the integrity of the data. The researcher must avoid distorting data and placing negative values on different aspects of African culture and life. The sorting and coding process must maintain the original Africanism displayed during the observational phase. This simply implies that the cultures, motifs, traditions, histories, ideas, languages, and experiences of African people must inform the coding process; non-African-aligned standards of data processing can seriously retard the data scheme and can result in the corruption of the research. This understanding allowed the researcher to look for latent meanings and contextual interpretations (Braun & Clarke, 2021). The analysis was conducted according to the steps described by Terry *et al.* (2017). The analytic process began during the data collection as the researcher was posing research questions to participants. For instance, the researcher wanted to understand how participants perceive the changing climate and how they are adapting to it. Second, after gathering data through recorded transcripts, the researcher moved back and forth between discussions with researcher assistants and a close examination of the findings in an iterative process (Patton, 2014). The researchers, as they discussed the themes, were cognizant of Braun & Clarke's (2012) criteria, which include (i) having a singular focus, (ii) avoiding overlap but maintaining connection, and (iii) they were directly addressing the research question. The researcher was successful in meeting Braun & Clarke's (2012) criteria, as after writing the draft paper, peer debriefing was used to ensure trustworthiness; in this case, the themes were discussed and reviewed by other colleagues. In line with the Afrocentric approach, reflexive thematic analysis requires self-reflection on how our background influences our understanding of the results (Braun & Clarke, 2021). As a Zimbabwean, the researcher understood the context and interpretation of the indigenous knowledge utilized by the Ndau people to adapt to climate change. This enabled the researcher to make follow-ups and get clarity on the knowledge shared. The researcher was able to reflexively develop and make meaning of the data and report indigenous seasonal predictors, which are important for climate change adaptation in Chimanimani, Zimbabwe.

3. Results

Through data analysis during and after fieldwork, the research understood that human mobility was used as an adaptation mechanism by the Ndau people in response to climate change-induced disasters. Hence, in this section, the study discussed climate-induced human mobility in Chimanimani in Zimbabwe as explained from an Afrocentric narrative gained from the fieldwork conducted. These data are discussed with existing literature in Zimbabwe. The emerging data were grouped into themes. The researcher used the two Afrocentric tenets – historicity and culture – to explain the decision-making process by the Ndau people concerning mobility in their community.

3.1. Community perceptions on the impact of climate change-related disasters in Chimanimani

The researcher observed from field data that the Chimanimani people are susceptible to both sudden and gradual climate change-induced catastrophes, such as cyclones, storms, and heavy precipitation, which can lead to landslides and floods. These events result in various forms of human displacement in the area. The research assistants and the researcher visited two communities severely impacted by Cyclone Idai: Kopa and Ngangu. More than 80 households were destroyed, over 300 individuals remained missing, and an estimated 270,000 individuals were displaced, according to non-governmental organizations operating in the area (Tirivangasi *et al*., 2021b). Talking-cycle discussions were successfully conducted by the researcher at both Chikukwa and Ngangu. To initiate this investigation, the researcher questioned the participants regarding their perspectives on climate change, personal encounters with climatic events that transpired in the region, and their corresponding reactions. Many participants recounted their experiences with Cyclone Idai with deep sorrow, noting how the disaster had significantly impacted their lives. Several participants expressed their views regarding the cyclone and its impact.

"There were dead people all over, and individuals were weeping for various reasons. Some were bereft because they had been separated from their families, while others had been bereaved of relatives. We had to assist everyone we could. Although help arrived very late, we had already begun assisting one another to stay alive before help from the government arrived." (Participant A24, community member, male, talking cycles, Ngangu village, Chimanimani).

Another participant added:

> "After their residences were severely damaged or destroyed, many people were left without shelter. Hotels and institutions were converted into makeshift shelters. Others stayed in empty businesses or with relatives and friends whose homes were unaffected by the catastrophe, while I was accepted at a local hotel and later moved to my friend's place. "I am the only surviving member of my family." Why should it be me? I never cease to ponder. After, it had been raining consistently on March 14, 2019, I could only hear sounds. I was both perplexed and horrified when I awoke to find myself surrounded by water that was pouring into the room. My home was reduced to rubble in one night, and there were numerous reports of missing persons the following morning. The incidents were extremely distressing to endure. I could only offer whatever assistance I could summon as a young person then." (Participant A17, community member, male, talking cycles, Kopa, Chimanimani).

The historical narratives provided by the participants reveal that people experienced both physically and emotionally suffering. The occurrence of the cyclone made many people relocate to other areas such as Machongwe, Chitsa, Chikukwa, and other surrounding areas less prone to disaster. In addition, people began to heed the warnings of the extension officers and other community leaders about the changing climate. Before the occurrence of the catastrophic cyclone Idai, people negated advice to move from their birthplace to safer areas. The participants noted that the catastrophic situation they found themselves in was a result of the failure in land distribution in the area. In its colonial times, good fertile and arable land was taken by forestry companies and white farmers in the area, and then post-colonial district politics resulted in people living where they were (Spiegel *et al*., 2023). A township was built in low-lying areas, while others settled in areas below the mountains. An elderly participant remarked, "*Rwizi harukanganwe parwakafamba napo*," which translates to, "A river does not forget where it flowed before." Despite warnings to move away from the low-lying areas, town planners did not heed these concerns. Although most people no longer follow cultural beliefs, the Ndau people are well attached to their environment. This has made it difficult for some to see the changing environment as dangerous to them. However, following Cyclone Idai, some affected individuals were relocated, while others moved independently to safer locations, leaving some still desperate for permanent shelter and the resumption of livelihoods (Mudombi, 2019). Often during the discussions, the participants mentioned that the occurrence of the heavy destructive rain was due to the people's failure to appease gods using traditional means. In the past, three chiefs would go to the community's sacred place to appease gods and perform necessary rituals. However, this has not been happening. This revealed that the Ndau people are religious people, and once they used to uphold their African religious beliefs, and this prevented them from catastrophic events like climate-induced disasters, that is, droughts, cyclones, or floods (Gwimbi, 2009). Despite the visible changes in climate, there was hope from all the participants who participated.

The following sections discuss the short- and long-term mobility patterns that emanated as a result of climate-related disasters such as tropical Cyclone Idai, severe tropical storm Chalane, storm Eloise, and droughts that affected a large number of people since Zimbabwe attained its independence in 1980. The results reveal that Cyclone Idai triggered the population movement in the Chimanimani area as it caused widespread destruction of homes, agriculture yields, infrastructure, and sources of income for the indigenous people. These results were collaborated by studies that reveal that migration is increasingly becoming an adaptation strategy in the context of climate change (Mupesa, 2023; Nyahunda & Tirivangasi, 2021a).

3.2. Short-term human mobility patterns in Chimanimani

In the immediate aftermath of the cyclone, participants revealed that people from the most affected areas such as Ndima, Ngangu, and Kopa led to the massive outward migration of people to establish their businesses and their livelihoods in closer villages, and some went as far as Chipinge, Mutare, and Chimanimani compared to other growth points. The observations by the participants were not wrong, as the survey carried out by IOM (2020) in three of the affected villages revealed that everyone managed to return to their original homes in two villages, while only 25% of the displaced returned to their original homes in one village. The study also shows that 25% of the people who returned to that village had income-generating or livelihood opportunities. This proves two aspects: first, families whose livelihoods were destroyed by the cyclone chose to relocate to other places or safer locations. The 25% of those who returned had an incentive to return as they hoped to resuscitate their businesses and livelihood. However, apart from this village and two other villages, all people returned to their homesteads. The report cited that they had returned permanently. This explains the assertion that people in Africa choose not to leave their place of birth but rather engage in temporal mobility.

In the aftermath of Cyclone Idai and Charlene, people in Chimanimani started to find ways to supplement and diversify their livelihoods. They did this using two ways, narrated by one of the participants:

As for me, I have not been outside the country; I go and work in banana plantations for about 4 weeks, and then I have to come back and provide for my family with food and money I would have worked for. In cases where it takes too long, I send cash transfers. (Participant A2, community member, male, talking cycles, Chikukwa Village, Chimanimani).

These are just short-term mobility initiatives where people sought to find other means of income, especially after sources of income had been destroyed. Research on peasant agriculture has shown that when confronted by climatic challenges, farming households are forced to send at least one member to urban areas to search for paid employment as a strategy for diversifying incomes and cushioning the family from stressed livelihoods (Maganga, 2020). The second way was to cross the border to access better opportunities. The bad tropical events, aided by the changes in temperature and unreliable rainfall patterns, made farming more unreliable. This made the indigenous people of Chimanimani travel to Mozambique. Some started to do cross-border trading, while others went on to find work in Mozambique (Crush *et al*., 2015). These findings are consistent with IPCC's observations. It is expected that by 2050, both movement within a country and mobility across borders will increase due to climate change. However, the number of people moving within a country will be much higher than international migration. This trend fits with the IPCC's assessment that climate change impacts are particularly pronounced in African countries. The IPCC also predicts that there will be a notable increase in internal migration, with a shift from rural areas to cities (Amakrane *et al*., 2023).

In other areas, people would go to Mozambique's closest towns to buy food. One participant had this to say:

"Cyclone Idai destroyed my business; I had no choice but to go to Chimoio to buy clothes for sale in Harare. Prices of these goods are cheaper in Mozambique than in Zimbabwe. I cannot wait for farming right now; the rains will come when my family has starved. At least I should do cross-border trading for now. I am not the only one. Some traders come as far as Chipinge, and they go to Mozambique for groceries and to buy goods for sale; this is the only way to maintain my livelihoods." (Participant A23, community member, male, talking cycles, Kopa, Chimanimani).

"All my two sons are working outside the country in Mozambique and South Africa. They will come back next year when the farming season resumes. I hope we will not experience another cyclone. They are not the only ones; some villagers also left for Mutare and other cities, and others went to the plantations here in Chimanimani. However, it is just for short periods. They will return home and help with weeding and harvesting" (Participant A13, community member, female, talking cycles, Kopa, Chimanimani).

The cross-border trading and accessibility of Mozambique from the border villages made it easy for the affected villagers to cross the border and rekindle their livelihood. This is another case example of migration as an adaptation strategy. In this case, short-term mobility is indeed an adaptation strategy for the people in

Chimanimani who have been affected by tropical cyclones in recent years. Historically, there are social and cultural ties that exist between Mozambique and Zimbabwean border communities. The Chimanimani communities have traditionally maintained relations with people from Mozambique in response to economic, political, and social reasons. Mozambicans fled to Zimbabwe during the 1975 civil conflict and settled at Chipinge's Tongogara refugee camp (Hughes, 1999; Pophiwa *et al*., 2023). At the same time, others also managed to integrate in areas like Chimanimani. Amid Zimbabwe's economic catastrophe, people in Chimanimani and Chipinge travel to Mozambican villages for jobs (Hlongwana, 2021; Spiegel *et al*., 2023). The historic cultural exchange between the two nations has created stronger relations based on marriage, kinship, and ethnicity (Hlongwana, 2021; MacGonagle, 2007). As a consequence, there are nomadic families today along the border.

While others had the option to move across the border to find livelihoods, Participant A30 had a completely different encounter, with Cyclone Idai being her biggest challenge in terms of climate-induced disasters in recent memory. The participant had this to say:

"I lost everything during the cyclone, I used to be a cross-border trader earning a living, but the cyclone destroyed my house, and my travel documents were destroyed in the process. I do not have money to get new documents for me to resume my business." (Participant A30, community member, female, talking cycles, Ngangu, Chimanimani).

This account underscores the varied impact of Cyclone Idai on individuals' livelihoods and highlights the severe challenges faced by those who lacked the resources to recover. Participant A30's experience illustrates the compounded difficulties of losing both property and essential documentation, which hindered the resumption of her cross-border trading business. This case exemplifies the critical need for targeted support to help the most vulnerable rebuild their lives and regain economic stability in the aftermath of climate-induced disasters.

3.3. Long-term mobility patterns

Field observations reveal that human mobility patterns in Chimanimani have shifted. Previously, people migrated to Chimanimani in search of arable land and permanent settlement due to its locations in regions I and II, which receive better rainfall. Some individuals choose to move to the area permanently. Droughts linked to climate change made people move from Manicaland's western low-lying areas, which receive rain not enough to sustain agricultural activities. However, a stretch of mountains in the province's east, running from Nyanga in the north to Chimanimani in the south, still has flowing rivers due to abundant rainfall received in the region. According to the Ministry of Local Government, Urban, and Rural Development, over 20,000 individuals from the dry regions of districts such as Mutare, Nyanga, and Chipinge have moved to the Chimanimani area, settling on fertile land not designated for human habitation (Mambondiyani, 2015). However, due to droughts caused by cyclones and high temperatures over the last couple of years in communal areas, these trends have changed. The majority of the participants revealed that the worsening climatic conditions have been exposing Ndau people to food insecurity and low agricultural incomes; hence people opting to out-migrate and settle permanently in places like Chipinge or Buhera. These are places often referred to as not agriculturally productive. One participant had this to say:

"I stayed behind, I was born here, and I am a leader in this community, I cannot afford to go to areas like Chipinge and Buhera where I have seen others go to resettle. The process of resettling requires more capital but those with money have gone there to start animal husbandry among other projects. I have life examples of people who moved away from here permanently. These include some of my friends and other well-to-do families who can withstand such areas. As for me, I have to stay with people who are left here." (Participant B2, Village headman, Male, Kopa, Chimanimani).

Other participants echoed these sentiments, noting that these movements were driven by the high prevalence of natural disasters, such as cyclones that killed people and destroyed properties and agricultural lands in Chimanimani. However, those who moved had financial capital to start new projects where they could and also to withstand the effects of climate change in those lands that are not agriculturally suitable. The historical narratives reveal that people who had kinsmen in closer areas such as Chipinge and Borderline villages in Mozambique were able to make quick mobility decisions following the climatic disasters. The Chimanimani area is mostly inhabited by the Ndau people who have relatives with other Ndau kinsmen in Chipinge and Mozambique (Hlongwana, 2021). These ties played an important role in motivating the mobility patterns of Chimanimani people residing in the most affected areas, like Kopa and Ngangu. Kinship ties influenced families' decisions to move permanently away from the affected areas or the ability to withstand times of climatic crisis. One participant summed up the whole situation well.

"In the aftermath of the cyclone, in fact, in times of crisis, we have always helped each other, they say, "*Kutsva kwendebvu Varume vanodzimurana*." It is an idiom that indicates that "man helps each other when crisis attacks." *pamwe tinoti* "*Nhamo yako ndeyangu*" ("Your problems are mine"). Our kinsman in Chipinge came to our aid in terms of resources. We went there to settle temporarily, and we left others there. It is only that I am a grown man, and I prefer to die in the land of my fathers. I would have stayed with my relatives. However, this is a new year, and I will survive here. I would not deny we left young people there in Chipinge; they are continuing with their lives" (Participant B6, elderly woman, Ngangu village, Chimanimani).

The participants noted that they would not have succeeded without the support of their kinsmen, who provided shelter, land, and assistance with relocation. In addition, the participants received valuable information from their kinsmen about areas with good livelihoods, available agricultural land, job opportunities, and marketable products. These findings are consistent with Nyahunda & Tirivangasi (2021b), who argue that social capital enhances the adaptive capacity of a community to climate-induced disasters in rural Zimbabwe. Regarding long-term climate-induced human mobility in Chimanimani, the researcher noted a change in the historical narrative where people who were often reluctant to leave vulnerable areas near the mountains and rivers are now willing to relocate. The interviews with NGO officials working in Chimanimani revealed that the United Nations Office for Project Services (UNOPS) and the World Food Programme were building permanent structures for the affected communities. The UNOPS, at the time of the study, was building climate-resilient houses similar to those built to withstand earthquakes. In a post-disaster situation, organizations involved in housing reconstruction aim to provide better housing to the surviving communities compared to their pre-disaster conditions. This approach has been effective in cyclone-prone countries like Fiji (Elkharboutly & Wilkinson, 2022). This commendable initiative has resulted in permanent, long-term human mobility in Chimanimani, not knowing how successful these were in the end. The community members have no choice but to abide by the provisions made available to them. The changing climate is now a reality in Zimbabwe, Southern Africa, and Africa as a whole.

4. Conclusions

The study examined human mobility patterns based on the experiences of the climate-affected Chimanimani constituency in Zimbabwe. Previously, community members often disregarded or dismissed climate-related communications due to their lack of firsthand exposure to the severe consequences of climate-related events. Chimanimani, with its fertile land and favorable climate, attracted migrants from nearby areas seeking to relocate and establish new lives. Nevertheless, the frequent incidence of climate-induced disasters has prompted many to relocate to different locations. The researcher noted that most individuals, however, only engaged in temporary migration, returning to their place of origin after disasters. The Afrocentric interpretation of this phenomenon posits that community members possess a strong attachment to their birthplace. In Chimanimani, the researcher examined both short-term and long-term climate-induced mobility patterns. These findings reinforce the idea that most migration within Africa occurs internally, with individuals impacted by climatic disasters typically reluctant to move beyond their original locations. However, livelihood incentives significantly influence mobility decisions. Individuals often migrate in search of sustenance and temporary job opportunities to ensure their families' survival. This study uncovers that, for long-term climate-induced migration, the decision to permanently relocate from impacted areas is contingent upon the availability of financial resources and the presence of relatives. The researcher successfully developed a new narrative using Afrocentric methodologies, specifically the philosophical sagacity approach and talking cycles. These methodologies are valuable for examining the connections between mobility and climate-related disasters. By emphasizing historical and cultural aspects, they facilitate a deeper understanding and re-conceptualization of internal and regional mobility. The researcher concludes that human mobility is an essential adaptation mechanism in response to climate-induced disasters.

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Conflict of interest

The author declares that he has no competing interests.

Author contributions

This is a single-authored article.

Ethics approval and consent to participate

The researcher obtained written consent from participants to participate in the study.

Consent for publication

The researcher ensured the anonymity of participants when reporting excerpts and ensured that the research was not harmful to the participants in any way.

Availability of data

Data used in this work is available from the corresponding author on reasonable request.

Further disclosure

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RESEARCH ARTICLE

Gender disparities in telehealth use among older adults in the United States during the COVID-19 pandemic

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Abstract

The coronavirus disease 19 (COVID-19) pandemic underscored the significance of telehealth as a health-care delivery method, particularly for the vulnerable older adult population. Nonetheless, disparities in accessing and utilizing telehealth services persist, influenced by demographic and socioeconomic factors such as gender. This study aims to investigate the utilization of telehealth services among older adults in the United States, focusing on gender-related disparities and associated factors. Using the Round 10 and COVID-19 supplement data from the National Health and Aging Trends Study, the study examined 3,257 participants (male: 42.06%; female: 57.94%). We compared the use of telehealth services before and during the pandemic and conducted a series of logistic regression models to assess factors linked to telehealth utilization by gender. Overall, there was a significant shift toward greater use of telehealth among females during the pandemic, with multimorbidity significantly influencing the relationship between gender and telehealth utilization. For males, those who had multimorbidity (odds ratio [OR] = 2.03; 95% confidence interval [CI] = 1.07 – 3.84), owned a tablet before COVID-19 (OR = 1.89; 95% CI = 1.13 – 3.14), and learned new technologies during the pandemic (OR = 2.29; 95% CI = 1.37 – 3.82) had higher odds of telehealth use. For females, those with worse self-reported health scores (OR = 1.28; 95% CI = 1.03 – 1.59), owned a tablet (OR = 2.07; 95% CI = 1.32 – 3.23), and learned new technology (OR = 3.37; 95% CI = 2.17 – 5.24) during the pandemic demonstrated increased odds of telehealth use. Gender-based differences in telehealth utilization were evident, highlighting the need for targeted interventions that enhance older adults' access to telehealth services and mitigate digital disparities.

Keywords: Digital technology; Social work; Telehealth; Gender disparity; Coronavirus disease 19

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1. Introduction

The coronavirus disease 19 (COVID-19) pandemic has presented unprecedented challenges to health-care systems worldwide. With its onset, many health-care practitioners and health systems transitioned from traditional ambulatory in-office treatment to a telehealth care paradigm, facilitating remote patient–provider communication. The utilization of telehealth, particularly through video conversations (commonly referred to as telemedicine), witnessed a significant surge during this period (Alexander *et al*., 2020). Notably, telehealth platforms are increasingly recognized as accessible and practical tools, playing a pivotal role in reducing physical human interactions and managing the spread of the pandemic (Bokolo, 2021).

During the COVID-19 pandemic, older adults emerged as the most vulnerable group, facing increased risks of morbidity and mortality associated with the virus (Whiteman *et al*., 2021). This heightened vulnerability prompted a significant transformation in health-care delivery. Telehealth swiftly became a vital solution, offering continuous medical services remotely when reducing the risk of virus transmission (Bokolo, 2021). However, this digital transition was not universally accessible. Many older adults, particularly those with limited resources and information and communication technology (ICT) literacy, encountered obstacles in harnessing telehealth benefits (Choi *et al*., 2022). Compounding the age challenges, gender disparities in health-care access and outcomes have also been a longstanding concern, with numerous studies highlighting the differential treatment, access, and outcomes experienced by different genders (Chang *et al*., 2021; Shibli *et al*., 2021). The advent of the COVID-19 pandemic further accentuated these disparities, bringing them to the forefront of global health discussions. Studies have reported that women, particularly those from marginalized communities, face unique barriers to accessing and utilizing telehealth services (Shibli *et al*., 2021). Factors such as socioeconomic constraints, limited technological literacy, and traditional gender roles can also further impede women's full participation in the digital health realm (Choi *et al*., 2022; Kruse & Heinemann, 2022; Zhang *et al*., 2021).

As an innovative mode of health-care delivery, telehealth holds the promise of bridging some of these disparities. However, its effectiveness is intrinsically linked to its accessibility and usability, especially among older groups. As we navigate the evolving health-care landscape shaped by the pandemic, it becomes imperative to address and understand the gender disparities in telehealth utilization among older adults. Addressing these disparities is crucial to guaranteeing that all individuals, regardless of age or gender, have equitable access to health care and can achieve optimal health outcomes (Campos-Castillo & Anthony, 2020).

The late 20th and early 21st centuries witnessed rapid technological advancements, particularly in the fields of Internet connectivity and mobile technology. This period witnessed the development of various telehealth tools, including remote patient monitoring, video consultations, and electronic health records (Ackerman *et al*., 2010). The expansion of broadband Internet further facilitated real-time video consultations, making telehealth a viable option for a broader range of medical services (Ekeland *et al*., 2010). Notably, the evolution of regulatory frameworks and reimbursement strategies played a substantial role in amplifying the adoption of telehealth. Numerous insurance entities acknowledged the economic advantages of telehealth, subsequently incorporating coverage for online consultations (Dorsey & Topol, 2016). Moreover, integrating telehealth with electronic health records has proven beneficial in enhancing patient outcomes, particularly in managing chronic conditions (Gandrup *et al*., 2020). Telehealth undoubtedly holds promise in enhancing health-care delivery for underserved populations by facilitating broader access to specialized services, elevating health literacy, and expanding the health-care workforce via virtual education and training (Ackerman *et al*., 2010).

1.1. Expansion of telehealth during the COVID-19 pandemic

The COVID-19 pandemic marked a turning point in the evolution of telehealth. Faced with multifaceted challenges, global health-care systems urgently seek to minimize in-person interactions. Telehealth emerged as a critical solution, enabling the continuation of non-emergency medical services while reducing the risk of virus transmission. A 2021 cohort study underscored a notable shift in care delivery methods following the initial surge of COVID-19 in the United States of America (US) (Weiner *et al*., 2021). The data revealed an 18% reduction in ambulatory visits between March and June 2020 compared to the same period in 2019. In contrast, telehealth adoption escalated dramatically from a modest 0.3% in 2019 to an impressive 23.6% in 2020 (Weiner *et al*., 2021). Factors such as increased disease burden, COVID-19 prevalence, and greater social resources were identified as drivers of this heightened telehealth utilization (Weiner *et al*., 2021). Indisputably, the pandemic catalyzed the rapid integration of telehealth from a supplementary service to a mainstream health-care delivery method. In response, regulatory entities and insurance agencies quickly adapted, offering more flexible reimbursement policies and reducing regulatory barriers to service development (Chang *et al*., 2021).

1.2. Telehealth use among older adults

The digital revolution in health care has ushered in the era of telehealth, and the recent COVID-19 pandemic has illuminated both the potential and challenges of this mode of health-care delivery for older adults. While older adults have traditionally been more hesitant than younger cohorts to adopt new technologies, the exigencies of the pandemic have served as a catalyst for change. The prevalence of telehealth use among older adults has seen a marked increase (Choi *et al*., 2022). Studies conducted in the US have highlighted this shift, noting a substantial rise in telehealth consultations among those aged 70 and above during the pandemic. This trend signifies more than just a temporary response to a health crisis; it indicates a more profound change in how older adults perceive and engage with digital health platforms (Choi *et al*., 2022).

For older adults, the advantages of telehealth are numerous and significant. At the forefront are safety and convenience. In the context of health emergencies like the COVID-19 pandemic, telehealth provides a secure platform for medical visits and consultations, eliminating the risks associated with face-to-face interactions (Choi *et al*., 2022). Beyond the safety aspect, telehealth exemplifies the convenience of accessing health-care services from the comfort of one's own home. Many older adults, particularly those living with chronic illnesses and requiring consistent medical attention, greatly benefit from the immediacy of telehealth services (Volders *et al*., 2020). This digital approach not only facilitates prompt medical responses but also alleviates the logistical and physical burdens associated with transportation to health-care facilities (Abdallah *et al*., 2022).

Meanwhile, older adults face various challenges while engaging with telehealth. A primary concern is technological literacy. Many older individuals, due to their limited exposure to digital innovations over the years, find it challenging to navigate telehealth platforms (Mao *et al*., 2022). This difficulty is exacerbated by disparities in access to the requisite hardware and reliable Internet connectivity, both crucial for effective telehealth experiences (Litchfield *et al*., 2021; Mao *et al*., 2022). In addition, sensory challenges, such as age-related hearing or vision decline, can further impede their engagement with technology and virtual medical visits (Mitzner *et al*., 2018). Beyond these tangible barriers, there are psychological barriers. The lack of face-to-face interactions, which is often prized by this demographic for fostering trust and building rapport, can lead to feelings of detachment or skepticism toward the virtual treatment process (Ftouni *et al*., 2022). Concerns about data privacy and the potential for misdiagnoses in virtual settings further contribute to these reservations (Ftouni *et al*., 2022). Therefore, while telehealth offers various advantages, its adoption and effective utilization among the elderly necessitate addressing these multifaceted challenges.

1.3. Gender disparity in health-seeking and digital divide

Gender disparities in health care have long been a concern, with notable differences in access, treatment, and outcomes between men and women. These disparities are influenced by socio-economic and systemic factors. Historically, clinical trials have predominantly focused on male participants, leading to a dearth of information on health issues specific to females and their responses to various treatments (El-Serag & Thurston, 2020). Compared to males, females often face heightened barriers when seeking health information, such as limited mobility, diminished decision-making authority, lower literacy levels, biases from both communities and health-care providers, and insufficient health-care provider training on and system awareness regarding the unique health needs and issues faced by women (Abufaraj *et al*., 2021; Stormacq *et al*., 2020; World Health Organization, n.d.).

With the increasing integration of ICT into our daily lives and the rise of telehealth, there was an expectation that technology-driven care could help alleviate some of the existing gender disparities. Telehealth inherently addresses several traditional challenges women have faced, such as coordinating childcare or taking work leave for medical appointments (Pifer, 2021). Moreover, telehealth provides a confidential and secure environment, enabling female users to address sensitive health topics, including reproductive health, mental well-being, and concerns related to domestic violence (Hassija & Gray, 2011). Such a confidential environment can be instrumental in circumventing potential stigma or judgment that might be encountered in traditional health-care settings (Amon, 2020).

While telehealth offers numerous advantages, ensuring its accessibility and efficacy to meet the unique needs and challenges of all female users is crucial. A pressing concern is the gender digital divide, which highlights the discrepancies in accessing and utilizing digital technologies between genders. Research indicates that women often have limited access to digital devices compared to men (Acilar & Sæbø, 2023). The 2018 OECD report further revealed that females not only utilize fewer digital services but also possess less confidence in Internet usage than their male counterparts (OECD, 2018). This is further corroborated by UNICEF's 2021 data, indicating that women are less likely to own ICT devices or engage in tech-related professions (Tyers-Chowdhury & Binder, 2021). Such disparities could hinder their ability to fully harness the advantages of telehealth. Moreover, there is a digital literacy gap, especially among older female users, which might deter them from embracing telehealth. A previous study has highlighted the barriers among older female users in navigating online patient portals, primarily due to technical difficulties (Zoorob *et al*., 2022). Similarly, research on participation in telehealth trials for cardiovascular disease risk found that females were more inclined than males to refuse participation due to technological reasons (Foster *et al*., 2015). The frustrations due to the recurring need for technical assistance throughout their use were also documented (Zoorob *et al*., 2022).

1.4. Objectives

The objective of this study is to investigate the usage status and factors of telehealth among male and female adults aged over 65 in the US during the COVID-19 pandemic. Key research questions include: (i) What are the gender differences in telehealth usage among older adults before and during the COVID-19 pandemic? (ii) how does health status influence the relationship between gender and telehealth usage during the pandemic? (iii) what factors are associated with telehealth usage within each gender? We hypothesize that telehealth usage among older adults increased during the COVID-19 pandemic for both genders, albeit with differences between males and females. We further posit that the impact of gender on telehealth usage is influenced by the health status of older adults. In addition, we anticipate that socioeconomically advantaged older adults with better health and greater access to technology and knowledge will be more likely to engage in telehealth.

2. Methods

2.1. Study population

The study utilized data from Round 10 (R10) and COVID-19 supplement data from the National Health and Aging Trends Study (NHATS), a longitudinal study representing Medicare enrollees aged 65 and older living in the US in 2011 and 2015. The survey collects annual information on participants' health, function, and technological environment. Data for NHATS R10 were collected via phone during the COVID-19 pandemic outburst. The NHATS participants who completed the sample person (SP) interview in R10 were subsequently mailed a supplemental COVID-19 questionnaire between June 2020 and January 2021. Out of 3,961 SP who completed the R10 interview, 3,257 participants or their proxies completed the COVID-19 supplementary survey. The NHATS data can be retrieved through official requests made at https://www.nhats.org/researcher.

2.2. Variables

2.2.1. Telehealth use

In this study, telehealth was defined as utilizing video-based communication with health-care providers. Participants were surveyed regarding their methods of communication with their regular health-care providers before and during the COVID-19 outbreak. Response options included "in-person visits," "phone calls," "emails/texts or portal messages," and "video calls/telehealth," with each option coded as yes = 1 or no = 0 for each category.

2.2.2. Technology access and knowledge characteristics

Technology access in this study refers to ownership of digital devices, including having a working cell phone, computer, or tablet, coded as yes = 1 or no = 0. Technology knowledge is defined as whether participants have learned to use a new technology or program (e.g., smartphone, computer, iPad, Zoom, or FaceTime) to access online services during the COVID-19 outbreak, also coded as yes = 1 or no = 0.

2.2.3. Health characteristics

Participants' overall self-reported health was assessed on a continuous scale ranging from 1 to 5, where a higher score indicated poorer self-reported health. Multimorbidity was defined as the presence of multiple chronic conditions, including heart diseases, arthritis, osteoporosis, diabetes, lung disease, stroke, dementia/Alzheimer's disease, and cancer, coded as yes = 1 or no = 0.

2.2.4. Sociodemographic characteristics

Gender among NHATS participants was categorized as "male" or "female." Age was measured continuously. Race/ethnicity was categorized as "White," "Black," and "others." Marital status was classified as "married/partnered," "widowed," and "unmarried." Participants' self-rated income was initially divided into four quartiles: "< \$23,750 (level 1)," "\$23,750 ≤ × < \$42,500 (level 2)," "\$42,500 ≤ × < \$75,000 (level 3)," "≥ \$75,001 (level 4)." An additional category, "missing income (level 5)." Education level was categorized as "no or high school incomplete (level 1)," "completed high school (level 2)," "post-secondary education and some college (level 3)," and "completed college and above (level 4).

2.3. Statistical analysis

First, univariate and bivariate analyses were conducted to present the characteristics of sociodemographics, health, and methods of communication with health-care providers among male and female older adults. Furthermore, logistic regression models were employed to examine the gender differences in each communication method both before and during COVID-19. The study also examined the mediating role of health variables in the relationship between gender and telehealth usage during the pandemic. In addition, logistic regression was utilized to calculate odds ratios (OR) to assess the association of various health, sociodemographic, and technology use factors with telehealth utilization within male and female groups. Statistical significance was set at a threshold of two-tailed, with $p < 0.05$. All statistical analyses were conducted using the STATA software.

3. Results

3.1. Descriptive characteristics

In Table 1, out of the total 3,257 participants, 1,370 (42.06%) were male and 1,887 (57.94%) were female. The median age of the sample was 81.18 years, with an interquartile range of 6.82. Among male participants, the majority were White (78.39%), married/partnered (68.54%), had completed college or above education (47.32%), reported a high income (25.91%), and experienced multimorbidity (75.55%). In addition, 88.02% owned a cell phone, 75.24% owned a computer, and 47.81% owned a tablet. During the COVID-19 pandemic, 23.28% of male participants learned to use new technology.

For female participants, the majority were White (74.09%), widowed (49.18%), had completed high school (28.56%), reported the lowest income level (22.58%), and experienced multimorbidity (87.49%). In comparison to males, 84.57% of females owned a cell phone, 63.79% owned a computer, and 45.68% owned a tablet. In addition, 26.71% of female participants learned to use new technology during COVID-19. Comparing the two genders, a significantly higher proportion of males owned a working cell phone ($p < 0.01$) and a computer ($p < 0.001$).

Our study revealed that before COVID-19, the primary methods of communication with health-care providers among male older adults were in-person medical visits, followed by telephone calls. Only 23.68% used emails/texting/portal messages/social media, and the lowest proportion of the participants, 6.15%, used video calls/telehealth. For female older adults, similar to males, a small proportion, specifically 5.20%, utilized video calls/telehealth before the pandemic. During the COVID-19 outbreak, in-person visits decreased by nearly 24% for males and 30% for females, while telephone calls, emails, texting, and portal messaging saw significant increases. Telehealth usage during the outbreak increased significantly to 23.45% for males and 24.57% for females.

3.2. Gender differences in communication methods with health-care providers

Table 2 presents the gender differences in the utilization of various communication methods with health-care providers, accounting for covariates. Before the pandemic, the in-person visits for females were slightly less than for males (OR = 0.93; 95% confidence interval [CI]: 0.58 – 1.47), but this difference was not statistically significant. While during COVID-19, the odds decreased further (OR = 0.77; 95% CI: 0.60 – 1.00), reaching statistical significance ($p < 0.05$). Moreover, slightly lower odds of females had phone communication with the providers (Before: OR = 0.95; 95% CI: 0.74 – 1.22, During: OR = 0.88; 95% CI: 0.67 – 1.15), and slightly higher odds using social media or text compared to males in both periods (Before: OR = 1.12; 95% CI: 0.79 – 1.57, During: OR = 1.05; 95% CI: 0.77 – 1.44), but these differences were not statistically significant. In terms of telehealth use, the odds of females were lower compared to males (OR = 0.87; 95% CI: 0.49 – 1.55), with no significant outcomes before COVID-19. However, there was a significant shift toward greater use of telehealth by females during the pandemic (OR = 1.40; 95% CI: 1.02 – 1.91; $p < 0.05$).

3.3. The mediating effect of health characteristics between gender and telehealth use

Given the pivotal role of health in our study, we examined whether health characteristics among older adults mediate the relationship between gender and telehealth use during COVID-19. We first analyzed the mediating effect of multimorbidity while controlling for other covariates. The direct effect of female gender on telehealth use was non-significant ($\beta = 0.27$; standard error [SE] = 0.17; $p = 0.11$). Subsequently, the effect of gender on multimorbidity ($\beta = 1.08$; SE = 0.17; $p < 0.001$) and the effect of multimorbidity on telehealth use ($\beta = 0.69$; SE = 0.25; $p = 0.005$), were analyzed. The Sobel test was conducted to assess the significance of the mediating effect. The test statistic was calculated to be 2.55, indicating a significant mediating effect of multimorbidity in the relationship between the female gender and the use of telehealth services ($p < 0.05$). The study also tested self-rated health as a potential mediator but found no significant mediating effect.

3.4. Factors associations with telehealth use during the COVID-19 pandemic by gender

Table 3 presents the associations between telehealth use during the COVID-19 pandemic and a range of sociodemographic, health, and technology-related factors. For males, those with multimorbidity (OR = 2.03; 95% CI: 1.07 – 3.84), ownership of a tablet before COVID-19 (OR = 1.89; 95% CI: 1.13 – 3.14), and those who learned

Table 1. Descriptive characteristics of the participants by gender

Variables	Male (*n*=1370) (%)	Female (*n*=1887) (%)	Total (*n*=3257) (%)	*p*
Age (median, IQR)	80.56 (6.44)	81.63 (7.04)	81.18 (6.82)	<0.001
Race				<0.001
White	1,074 (78.39)	1,398 (74.09)	2,472 (75.90)	
Black	187 (13.65)	356 (18.87)	543 (16.67)	
Others	109 (7.96)	133 (7.05)	242 (7.43)	
Marital status				<0.001
Married/partnered	939 (68.54)	605 (32.06)	1,544 (47.41)	
Widowed	241 (17.59)	928 (49.18)	1,169 (35.89)	
Unmarried	190 (13.87)	354 (17.76)	544 (16.70)	
Education				<0.001
1	105 (15.20)	158 (16.41)	263 (15.90)	
2	137 (19.83)	275 (28.56)	412 (24.91)	
3	122 (17.66)	225 (23.36)	347 (20.98)	
4	327 (47.32)	305 (31.67)	632 (38.21)	
Per capita income				<0.001
1	160 (11.68)	426 (22.58)	586 (17.99)	
2	246 (17.96)	340 (18.02)	586 (17.99)	
3	297 (21.68)	290 (15.37)	587 (18.02)	
4	355 (25.91)	230 (12.19)	585 (17.96)	
5 missing	312 (22.77)	601 (31.85)	913 (28.03)	
Self-reported health (median, IQR)	2.69 (1.01)	2.76 (0.99)	2.73 (1.00)	0.02
Multimorbidity				<0.01
No	335 (24.45)	236 (12.51)	571 (17.53)	
Yes	1035 (75.55)	1651 (87.49)	571 (82.47)	
Digital device ownership				
Cell phone (yes)	1,205 (88.02)	1,595 (84.57)	2,800 (86.02)	<0.01
Computer (yes)	1,030 (75.24)	1,203 (63.79)	2,233 (68.60)	<0.001
Tablet (yes)	655 (47.81)	861 (45.68)	1516 (46.57)	0.23
Learn new technology during COVID-19				<0.05
Yes	294 (23.28)	454 (26.71)	748 (25.24)	
No	969 (76.72)	1246 (73.29)	2215 (74.76)	
In-person visit				
Before	1,196 (92.14)	1,646 (93.52)	2,842 (92.94)	0.14
During	848 (68.11)	1,115 (68.87)	1,859 (64.75)	<0.01
Phone calls				
Before	685 (59.67)	881 (58.31)	1,566 (58.89)	0.48
During	886 (72.92)	1,011 (62.18)	2,001 (70.61)	<0.01
Email/Text/Portal/Social media				
Before	255 (23.68)	264 (19.20)	519 (21.17)	<0.01
During	320 (29.25)	322 (23.05)	642 (25.77)	<0.001
Video calls/Telehealth				
Before	66 (6.15)	71 (5.20)	137 (5.62)	0.31
During	258 (23.45)	346 (24.57)	604 (24.08)	0.52

Abbreviation: IQR: Interquartile range.

Table 2. Adjusted OR and 95% CI of female and method in communication with health-care providers

Variables	Before COVID-19		During COVID-19	
	aOR	95% CI	aOR	95% CI
In-person visit	0.93	0.58 – 1.47	0.77*	0.60 – 1.00
Phone calls	0.95	0.74 – 1.22	0.88	0.67 – 1.15
Email/Text/Portal/Social media	1.12	0.79 – 1.57	1.05	0.77 – 1.44
Video calls/Telehealth	0.87	0.49 – 1.55	1.40*	1.02 – 1.91

Notes: *p<0.05. Reference is made to males, with the model adjusted for health, sociodemographic, and technology use characteristics.
Abbreviations: aOR: Adjusted odds ratio; CI: Confidence interval.

new technologies during COVID-19 (OR = 2.29; 95% CI: 1.37 – 3.82) had significantly higher odds of telehealth. Our result revealed that all predictors explained the variance of the logit of telehealth use (χ^2 [18] = 60.45; p < 0.001).

Meanwhile, for female participants, those with a higher self-reported health score (OR = 1.28; 95% CI: 1.03 – 1.59) had higher odds of telehealth use during the COVID-19 pandemic. For technology-related factors, ownership of a tablet (OR = 2.07; 95% CI: 1.32 – 3.23) and learning new technologies (OR = 3.37; 95% CI: 2.17 – 5.24) during the pandemic showed higher odds of telehealth use during the pandemic. The logistic regression model, including all

Table 3. Logistic regression of factors associated with telehealth use between male and female

Variables	Male						Female					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Age	0.99	0.95 – 1.04	0.99	0.95 – 1.03	1.02	0.97 – 1.07	0.96*	0.93 – 0.99	0.96*	0.93 – 0.99	0.97	0.94 – 1.01
Race (reference=white)												
Black	0.89	0.39 – 2.04	0.86	0.37 – 1.99	0.95	0.38 – 2.36	1.51	0.93 – 2.46	1.46	0.89 – 2.38	1.56	0.92 – 2.66
Others	2.36*	1.06 – 5.24	2.27*	1.01 – 5.09	2.31	0.94 – 5.65	1.94	0.87 – 4.34	1.79	0.80 – 4.00	1.37	0.53 – 3.56
Marriage (reference=married/partnered)												
Widowed	0.95	0.51 – 1.75	0.9	0.48 – 1.68	0.95	0.48 – 1.90	0.73	0.47 – 1.15	0.74	0.47 – 1.16	0.75	0.45 – 1.23
Unmarried	0.80	0.38 – 1.66	0.82	0.39 – 1.72	0.99	0.44 – 2.22	0.94	0.54 – 1.62	0.92	0.53 – 1.60	1.01	0.55 – 1.86
Per capital income (reference=1)												
2	1.46	0.48 – 4.46	1.44	0.47 – 4.42	1.32	0.37 – 4.68	1.90*	1.04 – 3.49	1.94*	1.05 – 3.57	1.9	0.95 – 3.79
3	2.20	0.71 – 6.78	2.37	0.76 – 7.41	2.07	0.57 – 7.56	0.97	0.49 – 1.91	1.02	0.51 – 2.03	0.98	0.46 – 2.12
4	2.91	0.93 – 9.08	3.21*	1.02 – 10.16	2.44	0.67 – 8.94	1.98	0.97 – 4.05	2.18*	1.05 – 4.51	2.25	0.99 – 5.09
5 missing	2.47	0.82 – 7.43	2.51	0.82 – 7.65	2.39	0.68 – 8.43	1.16	0.66 – 2.05	1.2	0.68 – 2.13	1.39	0.73 – 2.63
Education (reference=1)												
2	0.94	0.38 – 2.35	0.99	0.40 – 2.48	0.97	0.35 – 2.69	0.67	0.35 – 1.26	0.68	0.36 – 1.29	0.53	0.26 – 1.08
3	2.34	0.98 – 5.58	2.56*	1.07 – 6.16	1.84	0.67 – 5.05	0.90	0.47 – 1.72	0.91	0.48 – 1.75	0.55	0.26 – 1.17
4	1.64	0.72 – 3.71	1.89	0.83 – 4.33	1.35	0.51 – 3.57	1.17	0.62 – 2.20	1.23	0.65 – 2.33	0.7	0.34 – 1.47
Multimorbidity (reference=0)												
Yes			1.74	0.97 – 3.11	2.03*	1.07 – 3.84			1.56	0.79 – 3.07	1.79	0.85 – 3.79
Self-reported health			1.21	0.97 – 1.50	1.17	0.92 – 1.47			1.15	0.95 – 1.39	1.28*	1.03 – 1.59
Digital use												
Computer					1.9	0.87 – 4.16					1.1	0.67 – 1.81
Cellphone					0.59	0.27 – 1.27					0.91	0.49 – 1.71
Tablet					1.89*	1.13 – 3.14					2.07**	1.32 – 3.23
Learn new tech					2.29**	1.37 – 3.82					3.37***	2.17 – 5.24
Constance	0.13	0.00 – 4.42	0.06	0.00 – 2.04	0.00*	0.00 – 0.34	6.16	0.39 – 98.23	3.32	0.19 – 57.12	0.48	0.01 – 15.99
N		560		560		520		709		709		662

Notes: *p<0.05; **p<0.01; ***p<0.001.
Abbreviations: CI: Confidence interval; OR: Odds ratio.

predictors, explained the variance of the logit of telehealth use (χ^2 [18] = 93.57; $p < 0.001$).

4. Discussion

The COVID-19 pandemic has fundamentally reshaped the health-care paradigm, with telehealth emerging as a cornerstone of this transformation. Our study, focusing on older adults in the US, provides insights into the evolving patterns of telehealth utilization and its associated factors during this global health crisis. The results highlight a marked overall increase in telehealth use during the pandemic, with nearly a quarter of the participants, irrespective of gender, leveraging these services. This shift indicates that while older adults might have been slower in embracing digital health solutions previously, exigent circumstances such as the COVID-19 pandemic can significantly catalyze technology adoption.

Our findings revealed different usage patterns of telehealth between genders. Before COVID-19, female older adults were generally less likely to use telehealth compared to males; however, their use increased significantly during the pandemic. This increase could be attributed to the fact that female older adults reported worse self-rated health, and more of them experienced multiple health conditions than their male counterparts, which led to a greater necessity for frequent use of telehealth services to manage their more complex health needs. Our mediated analysis further provides evidence that females, who were more likely to experience multimorbidity, were consequently more likely to use telehealth services during the pandemic.

In our study, we underscore the role of health status and technology use factors in affecting telehealth uptake within each gender. For males, those with multiple health conditions were more likely to use telehealth during the pandemic. This finding aligns with the fundamental premise of such a digital method to provide convenient and safe medical consultations, especially for those with chronic ailments. For females, the self-reported health score played a pivotal role, suggesting those who perceive themselves as less healthy are more inclined to use telehealth, potentially reflecting the need and the proactive approach toward health management. Furthermore, for both groups, those who had access to a tablet or had recently acquired new technological skills during the pandemic were more likely to adopt telehealth services. A prior study has noted that many health-care providers use new technology systems, such as Zoom and Skype, to deliver services (Bokolo, 2021), thus motivating older adults to learn new technologies to access these medical services.

Interestingly, despite the widespread ownership of cell phones among the general population, our study found that owning a cell phone or computer was not significantly associated with increased odds of telehealth use. This could be explained by the fact that the smaller screens of cell phones may be less convenient for older adults, particularly those with diminished vision or hearing (Choi *et al*., 2022). Meanwhile, older adults may have lower digital literacy or comfort levels with using computers for health services (Mao *et al*., 2022). Conversely, tablets, with their user-friendly interfaces, resonated more with telehealth adoption, especially among the female group. This aligns with Neil-Sztramko *et al*.'s (2020) assertion that tablet familiarity can amplify technological adoption among older adults. With the aim of increasing telehealth use, more effort can be put into programs to assist older populations with tablet use.

It is noteworthy that the digital access divide, especially in terms of cell phone and computer ownership, persists between genders. A significantly higher proportion of males owned a working cell phone and a computer than females. As telehealth increasingly becomes a critical component of health-care delivery, a significant portion of older women risk being marginalized due to their limited access to digital tools. Consequently, there is a pressing need for well-designed interventions aimed at empowering older women to adopt and effectively utilize digital health solutions. These initiatives are crucial not only for ensuring equitable access to health care but also for leveraging the full potential of telehealth to improve health outcomes.

The limitations of the current study should also be discussed. First, regardless of the longitudinal nature of the NHATS, the COVID-19 supplement data was collected on a cross-sectional basis that only allowed for limited information about telehealth adoption during the pandemic, which restricted the ability to track its longitudinal evolution or post-pandemic sustainability. Moreover, potential underreporting of telehealth usage, due to unfamiliarity with the delivery method at the beginning of the pandemic period, could lead to an underestimation of its actual prevalence among older adults. The reliance on self-reported measures introduces potential recall bias, especially concerning telehealth usage and technological proficiency, which might not present actual engagement or skill levels. Future research should address these constraints to provide a more comprehensive understanding of telehealth dynamics in the aging population.

5. Conclusions

The accelerated adoption of telehealth during the pandemic has shown its potential for long-term integration into post-pandemic health-care systems. Our study noted a significant increase in telehealth utilization, revealing distinctive patterns influenced by health status and technological familiarity. Gender differences in telehealth utilization underscore the need for gender-specific health-care strategies. However, despite bridging certain gaps, the full potential of telehealth is hindered by the persistent digital divide. Addressing these challenges requires targeted education campaigns, simplified user interfaces, and affordable access to essential devices. As we plan for the direction of telehealth in a post-pandemic world, the focus should be placed on inclusivity, equity, and tailored interventions. It is essential to ensure that older adults, irrespective of socioeconomic or health status, have access to the necessary tools and resources. Only through concerted efforts can we guarantee equitable digital access, allowing every individual to benefit from the telehealth revolution.

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Conflict of interest

The authors declare they have no competing interests.

Author contributions

Conceptualization: Xiayu Summer Chen
Formal analysis: Xiayu Summer Chen
Investigation: Xiayu Summer Chen
Methodology: Xiayu Summer Chen
Writing – original draft: Xiayu Summer Chen
Writing – review & editing: Kun Wang

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

The data are available through official requests via https://www.nhats.org/researcher.

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RESEARCH ARTICLE

Adolescents' behavioral changes and preventive practices against COVID-19 in South Africa: The influence of household characteristics

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Abstract

The South African government instituted a countermeasure against COVID-19 in March 2020, which had a significant impact on many individuals, particularly the youth. However, there is a limited understanding of how household characteristics influenced adolescents' behavioral changes and their adoption of preventive measures during the pandemic. This study aimed to explore the relationship between the role of household characteristics and adolescents' behavioral responses to COVID-19 in South Africa. Using the latest data from the South African National Income Dynamics-Coronavirus Rapid Mobile Survey (Wave 5), which includes responses from 5581 (99.9%) youths aged 15 – 24, we analyzed changes in their behaviors and the preventive measures they adopted. The study controlled for various household, demographic, and socioeconomic characteristics of the respondents. We utilized cross-tabulations and an ordinal logistics regression model to determine the relationship between the covariates and the outcome of behavioral changes and preventive measures adopted. Our findings revealed that none of the respondents adopted all recommended precautionary measures for COVID-19, while 55.7% exhibited low behavioral changes, and only 2.7% exhibited higher behavioral changes throughout the pandemic. The results indicate that, at both the individual and household levels, factors such as gender, educational attainment, source of household income, and access to electricity increase the odds of behavioral changes against COVID-19 in South Africa. In addition, among household-level factors, adolescents without access to water were more likely to adopt one to three preventive measures compared to those with access to water (52.2% vs. 47.9%, $p < 0.001$). Therefore, to effectively prevent the spread of infection in South Africa, it is pertinent to address these household characteristics and encourage preventive measures tailored to these factors.

Keywords: Adolescent; Behavioral changes; Preventive measures; COVID-19

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1. Introduction

The South African government instituted a countermeasure against COVID-19 in March 2020 (Adebiyi *et al.*, 2021), which had a significant impact on many individuals, particularly the youth. However, there is a limited understanding of how household characteristics influenced adolescents' behavioral changes and their adoption of preventive measures during the pandemic. COVID-19 was transmitted primarily through close contact with infected individuals (Garba *et al.*, 2020) and spread through physical contact or droplets that were inhaled or came into direct contact with the eyes, nose, or mouth (Li, 2021). According to Allan *et al.* (2022), the World Health Organization, the Africa Center for Disease Control (Africa CDC), and the CDC and Prevention, instituted precautionary to curb the spread of the virus and they encouraged individuals to adopt prescribed measures, including social distancing, frequent hand-washing, and the regular use of face masks. During this period, the most common symptoms were dry cough, fever, and tiredness (Simpeh & Amoah, 2023). Due to the severity of the infection, many nations made concerted efforts to publicize both behavioral measures introduced and the preventive practices, as well as the symptoms of the virus, to minimize its spread (Wet-Billings & Anyanzu, 2022).

In South Africa, both printed and electronic media were used to inform citizens about the spread of the COVID-19 infection and the importance of testing for the virus (Nawe & Garaba, 2021). These campaigns, including the contributions of health-care professionals, played a significant role in controlling the infection and mitigating the mortality rates associated with COVID-19 (Wet-Billings & Anyanzu, 2022). However, during this period, many hospitals faced severe shortages of personal protective equipment, beds, and oxygen for infected patients, which placed a significant strain on the health-care system (Moyo *et al.*, 2021). This situation demonstrates the numerous challenges faced by the South African health-care system and underscores that public education campaigns and regulations for prevention and symptom monitoring have not always been fully effective.

Many countries in Sub-Saharan Africa (SSA), including South Africa, faced challenges in managing their health-care systems during this period. The COVID-19 regulations, particularly the lockdown, which forbade people from leaving their homes except for essential reasons, disrupted daily life for everyone (Eyawo *et al.*, 2021; Nechifor *et al.*, 2021; Wet-Billings & Anyanzu, 2022). From March to May 2020, a "hard lockdown" at levels 5 and 4 enforced the strictest regulations, including banning the sale of alcohol and tobacco, closing stores and malls, and suspending in-person schooling (Carlitz & Makhura, 2021; Dorward *et al.*, 2021; Wet-Billings & Anyanzu, 2022). During this period, there was an increase in mental and emotional stress, intimate partner violence, and unemployment (Ndlovu *et al.*, 2022; Posel *et al.*, 2021). A study found that adults who lost their jobs due to the lockdown in South Africa experienced higher rates of depression than those who remained employed (Posel *et al.*, 2021). Many parents also struggle with the demands of working from home or being unemployed while supporting their children (Cantillon *et al.*, 2021; Rich *et al.*, 2022). In addition, in many communities, families, including young people, were infected. This resulted in increased responsibilities for young people due to the impact of household factors (Rich *et al.*, 2022). Low-income households and those with special needs were particularly impacted by the pandemic in South Africa (Rich *et al.*, 2022). These factors also affected youth employment and education, and the ensuing lockdown along with additional household responsibilities likely made it difficult for young people to learn effectively and adhere to safety procedures (Rich *et al.*, 2022; Wet-Billings & Anyanzu, 2022).

The health belief model (HBM) provides a theoretical foundation for understanding how behavioral changes and preventive practices were adopted during the COVID-19 pandemic. The HBM is one of the earliest models in the study of health behavior, developed by social psychologists Irwin M. Rosenstock *et al.* in the 1950s (Drestalita *et al.*, 2022; Jones & Wallis, 2022; Roberts & David, 2021). It is a theoretical framework that explains and predicts health-related behaviors in populations or groups. Its original purpose was to identify the factors contributing to people's refusal to participate in health-care surveillance initiatives. The HBM states that a person's health-related decisions are influenced by their beliefs about their susceptibility to sickness, the severity of the medical conditions, the benefits of taking preventive actions, and the barriers to those actions (Campos-Mercade *et al.*, 2021; Jones & Wallis, 2022). Considering the perceived benefits, The HBM, for example, highlights how an adolescent's understanding of their presumed susceptibility to the COVID-19 virus and the severity of its effects might impact their decision-making when it comes to whether or not to embrace preventative therapy. Low preventive measures and behavioral changes among young people may also be caused by adolescents' inadequate financial strength to cope with the realities surrounding the infection where they congregate (Duby *et al.*, 2022). In addition, poverty and lack of access to basic amenities such as radio, televisions, water, and electricity contributed to increased infection among young people in South Africa due to limited knowledge of the disease's symptoms (Muchanga, 2020). To develop targeted interventions addressing the issues and challenges households faced in accessing healthcare services during the COVID-19 period—which had a negative impact on many South African households—it is imperative to understand these dynamics within the framework of health behavior models.

To fully understand the effect of behavioral changes and preventive measures among adolescents during the COVID-19 pandemic in South Africa and to identify the household factors influencing health-seeking behavior, it is crucial to examine micro-level national data such as the National Income Dynamics Study—Coronavirus Rapid Mobile Survey 2021 (NIDS-CRAM; Wave 5). The specific household factors affecting adolescents' behavioral changes and preventive measures throughout the COVID-19 outbreak in SSA, particularly in South Africa, remain unclear. This study aims to provide evidence that could support the development and implementation of behavioral health programs during pandemics. Thus, the objectives of this study are to (i) estimate the levels of behavioral changes and preventive measures adopted during the COVID-19 period in South Africa and (ii) explore the role of household characteristics on young people during this time.

2. Methods

For this study, we utilized data from the NIDS-CRAM; Wave 5. The NIDS-CRAM was developed by academics from South African universities to track the socioeconomic and health impacts of the COVID-19 pandemic in the country. The survey aimed to assess the effects of the government-imposed lockdown on South African households. The sample for this study was drawn from the National Household Survey, referred to as the NIDS. We focused on adolescents aged 15 – 24 years, using data from the NIDS-CRAM (Wave 5) (Ingle *et al*., 2021) to evaluate the impact of the COVID-19 pandemic outbreak on social and economic effects in South Africa. The fifth wave of the survey, conducted from April 6, 2021, to May 11, 2021 (Ingle *et al*., 2021), was chosen because it was the most recent at the time this study was conceived. It provided updates and analysis of the trend in household living conditions during the pandemic. The data is freely available for research at https://www.gtac.gov.za/nids-cram-releases-wave-5-results/. The survey sample included 2150 males and 3431 females, totaling 5581 individuals. However, only adolescents aged 15 – 24 years were included in our analysis. The NIDS-CRAM (Wave 5) survey consisted of four main questionnaires, covering household, individual, social, economic, schooling, and housing factors. In addition, data from NIDS-CRAM 2021 (Wave 5) were used to assess the prevalence of household characteristics among young people during the COVID-19 period in South Africa. We used data from this wave to evaluate how household characteristics affected adolescents' behavioral changes and preventive measures adopted during the COVID-19 pandemic in South Africa.

2.1. Study sample

The sample for this study was extracted from the latest data available from NIDS-CRAM 2021 (Wave 5), which included 5581 youths (99.9%) aged 15 – 24 years who listed preventive measures and ways their behaviors changed due to the COVID-19 infection. The study comprised 2150 males and 3431 females. Among the respondents, more than 50% reported minimal behavioral changes, whereas 60.1% did not adopt any preventive measures throughout the COVID-19 outbreak.

2.1.1. Statement of ethics

Ethics approval for the NIDS-CRAM survey was granted by the Commerce Faculty Ethics Committee of the University of Cape Town and the Research Ethics Committee: Social, Behavioral, and Education Research of the University of Stellenbosch.

2.2. Study variables and measures

2.2.1. Outcome variables

This research investigated (i) behavioral changes due to COVID-19 and (ii) preventive measures adopted by adolescents during the pandemic. The NIDS-CRAM 2021 (Wave 5) ranked behavioral changes into seven rankings (Appendix A1), while preventive measures were ranked into six rankings (Appendix A2). Appendix A1 presents the measurement of adolescents' responses to behavioral changes during the COVID-19 period. These responses were tracked over 7 weeks of telephone interviews and categorized into three levels: (i) low, (ii) medium, and (iii) high. Appendix A2 outlines the measurement of preventive practices adopted by adolescents, based on 6 weeks of telephone interviews. These responses were categorized into (i) none, (ii) 1 – 3 preventive measures, and (iii) 4 – 7 preventive measures.

2.2.2. Independent variables

The primary independent variables considered in this investigation were "household characteristics." Adolescent respondents were asked about their households in terms of (i) access to electricity, (ii) access to water, (iii) source of income of the household, and (iv) whether household members received grants. Some of these variables were recorded using binary responses (yes/no), whereas others involved categorical responses.

The covariate variables used in this study included gender (male/female) and ethnicity/race (African, White, Colored, and Indian/Asian). In the South African context, "Africans" refers to Black South Africans. The term "Colored" was used by the South African government from 1950 to 1991, to describe individuals of mixed European ("White") and African ("Black") or Asian ancestry. This term is also used more broadly to refer to Black expatriates in South Africa. In addition, the study considered a province of residence and the highest level of education. These covariates capture key demographic factors of adolescents. Demographic factors have been documented to be more connected to young people's attitudes and perceptions toward infections such as COVID-19 pandemics (Hager *et al*., 2020; Yang *et al*., 2020). In this study, gender was categorized as male and female. Research indicates that the level of education is related to changes in behaviors during pandemics (Odimegwu *et al*., 2019; Pförtner *et al*., 2022; Van *et al*., 2010). More educated youth are more likely to be aware of preventive measures associated with pandemics, which may lead to protection against the spread of the virus. Education levels in this study were classified as: "National certificate," "senior certificate," "below senior certificate," "Adult Basic Education and Training (ABET)," and "no schooling." The ABET is a program in South Africa that provides basic education and skills training to adults who have not completed their formal education. The ethnicity/race was expressed through a combination of physical, behavioral, and cultural attributes of the respondents in this study. This approach captures the variety of groups in an area along with their relative representation (Vyas & Kumaranayake, 2006). This variable was chosen to ascertain how adolescents and/or young people responded to the behavioral and preventive measures instituted by the government during the COVID-19 pandemic in South Africa. The province of residence was defined as the geographical location where the respondents resided, including the Western Cape, Eastern Cape, Northern Cape, Free State, KwaZulu-Natal, North West, Gauteng, Mpumalanga, and Limpopo.

2.3. Analysis plans

Descriptive statistical methods were used to analyze the responses regarding households, demographics, and socioeconomic variables. Cross-tabulations were employed to examine the percentages of identified behaviors that changed and preventive practices adopted. The likelihood of behavior changes and preventive practices by the respondent and household characteristics was calculated using the ordinal logistic regression model, with the outcome modified into low, medium, and high behavior changes, as well as none, 1 – 3, and 4 – 7 preventive practices. The ordinal regression method was chosen in this study due to the order of satisfaction of the dependent variables. To account for the ordinal outcomes, various ordinal logistics regression models exist. In this study, we used the proportional odds model (POM), which is commonly employed in epidemiology and public health research. The POM compares cumulatively higher categories rather than focusing solely on specific categories. The statistical models adopted for this study focus on the POM model's decisions.

3. Results

3.1. Description of adolescents and young adults included in the NIDS-CRAM (Wave 5)

Table 1 presents the background characteristics of the adolescents (15 – 24 years) included in the study. The research encompassed 2150 males and 3431 females, with females representing a higher proportion (61.5%). A significant majority of the respondents were from the African/Black ethnic group (86.6%) at the time of the survey. Most of the adolescents and young adults captured in the study were from the KwaZulu-Natal province. Regarding education, slightly more than half of the respondents (51.6%) held a senior school certificate. Among the respondents, only 44.3% were employed, whereas 41% of the respondents came from households that relied on government grants. However, most respondents lived in households that did not receive any COVID-19 grants from the government. Only a small number of individuals (10.7%) indicated that they are from households that received COVID-19 grants from the government to mitigate the effects of the COVID-19 pandemic in South Africa.

3.2. Measures of behavioral changes and levels of preventive practices among adolescents and young adults throughout the COVID-19 outbreak

Figure 1 illustrates that there were no significant behavioral changes in adolescents and young adults during the COVID-19 period. The results indicate that 56% of adolescents experienced low behavioral changes during the COVID-19 pandemic. Similarly, 41% of the respondents reported medium-level behavioral changes, while only 3% of the respondents had high behavioral changes. In addition, Figure 1 reveals that no significant preventive measures were adopted by adolescents and young adults during the COVID-19 period. The data show that 61% of adolescents did not adopt any preventive measures during the COVID-19 pandemic. Meanwhile, 35% of the respondents adopted one to three preventive measures, and only 4% adopted four to seven or more preventive measures.

Table 1. Distribution of adolescents and young adults (15 – 24 years) who changed behaviors or adopted some preventive measures according to selected background/household characteristics (COVID-19 NIDS-CRAM, 2020, South Africa)

Background characteristics	Participants	Percentage
Gender		
Male	2,150	38.5
Female	3,431	61.5
Ethnicity		
African/Black	4,834	86.6
Colored	463	8.3
Asian/Indian	44	1.0
White	240	4.3
Province		
Western Cape	7.36	7.4
Eastern Cape	546	9.8
Northern Cape	334	5.9
Free State	335	6
KwaZulu-Natal	1,638	29.3
North West	332	5.9
Gauteng	853	15.3
Mpumalanga	534	9.6
Limpopo	598	10.7
Education level		
National certificate	53	0.9
Senior cert	2,462	44.1
Below senior cert	2,881	51.6
ABET	19	0.3
No schooling	166	3.0
Household access to electricity		
Yes	5,298	94.9
No	283	5.0
Access to water		
Yes	4,109	73.6
No	1,472	26.4
Household size		
1 – 4	2,648	47.4
5 – 6	1,850	33.1
7+	1,083	19.4
Household income		
Employment	2,474	44.3
Business	331	5.9
Government grants	2,290	41.0
Family	226	4.0
No income	124	2.2
Pension	133	2.4
Household members who received grants		
None	3,737	66.9
1	1,246	22.3
2+	598	10.7
Total	5,581	100

(Cont'd...)

Table 1. *(Continued)*

Abbreviation: ABET: Adult basic education and training.

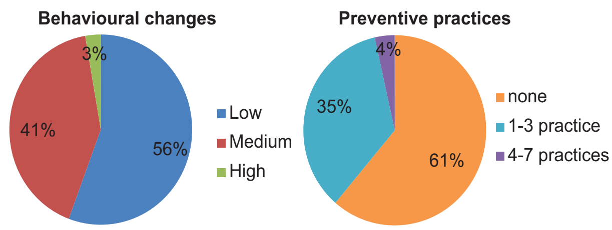

Figure 1. Measures of behavioral changes and levels of preventive practices among adolescents and young adults during the COVID-19 period in South Africa (2021)

3.3. Behavioral changes and adolescent background/household characteristics throughout the COVID-19 outbreak

Table 2 presents the distribution of adolescents' behavioral changes during the COVID-19 period, categorized by background and household characteristics. Bivariate analysis revealed that some individual and household-level factors were associated with behavioral changes among adolescents ($p < 0.001$) in South Africa. The data show that male (40.8%) and female (36.7%) adolescents aged 15 – 24 years experienced low behavioral changes in response to COVID-19. In contrast, only 3.3% of males and 4.1% of females had high behavioral changes during the pandemic. Our results also indicate that the association between gender and behavioral changes during the COVID-19 period is significant. Regarding ethnicity, adolescents from the Colored racial group constituted 2.8% of those with high behavioral changes during the COVID-19 period, while adolescents from the White and Asian/Indian racial groups had high behavior changes at 7% and 6.8%, respectively. The results show a significant association between racial diversity and behavioral changes related to COVID-19. In addition, the association between the province of residence and educational level during the COVID-19 period was also significant. For instance, adolescents who reported being in the ABET education group and having no schooling constituted 0% and 3% with high behavior changes, respectively, which was equally low among those with below the senior certificate (3%).

Table 2. Percentage distribution of COVID-19 behavioral changes among adolescents and young adults aged 15 – 24 by background/household characteristics in South Africa

Background characteristics	Behavioral changes (*n*=5581)			*p*-value
	Low	Medium	High	
	n (%)	*n* (%)	*n* (%)	
Gender				0.004*
Male	878 (40.8)	1,282 (55.9)	70 (3.3)	
Female	1,259 (36.7)	2,030 (59.2)	142 4.1)	
Ethnicity				0.09
African/Black	1,845 (38.2)	2,810 (58.1)	179 (3.7)	
Colored	179 (38.7)	271 (58.3)	13 (2.8)	
Asian/Indian	16 (36.4)	25 (56.8)	3 (6.8)	
White	97 (40.4)	126 (52.5)	17 (7.0)	
Province of residence				0.05*
Western Cape	154 (37.5)	242 (58.9)	15 (3.6)	
Eastern Cape	211 (38.6)	318 (58.2	17 (3.1)	
Northern Cape	120 (35.9)	207 (61.9)	7 (2.1)	
Free State	99 (29.5)	221 (65.9)	15 (4.5)	
KwaZulu-Natal	652 (39.8)	918 (56.0)	68 (4.2)	
North West	114 (34.3)	201 (60.5)	17 (5.1)	
Gauteng	326 (38.2)	490 (57.4)	37 (4.3)	
Mpumalanga	213 (39.9)	302 (56.5)	19 (3.6)	
Limpopo	248 41.5)	333 (55.7)	17 (2.8)	
Education level				0.001**
National certificate	19 (35.8)	31 (58.5)	3 (5.7)	
Senior certificate	825 (33.5)	1,521 (61.8)	116 (3.0)	
Below senior certificate	1,190 (43.1)	1,603 (55.6)	88 (3.0)	
ABET	6 (31.6)	13 (68.4)	0 (0.0)	
No schooling	97 (59.4)	64 (38.5)	5 (3.0)	
Household access to electricity				0.9^{ns}
Yes	2,031 (38.3)	3,065 (57.8)	202 (3.8)	
No	106 (37.5)	167 (59.0)	10 (3.5)	
Household access to water				0.004*
Yes	1,531 (37.3)	2,407 (58.6)	171 (4.2)	
No	606 (41.2)	825 (56.0)	41 (2.8)	
Household size				0.08
1 – 4	980 (37.0)	1,564 (59.0)	104 (3.9)	
5 – 6	748 (40.4)	1,027 (55.5)	75 (4.0)	
7+	409 (37.8)	641 (59.2)	33 (3.0)	
Household income				0.001**
Employment	840 (33.9)	1,521 (61.5)	113 (4.6)	
Business	112 (33.8)	201 (60.7)	18 (5.4)	
Government grants	973 (42.5)	1,255 (54.8)	62 (2.7)	
Family	89 (39.4)	124 (54.9)	13 (5.7)	
No income	57 (45.9)	62 (50.0)	5 (4.0)	
Pension	64 (48.1)	68 (51.1)	1 (0.7)	
Household members who received grants				0.35^{ns}
None	1,419 (37.9)	1,168 (58.0)	150 (4.0)	
1	479 (38.4)	719 (57.7)	48 (3.8)	
2+	239 (39.9)	345 (57.7)	14 (2.3)	

(Cont'd...)

Table 2. *(Continued)*

Notes: ***p*<0.01; **p*<0.05; ns: Non-significant.
Abbreviation: ABET: Adult basic education and training.

Our study revealed that adolescents who reported to have come from households with no access to water and electricity had a low behavioral change during the COVID-19 period compared to those who had access to water and electricity (41.2% vs. 37.3%; $p < 0.04$). Household income and size were found to be associated with the chances of adopting new behaviors during the COVID-19 period, and only households that received grants were found not to be associated with adopting new measures of behaviors throughout the COVID-19 outbreak.

3.4. COVID-19 preventive measures among adolescents and young adults aged 15 – 24 by background/household characteristics in South Africa

Table 3 presents the percentage distribution of adolescents who adopted some level of preventive measures during COVID-19 in South Africa. Bivariate analysis revealed that some individual and household characteristics were associated with adolescent preventive measures adopted during the COVID-19 period ($p < 0.01$) in South Africa. From the three categories of preventive measures created for this study, 45% of adolescents, both male and female, adopted one to three preventive measures, while <5% of adolescents reported adopting more than four preventive measures during the pandemic. The findings also reveal a relationship between ethnicity and province of residence during the COVID-19 period. Adolescents from the Free State and Gauteng provinces adopted the highest number of preventive measures, with 9.2% and 6.2%, respectively.

Among the household-level factors, the study revealed that adolescents with no access to water had a higher chance of adopting one to three preventive measures compared to those who had access to water (52.2% vs. 47.9%; $p < 0.001$). Access to electricity and household size were found not

Table 3. COVID-19 percentage distribution of preventive measures among adolescents and young adults aged 15 – 24 by background/household characteristics in South Africa

Background characteristics	Preventive measures (*n*=5581)			*p*-value
	None	1 – 3 practices	4 – 7+ practices	
	n (%)	*n* (%)	*n* (%)	
Gender				0.03*
Male	979 (45.5)	1,084 (50.4)	87 (4.0)	
Female	1,590 (46.3)	1,655 (48.2)	186 (5.4)	
Ethnicity				0.001**
Africans/Black	2,138 (44.2)	2,453 (50.7)	243 (5.0)	
Colored	281 (60.7)	162 (34.9)	20 (4.3)	
Asian/Indian	23 (52.3)	20 (45.4)	1 (2.3)	
White	127 (52.9)	104 (43.3)	9 (3.7)	
Province of residence				0.001**
Western Cape	243 (59.1)	150 (36.5)	18 (4.4)	
Eastern Cape	252 (36.1)	271 (49.6)	23 (4.2)	
Northern Cape	221 (66.2)	105 (31.4)	8 (2.4)	
Free State	144 (42.9)	160 (47.8)	31 (9.2)	
KwaZulu-Natal	611 (37.3)	954 (58.2)	73 (4.5)	
North West	224 (67.5)	100 (30.1)	8 (2.4)	
Gauteng	397 (46.5)	403 (47.2)	53 (6.21)	
Mpumalanga	253 (47.4)	261 (48.9)	20 (3.7)	
Limpopo	224 (37.5)	335 (56.0)	39 (6.5)	
Education level				0.3^{ns}
National certificate	32 (60.4)	20 (37.7)	1 (91.9)	
Snr cert	1,152 (46.8)	1,189 (48.3)	121 (4.9)	
Below senior certificate	1,296 (44.9)	1,442 (50.0)	143 (4.9)	
ABET	7 (36.8)	12 (63.2)	0 (0.0)	
No schooling	82 (49.4)	76 (45.8)	8 (4.8)	
Household access to electricity				0.45^{ns}
Yes	2,449 (46.2)	2,591 (48.9)	258 (4.9)	
No	120 (42.4)	148 (52.3)	15 (5.3)	
Household access to water				0.01*
Yes	1,937 (47.1)	1,971 (47.9)	281 (4.9)	
No	632 (42.9)	768 (52.2)	72 (4.9)	
Household size				0.42^{ns}
1 – 4	1,234 (46.6)	1,280 (48.3)	134 (5.0)	
5 – 6	861 (46.5)	907 (49.0)	82 (4.4)	
7+	474 (43.8)	552 (50.9)	57 5.3)	
Household income				0.001**
Employment	1,275 (51.5)	1,087 (43.9)	112 (4.5)	

(Cont'd...)

Table 3. ***(Continued)***

Background characteristics	Preventive measures (*n*=5581)			*p*-value
	None	1 – 3 practices	4 – 7+ practices	
	n (%)	*n* (%)	*n* (%)	
Business	147 (44.4)	175 (52.9)	9 (2.7)	
Government grants	962 (42.0)	1,207 (52.7)	121 (5.3)	
Family	68 (30.0)	138 (61.0)	20 (8.8)	
No income	49 (39.5)	70 (56.4)	5 (4.0)	
Pension	67 (50.4)	60 (45.1)	6 (4.5)	
Household members who received grants				0.01*
None	1,772 (47.4)	1,786 (47.8)	179 (4.8)	
1	558 (44.8)	628 950.4)	60 (4.8)	
2+	239 939.9)	325 (54.3)	34 (5.7)	

Notes: $^{**}p<0.01$; $^{*}p<0.05$; ns: Non-significant.
Abbreviation: ABET: Adult basic education and training.

to be associated with the chance of adopting preventive measures during the COVID-19 outbreak.

3.5. Household and individual level determinants of COVID-19 behavioral and preventive measures during the COVID-19 period in South Africa

Utilizing multivariate binary logistic regression, we examined the impact of both individual and household-level factors on behavioral changes and preventive measures adopted by adolescents during the COVID-19 outbreak in South Africa. After controlling for the other covariates, we noticed that gender, ethnic affiliation, province of residence, education attainment, access to electricity, access to water, and household income increased the odds of behavioral changes during the COVID-19 period. Being female had a positive association with the chances of behavioral change. Adolescents from Colored and White racial groups (15 – 24 years) had lower odds of behavioral changes during the COVID-19 period; (adjusted odds ratio [AOR]: 0.84; 95% confidence interval [CI]: 0.66 – 1.08) and (AOR: 0.87; 95% CI: 0.65 – 1.16), respectively. Conversely, adolescents from the Asian/Indian ethnic group had increased chances of adopting new behavioral measures, although their odds did not differ significantly from those of the Colored and White ethnic groups.

In terms of province or residence, adolescents from the Northern Cape, Free State, and Gauteng provinces were associated with increased chances of adopting new behavioral measures during the COVID-19 period. However, adolescents residing in the Eastern Cape, KwaZulu-Natal, Gauteng, Mpumalanga, and Limpopo

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had lower odds of adopting these measures: (AOR: 0.97; 95% CI: 0.73 – 1.73); (AOR: 0.94; 95% CI: 0.72 – 1.23); (AOR: 0.90; 95% CI: 0.69 – 1.19); (AOR: 0.89; 95% CI: 0.66 – 1.20); and (AOR: 0.89; 95% CI: 0.66 – 1.20), respectively. Furthermore, an association between educational level and behavioral changes was observed, with adolescents reported to have senior certificates, national certificates, and ABET having increased odds of behavioral changes during the COVID-19 period. Meanwhile, households with access to electricity, those with more than seven members, and households where at least one person received COVID-19 grants were also likely to adopt new behavioral measures during the COVID-19 period. Household income from government grants and pensions was associated with a positive change in behavior throughout the COVID-19 outbreak.

In analyzing the preventive measures adopted during the COVID-19 pandemic in South Africa, the full model, after controlling for various covariates, revealed that gender, ethnicity, and education level had no significant relationship with the adoption of preventive measures during the COVID-19 pandemic. Adolescent women from the Colored, Asian/Indian, and White racial groups (aged 15 – 24 years) had lower odds of adopting new preventive measures during the COVID-19 period: (AOR: 0.96; 95% CI: 0.69 – 1.22); (AOR: 0.91; 95% CI: 0.71 – 1.17); (AOR: 0.72; 95% CI: 0.39 – 1.31); and (AOR: 0.92; 95% CI: 0.69 – 1.22), respectively.

Furthermore, there were notable differences in the adoption of preventive measures across various provinces during the COVID-19 period in South Africa. Adolescents living in the Eastern Cape (AOR: 1.49; 95% CI: 1.12 – 1.99); Free State (AOR: 1.87; 95% CI: 1.35 – 2.58); Kwazulu-Natal (AOR: 2.04; 95% CI: 1.56 – 2.66); Gauteng (AOR: 1.54; 95% CI: 1.18 – 2.02); Mpumalanga (AOR: 1.38; 95% CI: 1.02 – 1.85); and Limpopo (AOR: 2.07; 95% CI: 1.54 – 2.79) were likely to adopt new preventive measures compared to adolescents living in the Western Cape, Northern Cape, and Northwest provinces. Regarding household characteristics, access to electricity, access to water, household income, and the number of household members who received grants were not associated with the adoption of preventive measures during COVID-19, although access to electricity, household income, and the number of individuals receiving grants had increased odds of adopting preventive measures during the pandemic (Table 4).

4. Discussion

This study's primary goal was to examine the influence of household characteristics on behavioral change and preventive measures adopted throughout the COVID-19 outbreak among adolescents in South Africa. The pandemic was a major global health crisis that impacted the social, economic, and development of many nations due to the shutdown of schools and the lockdown of many industries/factories (Carlitz & Makhura, 2021; Dorward *et al*., 2021; Eyawo *et al*., 2021). Most of the young population was largely affected by being dependent on their parents for guidance (Rich *et al*., 2022). Therefore, there is a need to further investigate the role of household-level factors on adolescents' behavior changes and preventive measures adopted during the pandemic. This study adds to the increasing body of research addressing the varied effects of the pandemic on the lives of teenagers in South Africa by demonstrating a relationship between behavioral changes, household features, and preventive actions taken to avert the virus and any other future pandemics.

Using cross-sectional survey data, bivariate analysis demonstrated that individual and household characteristics influenced the behaviors and preventive measures taken during the COVID-19 period in South Africa. The results of this study are in alignment with similar studies conducted in Nigeria and China (Gever *et al*., 2021; Ye *et al*., 2021), which also reported significant relationships between household factors and behavioral changes during the pandemic. This study investigated the influence of household characteristics on adolescents' health throughout the COVID-19 pandemic in South Africa. Two studies conducted in Kenya and Uganda in 2020 reported that about 23% and 15% of young individuals could not change their behaviors because of household conditions during the pandemic, highlighting the significance of household characteristics in shaping the behaviors of young individuals (Karp *et al*., 2021; Matovu *et al*., 2021). In addition, Gift *et al*. (2020) reported that access to water in households increased the change in behaviors and decreased the opportunities of being infected by coronavirus. Furthermore, Sengai *et al*. (2022) observed an increase in preventive measures among adolescents in Lesotho during the COVID-19 outbreak.

According to the literature, there is limited evidence on how household vulnerabilities affect adolescents' behavioral changes during the COVID-19 period in South Africa (Posel *et al*., 2021). Hence, the analysis of this research highlights the importance of our results in informing public health policy and programming, especially for young individuals who significantly depend on their parents for guidance during pandemics.

This study revealed that gender, ethnicity, province of residence, educational level, income, access to water and electricity, and household size were important factors

Table 4. Multivariate logistic regression analysis investigating the risk of background/household characteristics throughout the COVID-19 outbreak among adolescents and young adults (NIDS-CRAM 5, South Africa)

Background characteristics	Behavioral changes (*n*=5581)			Preventive measures (*n*=5581)		
	AOR	*p*-value	95% CI	AOR	*p*-value	95% CI
Gender						
Male	1			1		
Female	1.29	0.001**	(1.15 – 1.44)	0.96	0.492	(0.69 – 1.22)
Ethnicity						
African/Black	1			1		
Colored	0.84	0.191	(0.66 – 1.08)	0.91	0.48	(0.71 – 1.17)
Asian/Indian	1.04	0.9	(0.56 – 1.93)	0.72	0.284	(0.39 – 1.31)
White	0.87	0.349	(0.65 – 1.16)	0.92	0.553	(0.69 – 1.22)
Province						
Western Cape	1			1		
Eastern Cape	0.97	0.844	(0.73 – 1.73)	1.49	0.006**	(1.12 – 1.99)
Northern Cape	1.07	0.663	(0.79 – 1.43)	0.7	0.024*	(0.52 – 0.95)
Free State	1.3	0.109	(0.94 – 1.81)	1.87	0	(1.35 – 2.58)
KwaZulu-Natal	0.94	0.651	(0.72 – 1.23)	2.04	0	(1.56 – 2.66)
Northwest	1.67	0.36	(0.84 – 1.62)	0.62	0.006**	(0.44 – 0.87)
Gauteng	0.9	0.471	(0.69 – 1.19)	1.54	0.002**	(1.18 – 2.02)
Mpumalanga	0.89	0.452	(0.66 – 1.20)	1.38	0.034*	(1.02 – 1.85)
Limpopo	0.89	0.462	(0.66 – 1.20)	2.07	0***	(1.54 – 2.79)
Education level						
National cert	1			1		
Senior cert	1.33	0***	(1.19 – 1.49)	0.98	0.73	(0.88 – 1.09)
Below Snr cert	1.24	0.446	(0.70 – 2.18)	0.53	0.029*	(0.30 – 0.94)
ABET	1.32	0.547	(0.53 – 3.24)	1.1	0.831	(0.46 – 2.65)
No schooling	0.55	0***	(0.40 – 0.76)	0.74	0.063	(0.54 – 1.02)
Access to electricity						
Yes	1			1		
No	1.09	0.514	(0.85 – 1.39)	1.13	0.339	(0.88 – 1.44)
Access to water						
Yes	1			1		
No	0.91	0.167	(0.79 – 1.04)	0.99	0.963	(0.87 – 1.14)
Household size						
1 – 4	1			1		
5 – 6	0.9	0.118	(0.80 – 1.02)	0.93	0.225	(0.82 – 1.04)
7+	1.05	0.52	(0.89 – 1.23)	0.92	0.296	(0.79 – 1.07)
Household income						
Employment	1			1		
Business	1.09	0.476	(0.86 – 1.38)	1.12	0.327	(0.89 – 1.40)
Government grants	0.72	0***	(0.64 – 0.82)	1.33	0***	(1.18 – 1.50)
Family	0.83	0.2	(0.63 – 1.10)	2.31	0***	(1.75 – 3.05)
No income	0.68	0.041*	(0.47 – 0.98)	1.34	0.114	(0.93 – 1.91)
Pension	0.55	0.001**	(0.389 – 0.78)	1.02	0.925	(0.71 – 1.45)

(Cont'd...)

Table 4. ***(Continued)***

Background characteristics	Behavioral changes (*n*=5581)			Preventive measures (*n*=5581)		
	AOR	*p*-value	95% CI	AOR	*p*-value	95% CI
Household members who received grants						
None	1			1		
1	1.04	0.534	(0.91 – 1.19)	1.02	0.809	(0.89 – 1.16)
2+	0.96	0.661	(0.80 – 1.15)	1.17	0.086	(0.98 – 1.40)

Note: ***$p<0.001$; **$p<0.01$; *$p<0.05$.
Abbreviations: AOR: Adjusted odds ratio; CI: Confidence interval.

associated with behavioral changes among young people in South Africa during the COVID-19 pandemic. In addition, this study revealed that the number of household members who received COVID-19 grants did not affect adolescents' behavioral changes. One key reason for the resistance to behavioral change among some young people could be a lack of proper information about the COVID-19 pandemic, as adolescents without access to radio or TV did not receive the necessary information to make informed changes in their behavior.

Our study further revealed that gender, ethnicity, province of residence, access to water, household income, and the number of household members who received any form of COVID-19 grant were important factors in adopting any form of preventive measure during the pandemic. Furthermore, education level and household size were not associated with any form of preventive measure adopted among adolescents.

This study also found that the odds of behavioral changes during the COVID-19 period among adolescents were lower among the Colored and White racial groups. This suggests that an adolescent's ethnic background significantly influenced the extent to which they changed their behaviors throughout the period. In addition, the study revealed that being female had a positive association with behavioral changes, implying that females had increased odds of positive behavior change during the pandemic. This finding corroborates the results of other studies from Ghana, which reported that young women were more likely to change their behaviors during the COVID-19 pandemic (Asiamah *et al.*, 2021). Adoption of new behavioral measures was lower among male youth, probably because they were less aware of the various behavioral guidelines provided by the Department of Health throughout the COVID-19 outbreak. Literature states that men perform poorly in analyses concerning hygiene measures. This may also be the reason why male youth would be less aware of different behavioral guidelines provided by the Department of Health (Manirambona *et al.*, 2022).

There was a significant association between household access to electricity and behavior change during COVID-19 among young people in South Africa. A similar result was reported in a previous study (Gittings *et al.*, 2021). This research implies that, to ensure that households have access to electricity during pandemics and are well informed about the harmful effects of the illness, the government should give priority to these vulnerable homes. Furthermore, adolescents from households with seven members or above had increased odds of changing behaviors during pandemics. This finding signifies the importance of acknowledging the importance of large families in determining health-seeking behaviors during pandemics among young people. Meeting the health needs of large families, such as during the COVID-19 pandemic, has the potential to increase the necessary preventive measures to be taken during pandemic crises. By continuing to pursue the positive health-seeking behaviors of large families during a pandemic, such as the COVID-19 pandemic, the government will create an opportunity to reduce the risks, trends, and factors that will inform targeted public health interventions among the youth.

The research employed the HBM to elucidate the reasons for the behavioral modifications and preventative actions taken by a subset of South African youth during the COVID-19 pandemic. This model was adopted because people are more likely to take preventative health-promoting measures when they think the advantages of doing so exceed the challenges or drawbacks of doing so (Campos-Mercade *et al.*, 2021; Jones & Wallis, 2022). The paradigm presupposes that people acquire rational abilities to make decisions by means of communication or schooling.

It is pertinent for young people to understand the importance of adopting preventive measures during infectious disease outbreaks to avoid contracting the virus. Household factors play a pivotal role in this regard, as some youths mentioned that they could not adopt any measure of preventive mechanisms in South Africa, despite the benefits associated with it. This finding could be linked to the fact that HBM emphasizes that people adopt preventive health promotion measures when they think the advantages outweigh the challenges. The adolescents must have found that the challenges were too great to change their behaviors. The findings showed that adolescents from households with access to water were less likely to adopt any form of preventive measure during the pandemic compared with those with no access to water. This is a surprising result for us because both national and global agencies advocated for regular handwashing during the COVID-19 pandemic. It could also be a result of how the questions related to water were framed. On the contrary, it could be that the respondents did not understand the question based on their level of education, as the interviews were conducted through telephone calls; hence, a better approach for the adolescents to understand the question and provide appropriate responses could be a face-to-face interview. This finding confirms the assumption of the HBM that youth's increased knowledge may contribute to their understanding of the benefits of adopting preventive measures during pandemics. It shows that when an individual has better knowledge of an intervention, such as the preventive measures rolled out to minimize the spread of the COVID-19 pandemic, they are more likely to accept such an intervention.

4.1. Limitations of the study

This study has certain limitations that should be taken into account. First, causal inferences are limited by the study's cross-sectional design. Second, because participants were asked to express their attitudes about preventative health-seeking behavior in the survey rather than in the current year, recall bias may have affected their responses. Third, the dataset lacked information on a few significant outcomes and independent variables, including a woman's sexual activity, religion, and number of children. As such, carrying out an exhaustive investigation on the impact of COVID-19 on South African households during the pandemic proved to be difficult. Despite its shortcomings, this is a study that offered insight into adolescents' changes in behaviors and precautionary measures adopted during the COVID-19 era in South Africa. To address the damaging effects of the pandemic on youth's health, the study will therefore inform adolescents' health programming during any pandemic such as COVID-19.

Despite the fact that the full impact of the COVID-19 pandemic on adolescents' health and well-being experiences is not fully investigated in South Africa, this study provides a mini understanding of the effects of household-level factors during the COVID-19 period on behavioral changes, as well as preventive measures adopted among adolescents aged 15 – 24 years in South Africa. The percentage of young people who did not change their behaviors positively or adopt any preventive measures during the COVID-19 period is of concern for improving their health and well-being in the country. The low percentage of adopting any form of preventive measure during the pandemic observed in this study could be due to the challenges faced by many households seeking the means of survival as there were total lockdown rules, which made many individuals from an impoverished household unable to attempt to improve their situation. The other reasons could be poverty, lack of access to their farmlands, and disruptions in the supply and provision of food (Tripathi *et al*., 2021).

The findings of this study have significant implications for a theoretical understanding of the individual and household-level factors associated with behavioral changes, as well as preventive measures adopted during the COVID-19 period among youths in South Africa. In addition, the findings draw attention to individual, and household-level disruptions and challenges adolescents encountered during the pandemic in South Africa. It has also helped to identify the vulnerability of household conditions that need to be supported and improved during the COVID-19 period and any other infectious outbreak in the future. This is to ensure that young people from vulnerable households are supported to make decisions that will improve their health and well-being. Hence, the findings from this study will guide health policymakers in designing health policies and interventions that address the unique health-care needs of young people and support households during pandemics to avert the future consequences of COVID-19 on adolescent health in the country.

5. Conclusion

The study revealed that the behavior changes and preventive measures taken by adolescents were influenced by household-level characteristics during the COVID-19 pandemic in South Africa. This is evident from the increased proportion of adolescents who neither changed their behavior nor adopted any preventive measures during the pandemic. The impact of the COVID-19 infection on household living conditions in many communities may have contributed to this lack of behavioral change and preventive action. The study also established that lack of access to basic amenities such as social grants, water, and electricity altered the positive behaviors of youths toward the pandemic, thereby limiting their understanding of the infection's severity. This resulted in many young individuals falling victim to the COVID-19 infection in South Africa due to limited knowledge of the symptoms of the infection. Future studies should explore how community factors such as poverty, media exposure, and education affect preventive health-seeking behaviors during pandemics. In addition, studies should examine the impact of providing community support and addressing cultural norms related to infections in SSA countries. Therefore, to prevent the spread of infection in South Africa, policymakers should strive to address these household characteristics that have been undermining the lives of people during pandemics.

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Conflict of interest

The authors declare that they have no conflicts of interest.

Author contributions

Conceptualization: All authors
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Writing – review & editing: All authors

Ethics approval and consent to participate

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Consent for publication

Not applicable.

Availability of data

The study uses fully anonymized secondary data obtained from the South African National Income Dynamics CRAM Survey, which can be downloaded freely online at http://cramsurvey.org/.

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Appendix

Appendix A1. Ranking of how adolescents' behavior changed during COVID-19 in South Africa

In what ways has your behavior changed (week 1)?	In what ways has your behavior changed (week 2)?	In what ways has your behavior changed (week 3)?	In what ways has your behavior changed (week 4)?	In what ways has your behavior changed (week 5)?	In what ways has your behavior changed (week 6)?	In what ways has your behavior changed (week 7)?
Wash hands more; avoid close contact with others; avoid big groups; wear face masks; get a flu vaccine; eat garlic; stay home more; use sanitizer; regularly clean/disinfect home/surfaces; social distancing; wear gloves; avoid going to crowded places; spend time in the sun; no, I'm not doing anything; eating healthy.	Avoid close contact with others; avoid big groups; wear face mask; get a flu vaccine; eat garlic; stay home more; use sanitizer; regular cleaning/disinfect home/surfaces; use gloves; cough into elbow; stop drinking; stop smoking; avoid going to crowded places, spend time the sun; no, I'm not doing anything; eating healthy.	Avoid big groups; wear face mask; get a flu vaccine; eat garlic; stay home more; use sanitizer; regularly clean/disinfect home/surfaces; social distancing; wear gloves; cough into elbow; stop drinking; stop smoking; avoid going to crowded places; spend time the sun; no, I'm not doing anything; eating healthy.	Wear face mask; get a flu vaccine; eat garlic; stay home more; use sanitizer; regularly clean/disinfect home/surfaces; social distancing; wear gloves; cough into elbow; stop drinking; stop smoking; avoid going to crowded places; spend time the sun; no, I'm not doing anything; eating healthy.	Get a flu vaccine; eat garlic; stay home more; use sanitizer; regularly clean/disinfect home/surfaces; social distancing; wear gloves; stop drinking; avoid going to crowded places; spend time in the sun.	Use sanitizer; regularly clean/disinfect home/surfaces; wear gloves; cough into elbow; stop drinking; avoid going to crowded places; spend time in the sun; eat healthy.	Wear gloves and avoid going to crowded places.

Appendix A2. Ranking of adolescents' preventive measures adopted during COVID-19 in South Africa

Why unlikely to get the coronavirus (week 1)?	Why unlikely to get the coronavirus (week 2)?	Why unlikely to get the coronavirus (week 3)?	Why unlikely to get the coronavirus (week 4)?	Why unlikely to get the coronavirus (week 5)?	Why unlikely to get the coronavirus (week 6)?
Haven't interacted with someone with the virus; I stay at home; I wash my hands; I wear a mask; I social distance away from others; I don't believe there is something like this; coronavirus only affects people who are old; I sanitize my hands.	I stay at home; I wash my hands; I wear a mask; I social distance from others; I don't believe there is something like this; coronavirus only affects people who are old; I sanitize my hands.	I wash my hands; I wear a mask; I social distance from others; I don't believe there is something like this; I sanitize my hands.	I wear a mask; I social distance from others; I don't believe there is something like this; I sanitize my hands.	I don't believe there is something like this; I sanitize my hands.	I sanitize my hands.

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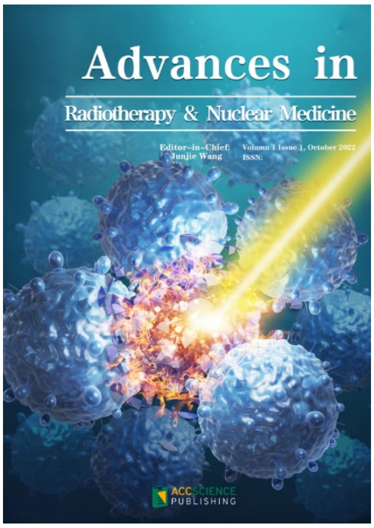

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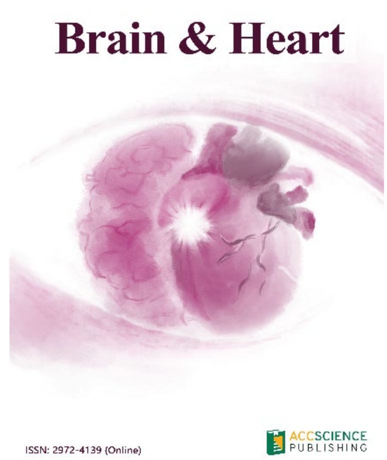

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