



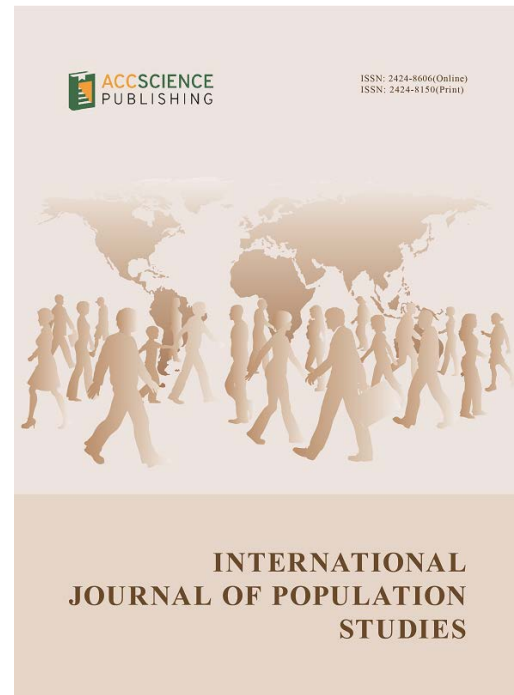
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# International Journal of Population Studies

Print ISSN: 2424-8150

Online ISSN: 2424-8606

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Volume 12 • Issue 1 • January 2026  
ISSN 2424-8150 (print) ISSN 2424-8606 (online)

# INTERNATIONAL JOURNAL OF POPULATION STUDIES

**Editor-in-Chief**

**Danan Gu**

*United Nations, New York, United States*



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***International Journal of Population Studies***

ISSN: 2424-8150 (print)

ISSN: 2424-8606 (online)

**Editorial and Production Credits**

Publisher: AccScience Publishing

Managing Editor: Celine Chen

Production Editor: Sharmila Velapasamy

Article Layout and Typeset: Sinjore Technologies (India)

Cover Design: ProPub (China)

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## REVIEW ARTICLE

## Effectiveness of cognitive interventions in mitigating mental fatigue among healthcare professionals in hospital settings: A systematic review

Sara Gonçalves<sup>1,2,3\*</sup>  and Rita S. Matos<sup>1,4\*</sup> <sup>1</sup>Academic Clinical Center of Trás-os-Montes and Alto Douro, University of Trás-os-Montes e Alto Douro, Portugal<sup>2</sup>Associate Laboratory for Animal and Veterinary Sciences (AL4AnimalS), University of Trás-os-Montes and Alto Douro, Portugal<sup>3</sup>Centre for Animal Sciences and Veterinary Studies, University of Trás-os-Montes and Alto Douro, Portugal<sup>4</sup>Local Health Unit of Trás-os-Montes and Alto Douro, Portugal**Abstract**

Mental fatigue poses a significant challenge to healthcare professionals in hospital settings, impairing cognitive performance, emotional well-being, and job satisfaction. This systematic review evaluates the effectiveness of cognitive interventions, including mindfulness programs, online psychological interventions, and telehealth cognitive-behavioral therapy (CBT), in mitigating mental fatigue among healthcare workers. A comprehensive literature search across PubMed, Web of Science, and Scopus identified six studies published between 2016 and 2023. These studies reported that cognitive interventions significantly reduced burnout and stress levels, with up to a 30% decrease in emotional exhaustion and improved coping mechanisms. In addition, participants demonstrated enhanced emotional well-being, reflected in increased mindfulness and life satisfaction scores of as much as 25%. Mindfulness-based programs and telehealth CBT were particularly effective in fostering resilience and improving overall cognitive function. However, the review also highlighted the need for future research to explore the long-term effects of these interventions, their cost-effectiveness, and innovative methods to improve accessibility and scalability, such as digital platforms. Integrating cognitive interventions into routine healthcare practice can enhance staff well-being, improve patient outcomes, and contribute to a more supportive work environment.

**Keywords:** Mental fatigue; Hospital; Healthcare professionals; Cognitive interventions**\*Corresponding authors:**Sara Gonçalves  
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Rita S. Matos  
(armatos@arsnorte.min-saude.pt)**Citation:** Gonçalves, S., & Matos, R.S. (2026). Effectiveness of cognitive interventions in mitigating mental fatigue among healthcare professionals in hospital settings: A systematic review. *International Journal of Population Studies*, 12(1):1-14.  
<https://doi.org/10.36922/ijps.4276>**Received:** July 18, 2024**Revised:** September 9, 2024**Accepted:** September 12, 2024**Published online:** October 14, 2024**Copyright:** © 2024 Author(s). This is an Open-Access article distributed under the terms of the Creative Commons Attribution License, permitting distribution, and reproduction in any medium, provided the original work is properly cited.**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.**1. Introduction**

Mental fatigue manifests as a multifaceted phenomenon in healthcare professionals. It is characterized by a depletion of cognitive resources and a decline in cognitive functioning after extended durations of intense mental effort (Marcora *et al.*, 2009). Healthcare professionals in hospital settings, including doctors, nurses, and other

staff, are frequently exposed to high mental workloads from varied sources such as critical decision-making, multitasking, information processing, and emotional labor (Koinis *et al.*, 2015).

Healthcare work often involves rapid response to emergencies, long hours of continuous work, and exposure to emotionally taxing situations, all of which can contribute to mental fatigue (Koinis *et al.*, 2015). Moreover, the cognitive demands of healthcare tasks are compounded by the need for accuracy, precision, and vigilance, as errors in clinical judgment or patient care can have serious consequences (Balogh *et al.*, 2015; Søvold *et al.*, 2021). As a result, healthcare professionals may experience a range of cognitive symptoms associated with mental fatigue, including reduced attentional focus, impaired decision-making ability, slower information processing speed, and increased distractibility (Karim *et al.*, 2024).

Mental fatigue affects the cognitive performance, emotional well-being, and job satisfaction (Marcora *et al.*, 2009) of healthcare professionals. Chronic exposure to mental fatigue can lead to feelings of burnout, decreased job engagement, and increased risk of medical errors, compromising both patient safety and the quality of provided care (Dall'Ora *et al.*, 2020; LeGal *et al.*, 2019; Lock *et al.*, 2018). Furthermore, mental fatigue can contribute to long-term health consequences for healthcare professionals, including an increased risk of anxiety, depression, and other mental health disorders (Lock *et al.*, 2018; Søvold *et al.*, 2021).

Thus, addressing mental fatigue among healthcare professionals is imperative for optimizing patient outcomes and promoting the well-being of the healthcare workforce (Søvold *et al.*, 2021). Cognitive interventions offer promising strategies to combat mental fatigue by enhancing cognitive resilience, improving stress management skills, and promoting adaptive coping mechanisms (Schäfer *et al.*, 2024). These interventions may include cognitive training programs to enhance cognitive skills such as attention, memory, and executive functions, mindfulness-based practices to cultivate present-moment awareness and stress reduction, and ergonomic interventions to optimize the work environment and reduce cognitive workload (Karim *et al.*, 2024; Nakao *et al.*, 2021; Whitfield *et al.*, 2022). In this review, “cognitive interventions” signify structured, evidence-based activities or therapeutic approaches designed to improve cognitive functions, such as attention, memory, and executive function, enhance cognitive resilience, and manage cognitive load. Such interventions aim to mitigate mental fatigue and promote mental well-being in healthcare professionals by employing cognitive-

behavioral therapy, mindfulness practices, and cognitive training exercises.

The current body of research is limited and fragmented despite growing interest in this area. Studies on cognitive interventions for healthcare professionals often exhibit drawbacks such as small sample sizes, diverse methodologies, and inconsistent reporting of outcomes. Moreover, comprehensive reviews that synthesize the available evidence are lacking, which makes it difficult to derive definitive conclusions about the effectiveness of such interventions.

This review proposes to fill this gap by systematically reviewing and analyzing studies examining the impact of cognitive interventions on mental fatigue among healthcare professionals. This study also addresses the methodological limitations and variability of previous research initiatives to deliver a more reliable and nuanced understanding of how such interventions can bolster the mental health of healthcare workers. In doing so, it contributes valuable insights to the literature and helps inform future research and clinical practice in this critical domain of occupational health.

## 2. Methods

The review protocol is registered with PROSPERO under registration number CRD42024524591. The systematic review approach follows Cochrane guidelines and evaluates evidence from randomized controlled trials on effectiveness. This method represents a structured and transparent approach for rating confidence in effect estimates.

### 2.1. Research framework

This quantitative systematic literature review aims to explore the effectiveness of cognitive interventions in alleviating mental fatigue among healthcare professionals in hospital environments. This study employs a meticulous approach in the quest to identify, evaluate, and interpret existing research on cognitive interventions to reduce mental fatigue in this specialized care context. The review illuminates the landscape of cognitive interventions, focusing on understanding their potential implications for the overall well-being and professional performance of healthcare professionals. It explores quantitative data, experiences, and perceptions to uncover the multifaceted aspects of cognitive interventions in managing mental fatigue in hospital settings. The review focuses thematically on elucidating the types, mechanisms, and perceived benefits of cognitive interventions to illuminate their roles in enhancing the quality of care delivery and promoting sustainable healthcare practices. This research

framework is positioned to contribute valuable insights and is promising in its ability to inform evidence-based strategies to address challenges posed by mental fatigue among healthcare professionals in hospital settings. Thus, it can ultimately foster improved patient outcomes and workforce well-being.

## 2.2. Research question

It was essential to formulate the research question to define the scope of the study and establish a clear focus for the review. Considering these particularities, we defined the research question based on the population, intervention, control, and outcomes method (Roever, 2018), for participants, interventions, comparisons, and outcomes. Therefore, we responded to the needs of the selected topic and established the following guiding and investigative research question for our assessment:

RQ1: How effective are cognitive interventions in reducing mental fatigue among healthcare professionals, given the existing methodological limitations and the variability in reported outcomes across studies?

## 2.3. Literature search

We addressed the research objectives of this study by conducting a comprehensive literature search to identify relevant articles related to the scientific evidence that supports the efficacy of cognitive interventions in reducing mental fatigue among healthcare professionals in hospital settings. The search was performed in the following databases: b-on (<https://www.b-on.pt/>), PubMed (<http://www.ncbi.nlm.nih.gov/pubmed>), Web of Science (<https://webofknowledge.com/>), and Scopus (<https://www.scopus.com/>). These databases were selected based on their coverage of relevant fields, including medicine, nursing, and psychology. The utilized search strategy combined Medical Subject Headings terms, keywords, and Boolean operators, including but not limited to the following: “mental fatigue,” “cognitive care,” “hospital personnel,” “hospitals,” “occupational health,” “cognitive training,” and “interventional studies.” These search terms were chosen to encompass the core elements of our research, ensuring that we capture articles addressing a specific population of healthcare professionals working in hospitals.

Synonyms and related terms were incorporated to maximize the retrieval of pertinent studies. This approach aimed to generate a comprehensive selection of peer-reviewed articles that met our inclusion criteria, facilitating a thorough evaluation of the evidence on the effectiveness of cognitive interventions in reducing mental fatigue among working professionals. No limitation of a year range or language for selecting articles was used. The employed

research query was inscribed as (((“Mental Fatigue” OR “Cognitive Fatigue”) AND (“Hospital Personnel” OR “Hospital workers” OR “Hospital staff” OR “Medical personnel” OR “Nurse fatigue” OR “Physician fatigue” OR “Healthcare fatigue”) AND (“Occupational Health” OR “Occupational Stress” OR “Occupational psychology”)) AND (“Cognitive Therapy” OR “Cognitive Behavioral Therapy” OR “Cognitive Training” OR “Intervention Studies”) OR (“Cognitive interventions” OR “Cognitive training programs” OR “Mindfulness interventions” OR “Cognitive behavioral therapy for fatigue” OR “Hospital fatigue management”))).

## 2.4. Inclusion criteria

We included the following studies:

- (1) Studies with both quantitative and qualitative designs including randomized controlled trials (RCTs) and non-RCTs, as well as quasi-experimental, cohort, case-control, cross-sectional, and mixed-methods investigations published in peer-reviewed journals;
- (2) Studies involving healthcare professionals (e.g., physicians, nurses, and allied health professionals) employed in hospital settings, including acute care hospitals, specialty hospitals, and outpatient clinics;
- (3) Studies examining cognitive interventions designed to reduce mental fatigue among healthcare professionals, which included but were not limited to cognitive training programs, mindfulness-based interventions, cognitive-behavioral therapy, relaxation techniques, or other cognitive enhancement strategies;
- (4) Studies comparing the effects of cognitive interventions to standard care, placebo, or alternative interventions to manage mental fatigue among healthcare professionals in hospital settings;
- (5) Studies measuring outcomes related to mental fatigue, cognitive performance, work-related outcomes, physiological markers, quality of life, well-being, or patient-related outcomes, which included validated scales, objective cognitive assessments, physiological measurements, self-reported measures, or administrative records;
- (6) Studies published at any time, without restrictions on their publication dates or languages.

## 2.5. Exclusion criteria

We excluded the following studies:

- (1) Studies presented as gray literature, conference abstracts, unpublished work, review articles, books, book chapters, and non-empirical investigations;
- (2) Studies involving participants who were not healthcare professionals working in hospitals (e.g., examinations focused on non-hospital

healthcare settings, community-based healthcare professionals, or non-healthcare professionals);

- (3) Studies that did not explicitly evaluate cognitive interventions to reduce mental fatigue among healthcare professionals (e.g., investigations focusing solely on physical, pharmacological, or interventions targeting conditions unrelated to mental fatigue);
- (4) Studies lacking relevant outcome measures related to mental fatigue, cognitive performance, work-related outcomes, physiological markers, quality of life, well-being, or patient-related outcomes;
- (5) Studies that duplicated other publications or entailed redundant data from the same study population and intervention (in such cases, we included the most comprehensive or recent publication).

## 2.6. Types of outcomes measured

The primary outcomes of interest were studies measuring outcomes related to mental fatigue, cognitive performance, work-related outcomes, physiological markers, quality of life, well-being, or patient-related outcomes. Acceptable outcome measures could include validated scales, objective cognitive assessments, physiological measurements, self-reported measures, or administrative records.

## 2.7. Study selection

Two reviewers independently implemented the screening process, each working in duplicate. One author (SG) carefully reviewed all citations, including titles and, when available, abstracts, to identify potentially relevant studies. Another author (RSM) simultaneously conducted a parallel screening. We retrieved the full-text articles for further evaluation when citations appeared relevant or provided insufficient information. We expected to resolve any eligibility-related disagreements occurring during the screening or full-text assessment phases through discussions with the broader review team and thus ensured a thorough and rigorous evaluation of the selected studies.

## 2.8. Risk of bias

One author (SG) evaluated the risk of bias for each study using the Cochrane Collaboration's ROBINS-I tool (Higgins & Green, 2008). This assessment was checked by a second author (RSM), who ratified the estimations. Any disagreements were resolved through discussion. The Cochrane evaluation criteria encompass five aspects: the randomization process, deviations from the intended intervention, missing outcome data, outcome measurement, and the selection of reported results (Cochrane Library of Cochrane Methods, 2008). Publication bias was assessed through funnel plots. Both authors independently evaluated the risk of bias and settled

any discrepancies through negotiation. Each study's risk of bias was classified as "high," "some concerns," or "low" in accordance with the Cochrane Statement of Risk of Bias.

To assess the risk of bias across the included studies, we utilized the ROBINS-I tool, which was initially designed for non-randomized studies on interventions. This tool is specifically tailored for non-randomized studies, but we extended its application to other study designs such as RCTs and observational studies included in our review. This decision was made to maintain consistency in our bias assessment approach. However, we acknowledge that this determination could present drawbacks, particularly in evaluating RCT-specific biases that ROBINS-I does not comprehensively incorporate, for instance, randomization and blinding. We adapted the criteria as necessary to account for such study-specific methodological considerations.

## 2.9. Data extraction

SG created a data extraction table that included details such as the journal name, publication year, study title, characteristics, intervention specifics, outcomes, main findings, limitations, and additional notes. SG extracted this information, which RSM subsequently verified for accuracy.

## 2.10. Ethical statement

The authors assert that the article does not require Ethics Committee approval because it entails a comparative analysis of theories and a literature review.

## 2.11. Data availability statement

The data that support the findings of this study are openly available in figshare at <https://doi.org/10.6084/m9.figshare.26335285.v1>.

## 3. Results

### 3.1. Study selection

We saved files in ".ris" format containing the exported search results and then imported them into the Rayyan web tool (Ouzzani *et al.*, 2016). The search included selected databases and retrieved an initial total of 157 articles. The removal of duplicates resulted in a preliminary range of 155 unique articles. Titles and abstracts were screened, resulting in the exclusion of 88 studies that failed to meet the inclusion criteria. This refinement produced a set of 67 articles. Full-text access to these articles was obtained through institutional subscriptions. However, 12 reports identified based on their titles and abstracts were not retrieved during the screening process because their full texts were inaccessible. The search process and

the inclusion of articles were documented and tracked using reference management software. Figure 1 visually summarizes the entire search process, which employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page *et al.*, 2021).

Figure 1 illustrates the number of articles identified, screened, and included at each stage. Six articles were considered suitable after the inclusion and exclusion criteria were rigorously applied. Table 1 details the results and highlights the principal findings and overall limitations of the included studies.

### 3.2. Study characteristics

The six studies included in the current review comprised a randomized controlled trial (Wilz *et al.*, 2018), a mixed-methods investigation (Duarte & Pinto-Gouveia, 2016), a one-group repeated design inquiry (Leary *et al.*,

2018), a quasi-experimental examination (Wang *et al.*, 2021), an exploratory analysis (Dames *et al.*, 2022), and a randomized, waitlist-controlled trial (Bhardwaj *et al.*, 2023). The six reviewed studies were published between 2016 and 2023; of these articles, two were published in 2018.

The studies collectively involved 999 participants. Sample sizes ranged from  $n = 16$  (Dames *et al.*, 2022) to  $n = 543$  (Wilz *et al.*, 2018). All studies were conducted with healthcare professionals: two studies focused on nurses (Dames *et al.*, 2022; Duarte & Pinto-Gouveia, 2016), two with healthcare providers (Bhardwaj *et al.*, 2023; Leary *et al.*, 2018), one with medical residents (Wang *et al.*, 2021) and the other with caregivers (Wilz *et al.*, 2018). The research setting of three studies was a hospital (Dames *et al.*, 2022; Leary *et al.*, 2018; Wang *et al.*, 2021), one study was conducted in a tertiary care facility (Bhardwaj *et al.*,

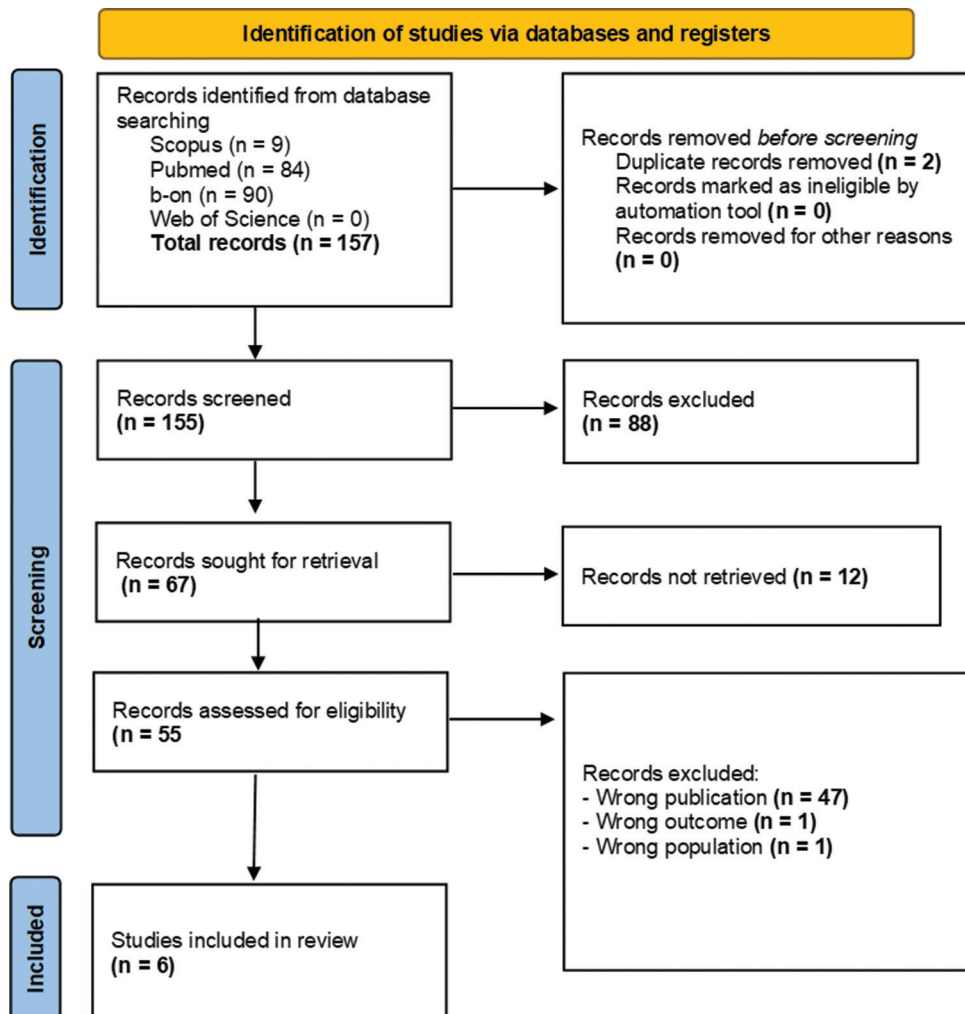


Figure 1. PRISMA flowchart for selecting the studies included in this systematic review. A total of nine articles were obtained from Scopus, 84 from PubMed, 90 from b-on, and 0 from Web of Science

Table 1. Basic features of the studies included in the systematic review (n = 6)

No./References	Source, year, title	Study characteristics	Participant characteristics	Intervention detail	Measures	Comparison group	Main findings	Limitations	Notes
(1)/(Duarte & Pinto-Gouveia, 2016)	<i>International Journal of Nursing Studies</i> (2016) Effectiveness of a mindfulness-based intervention on oncology nurses' burnout and compassion fatigue symptoms: A non-randomized study	Mixed-methods approach	94 oncology nurses	A 6-week mindfulness-based program with group sessions and home practice materials	Participants completed a battery of questionnaires before and after the 6-week training program and at a 3-month follow-up: <ul style="list-style-type: none"> <li>Professional Quality of Life Scale</li> <li>DASS-21</li> <li>Acceptance and Action Questionnaire – II</li> <li>Ruminative Responses Scale-Short</li> <li>The Five Facets of Mindfulness Questionnaire</li> <li>Self-Compassion Scale</li> <li>Satisfaction with Life Scale</li> </ul>	Nurses not participating in the intervention	<ul style="list-style-type: none"> <li>Significant reductions in compassion fatigue, burnout, and stress</li> <li>Increase in life satisfaction, mindfulness, and self-compassion</li> </ul>	<ul style="list-style-type: none"> <li>Small sample size</li> <li>Non-randomized allocation</li> <li>Lack of follow-up assessment</li> <li>Self-report measures</li> <li>Non-clinical sample</li> <li>Response rate at follow-up</li> <li>Sole reliance on self-report measures</li> </ul>	Positive psychological changes were linked to the frequency of mindfulness practice
(2)/(Leary et al., 2018)	<i>Workplace Health and Safety</i> (2018) The effect of Mantram repetition on burnout and stress among VA staff	One-group, repeated measures design comparing outcomes among participants at three different time points: baseline (T1), post-treatment (T2), and 3 months following completion of the intervention (T3)	39 VA staff members providing direct patient care	A 3-month MRP with online classes and daily practice	<ul style="list-style-type: none"> <li>MBI-GS: This is a 16-item questionnaire with a Likert-type response scale that measures three dimensions of burnout: feelings of EX, CY, and PE</li> <li>SCQ: This questionnaire assesses the frequency of stressful occurrences and the degree of troubled conscience resulting from these occurrences. It consists of two scores: FS and TC</li> </ul>	No specific comparison group was mentioned	<ul style="list-style-type: none"> <li>Reductions in emotional EX and TC</li> <li>No significant change in PE</li> </ul>	<ul style="list-style-type: none"> <li>Lack of a control group</li> <li>Self-report measures</li> <li>Lack of monitoring of other meditation practices</li> <li>Small sample size</li> <li>Potential selection bias</li> <li>Limited follow-up period</li> <li>Lack of assessment of intervention fidelity</li> </ul>	MRP benefited those new to meditation, but not preexisting practitioners

(Cont'd...)

Table 1. (Continued)

No./References	Source, year, title	Study characteristics	Participant characteristics	Intervention detail	Measures	Comparison group	Main findings	Limitations	Notes
(3)/(Wilz et al., 2018)	<i>The Gerontologist</i> (2018) The Tele.TAndDem Intervention: Telephone-based CBT for family caregivers of people with dementia	Randomized controlled trial	543 caregivers and care recipients	A 12-session telephone-based CBT over 6 months	<ul style="list-style-type: none"> <li>Symptoms of Depression</li> <li>Physical Health Symptoms</li> <li>Burden of Care of Care</li> <li>Coping with Challenging Behavior</li> </ul>	Caregivers receiving standard care	<ul style="list-style-type: none"> <li>Improved emotional well-being, coping, and reduced physical symptoms</li> <li>No significant impact on the burden of care</li> </ul>	<ul style="list-style-type: none"> <li>Absence of CG</li> <li>Lack of blinding and widely</li> <li>Potential for biased reporting</li> <li>Sample characteristics</li> <li>Drop-out rate</li> <li>Therapist qualifications</li> <li>Measurement error and missing values</li> <li>Non-blinded interviewers</li> </ul>	Flexible and widely implementable telephone-based intervention
(4)/(Wang et al., 2021)	<i>Frontiers in Psychology</i> (2021) Effect of online psychological intervention on burnout in medical residents from different majors: An exploratory study	Quasi-experimental research	63 medical residents from various specialties	Online mindfulness and psychoeducation program	<ul style="list-style-type: none"> <li>MBI</li> <li>DASS-21</li> </ul>	Comparison group comprised medical residents who completed the first online questionnaire but did not satisfy the criteria established for receiving the online psychological intervention	<ul style="list-style-type: none"> <li>Decreased EE, DP, anxiety, and depression</li> <li>No significant change in personal accomplishment or stress</li> </ul>	<ul style="list-style-type: none"> <li>Lack of follow-up research</li> <li>Limited generalizability</li> <li>Response bias</li> <li>Resource constraints</li> <li>Duration of intervention</li> </ul>	Specialties such as anesthesia and pediatrics evinced higher burnout levels
(5)/(Dames et al., 2022)	<i>Quality Advancement in Nursing Education</i> (2022) Changes in cognitive control following a novel resilience-focused nursing educational program: An exploratory study	Exploratory study conducted before the COVID-19 outbreak	15 female participants and 1 male participant; all white and Canadian by birth	A 5-week resilience-focused educational program	<ul style="list-style-type: none"> <li>EEG-based cognitive control tests (N200, P300)</li> <li>Focus groups for qualitative feedback</li> </ul>	No specific comparison group was mentioned	<ul style="list-style-type: none"> <li>Improved cognitive control</li> <li>Qualitative themes included increased self-efficacy and stress mitigation</li> </ul>	<ul style="list-style-type: none"> <li>Small, homogenous sample</li> <li>Short intervention duration</li> </ul>	Participants highlighted the need for cultural change and ongoing support

(Cont'd...)

Table 1. (Continued)

No./References	Source, year, title	Study characteristics	Participant characteristics	Intervention detail	Measures	Comparison group	Main findings	Limitations	Notes
(6)/ (Bhardwaj <i>et al.</i> , 2023)	<i>Frontiers in Public Health</i> (2023) Efficacy of mHealth aided 12-week meditation and breath intervention on change in burnout and professional quality of life among health care providers of a tertiary care hospital in north India: A randomized waitlist-controlled trial.	Randomized, waitlist-controlled trial	<ul style="list-style-type: none"> <li>A 12-week yoga-based meditation and breath program conducted online through Zoom, including a 4-day orientation, home practice, and weekly guided sessions</li> </ul>	<ul style="list-style-type: none"> <li>A 12-week yoga-based meditation and breath program conducted online using the Zoom Meetings application.</li> <li>The program included a 4-day orientation led by trained instructors, followed by home practice and guided weekly online sessions.</li> <li>Compliance with the intervention was monitored, with a minimum of 75% compliance required for participants to remain eligible for the final evaluation</li> </ul>	<ul style="list-style-type: none"> <li>MBI</li> <li>PQL scale.</li> <li>Secondary outcomes such as systolic and diastolic blood pressure, HR, BMI, waist circumference, and hip circumference were also assessed.</li> </ul>	<ul style="list-style-type: none"> <li>Participants in this group did not receive the intervention during the study period</li> </ul>	<ul style="list-style-type: none"> <li>Significant improvements in all MBI and PQL outcomes (EE, DP, PA, CS, BO, ST) for the experimental group compared to the control group</li> <li>Significant positive changes in all MBI and PQL outcomes in the experimental group from baseline to endpoint; the control group showed worsening in DP and PA</li> <li>The experimental group saw a significant reduction in HR, indicating reduced physiological stress; the exhibited control group changes in DP, PA, SBP, and DBP probably occurred due to job stress</li> </ul>	<ul style="list-style-type: none"> <li>Lack of blinding</li> <li>Absence of an active intervention for the control group</li> <li>Potential compliance issues</li> </ul>	<ul style="list-style-type: none"> <li>The twelve-week yoga-based intervention effectively reduced burnout and improved the quality of life among healthcare providers.</li> <li>Future research should examine long-term effects and the impact of in-person practice and include blinding and objective measures</li> </ul>

Abbreviations: BMI: Body mass index; BO: Burnout; CS: Compassion satisfaction; CY: Cynicism; CBT: Cognitive-behavioral therapy; CG: Control group; DASS-21: Depression Anxiety Stress Scale; DP: Depersonalization; EE: Emotional Exhaustion; EX: Exhaustion; HR: Heart rate; MBI: Maslach Burnout Inventory-General Survey; MBSR: Mindfulness-Based Stress Reduction; MRP: Mantram Repetition Program; PA: Personal accomplishment; PQL: Professional Quality of Life; SCQ: Science of Conscience Questionnaire; SBP: Systolic blood pressure; ST: Secondary trauma; TC: Troubled conscience about stressful events.

2023), one was home-based (Wilz *et al.*, 2018), and one was conducted at a hospital oncology service (Duarte & Pinto-Gouveia, 2016).

The mean age of the health professionals participating in all the reviewed studies spanned between 23.56 years (Wang *et al.*, 2021) and 69.19 years (Wilz *et al.*, 2018). Two studies utilized the Maslach Burnout Inventory (MBI) (Bhardwaj *et al.*, 2023; Wang *et al.*, 2021). Wang *et al.* (2021) compared participant outcomes at three different time points: the baseline (T1), post-treatment (T2), and 3 months after the intervention was completed (T3). Their study did not mention a specific comparison group. Bhardwaj *et al.* (2023) compared the outcomes of the experimental and control groups after a 12-week yoga-based meditation and breath program conducted online using the Zoom Meetings application. Two studies used the Professional Quality of Life Scale (PQL) (Bhardwaj *et al.*, 2023; Duarte & Pinto-Gouveia, 2016). Duarte and Pinto-Gouveia (2016) utilized a non-randomized design in which participants self-selected to be designated to the intervention or comparison group. The intervention entailed a 6-week mindfulness-based group program adapted from mindfulness-based stress reduction (MBSR) principles and exercises. That study employed the PQL scale and other measures such as depression, anxiety, stress, mindfulness, experiential avoidance, rumination, self-compassion, and satisfaction with life to assess professional quality of life. The comparison group comprised nurses who did not participate in the mindfulness intervention and continued their regular activities or possibly received standard care. This study highlighted the effectiveness of a mindfulness intervention in reducing burnout, compassion fatigue, and stress among nurses. It emphasized the importance of integrating mindfulness practices to enhance the well-being of healthcare professionals. Bhardwaj *et al.* (2023) employed a randomized waitlist-controlled trial design, randomly assigned participants to the intervention or control group and conducted a 12-week online yoga-based meditation and breath program. Their study also utilized the PQL scale but combined it with the MBI to evaluate components such as emotional exhaustion, depersonalization, and personal accomplishment. This study did not offer the intervention to the control during the study period. It demonstrated the efficacy of a yoga-based intervention in improving burnout and enhancing the PQL of healthcare providers. It recommended potential directions for future research endeavors, for instance, exploring long-term effects and utilizing objective outcome measures. Recent studies have demonstrated the reliability of the PQL measures across countries, including China (Shen *et al.*, 2015), Portugal

(Duarte, 2017), Japan (Fukumori *et al.*, 2018), Spain (Galiana *et al.*, 2017), and Israel (Samson *et al.*, 2016).

Two studies used the depression, anxiety, Stress Scale (DASS-21) (Duarte & Pinto-Gouveia, 2016; Wang *et al.*, (2021) to assess depression, anxiety, and stress levels among participants. Duarte and Pinto-Gouveia (2016) focused on oncology nurses and employed a mindfulness-based group program for nurses. The intervention group of nurses evinced a significant decrease in depression, anxiety, and stress levels compared to the comparison group. Wang *et al.* (2021) targeted medical residents from various specialties, including anesthesia and pediatrics, and utilized an online psychological intervention consisting of mindfulness decompression and psychoeducation for medical residents. The study results demonstrated a post-intervention reduction in anxiety and depression levels in medical residents. Both interventions proved effective in reducing psychological distress in their participants. The mindfulness-based program for nurses resulted in reduced depression, anxiety, and stress, while the online psychological intervention for medical residents led to post-intervention decreases in anxiety and depression levels. Both studies recommended increased psychological support and guidance for healthcare professionals, particularly those experiencing higher levels of burnout and emotional distress. The researchers also recommended adopting healthier lifestyles and targeted psychological interventions to mitigate stress-related problems.

Other utilized measures included the science of conscience questionnaire (SCQ) (Leary *et al.*, 2018), a tool used to assess the frequency of stressful occurrences and the extent of the resulting troubled conscience. The SCQ delivers two principal scores. First, the frequency of stressful events facet measures how often stressful events occur in an individual's life and quantifies the frequency with which individuals encounter situations that they perceive as stressful. Second, the troubled conscience about stressful events aspect assesses the level of distress or unease individuals experience in response to the stressful events they encounter. Thus, the SCQ gauges the degree to which individuals are disturbed by the stressful occurrences they confront. The SCQ was used as an outcome measure to evaluate the effectiveness of the mindfulness-based Mantram repetition program (MRP) in reducing burnout and stress in VA staff members. The study found that the MRP significantly reduced feelings of exhaustion and troubled conscience about stressful events for the entire sample between the baseline (T1) and 3 months after the completion of the intervention (T3). However, no significant changes were reported in professional efficacy, cynicism, or the frequency of stressful events for the entire sample throughout the study.

3.3. Risk of bias

It became evident during the examination of the risk of bias in the collective body of studies that each study presented distinctive challenges and strengths vis-à-vis its methodological rigor. Some studies demonstrated a moderate risk of bias typically stemming from potential confounding factors that may not have been comprehensively considered despite efforts to control them through randomization or matching techniques. Others exhibited a low risk of bias, particularly in employing rigorous sampling methods for participant selection to ensure a representative sample (Bhardwaj *et al.*, 2023; Wang *et al.*, 2021; Wilz *et al.*, 2018). However, some studies confronted persisting challenges due to missing data, which introduced uncertainty and potential bias in the interpretation of their results (Bhardwaj *et al.*, 2023; Leary *et al.*, 2018; Wang *et al.*, 2021; Wilz *et al.*, 2018). Moreover, some studies provided detailed information on the intervention and outcome measurement processes but others lacked transparency in these aspects, making it difficult to fully assess their risks of bias (Bhardwaj *et al.*, 2023; Leary *et al.*, 2018). The comprehensive understanding of the risk of bias across studies underscored the importance of critically evaluating methodological rigor in interpreting findings and drawing conclusions (Figure 2).

4. Discussion

Our systematic review highlighted the varying success of cognitive interventions in reducing mental fatigue among healthcare professionals. These findings align with the results of previous studies and evoke new questions about the most effective components of these interventions.

For instance, previous researchers such as Ong *et al.* (2024) demonstrated the efficacy of mindfulness-based interventions in reducing stress among healthcare workers. Our review supported these findings but also revealed that factors such as intervention durations and specific professional contexts could influence the effectiveness of such interventions. Weiner *et al.* (2020) reported limited benefits from CBT in similar settings. In contrast, our review suggests that CBT could be more effective when it is combined with other techniques or tailored to the needs of specific subgroups in the healthcare workforce.

The findings of reduced burnout symptoms, improved emotional well-being, and enhanced coping strategies were consistent across studies despite variations in intervention modalities and participant characteristics. These outcomes indicate the robustness of cognitive interventions in addressing mental fatigue in healthcare professionals. Moreover, the exploration of underlying mechanisms and moderators of intervention effectiveness delivered valuable

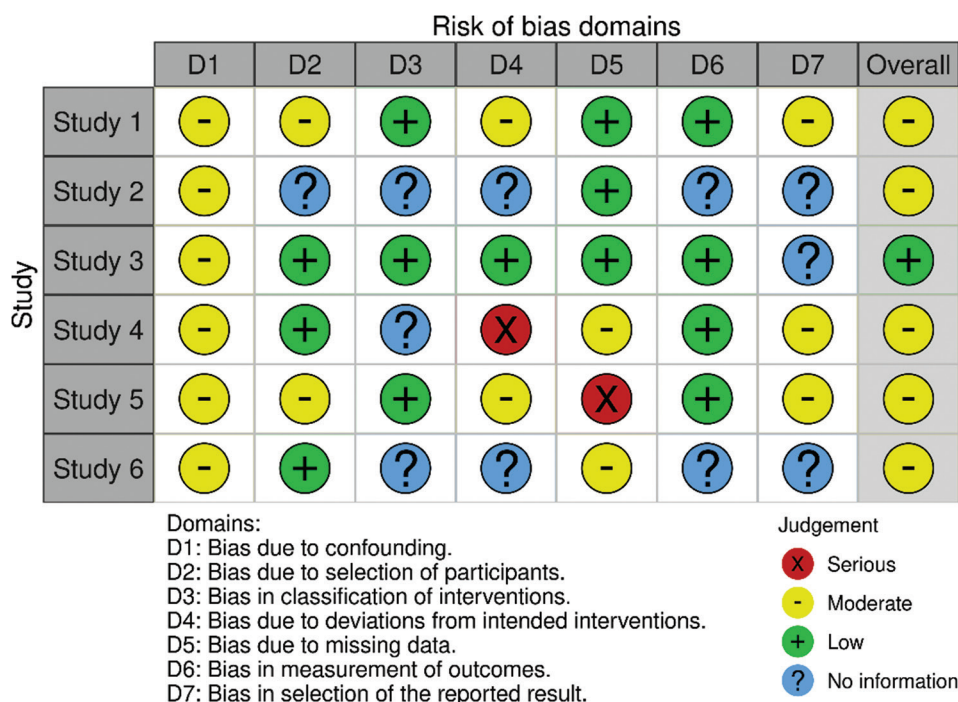


Figure 2. Risk of bias assessed in the reviewed studies using the Cochrane ROBINS-I tool

insights into optimizing intervention delivery and tailoring approaches to satisfy the diverse needs of healthcare professionals across different specialties and roles.

Cognitive interventions demonstrate promising results. However, several research gaps and limitations warrant consideration. Future studies should address methodological drawbacks such as small sample sizes, non-randomized designs, and reliance on self-report measures to enhance the rigor and generalizability of their findings. Longitudinal research is needed to assess the long-term sustainability of intervention effects and identify factors influencing intervention maintenance.

In addition, investigating the economic implications and cost-effectiveness of cognitive interventions can inform decision-making by healthcare organizations regarding resource allocation and intervention implementation. In addition, exploring innovative delivery methods such as telehealth platforms can enhance the accessibility and scalability of interventions, particularly given evolving healthcare delivery models and increasing demands for remote services.

Our systematic review evaluated varied cognitive interventions aiming to reduce mental fatigue among healthcare professionals. The interventions were wide-ranging in type but mindfulness-based approaches and CBT were the most commonly studied. Mindfulness-based interventions consistently displayed moderate effectiveness in reducing perceived stress and mental fatigue in three of the six studies, especially when implemented over extended periods. CBT-based interventions were less frequently studied but demonstrated significant improvements in cognitive functioning and reduced burnout symptoms, suggesting their potentially stronger impact when targeted at specific cognitive processes.

Despite the promising findings, the effectiveness of these interventions varied across different hospital settings and populations. For example, shorter interventions were less effective, indicating the importance of sustained practice in achieving meaningful reductions in mental fatigue. Furthermore, the lack of standardized outcome measures across studies made direct comparisons challenging, highlighting a critical gap in the current research.

Given these findings, healthcare institutions should consider implementing integrated cognitive interventions that combine mindfulness and CBT. Such programs could be particularly beneficial in high-stress environments or among professionals at greater risk of burnout. To maximize effectiveness, these interventions should be delivered over a sustained period, with ongoing support and follow-up to reinforce their benefits.

While cognitive interventions hold promise for alleviating mental fatigue among healthcare professionals, continued research addressing methodological rigor and long-term effects is imperative to inform evidence-based interventions within hospital settings.

#### 4.1. Limitations and future directions

This review admits to certain limitations. First, the included studies lacked comprehensive effect size measurements (e.g., relative risks, odds ratios). As highlighted in the reviewer's feedback, it becomes challenging to assess the true effectiveness of the interventions studied without such metrics. The absence of standardized effect measurements such as risk ratios or confidence intervals reduces the robustness of the conclusions that can be derived apropos the impact of cognitive interventions on mental fatigue among healthcare professionals. This shortcoming is compounded by the methodological weaknesses of the included studies, for instance, small sample sizes and diverse outcome measures, which restrict the ability to perform meta-analyses. Consequently, the present study is weakened by its inability to establish the magnitude of intervention effects and a gap remains in the understanding of the exposure-risk relationship of the variables under investigation.

In addition, many of the reviewed studies demonstrated moderate bias risks, further weakening the overall findings. Factors such as non-randomized designs, self-reported measures, and lack of control groups were prevalent, affecting the generalizability of the results. The scarcity of high-quality studies, particularly those focusing specifically on healthcare professionals, highlights a significant gap in the literature, as indicated by the reviewer. This lacuna pinpoints a surprising dearth of rigorous research targeting mental fatigue in healthcare settings even though psychosocial interventions are widely studied in occupational health.

Finally, the small number of studies included in this review, coupled with the variability in intervention types and outcome measures, limits the generalizability of our findings. Future research projects should focus on larger, more methodologically rigorous studies that have compared discrete cognitive interventions using standardized outcome measures. Such research is essential for the establishment of clear guidelines for implementing effective cognitive interventions in healthcare settings.

Longitudinal studies are needed to assess the sustained effectiveness of cognitive interventions over extended periods and to deliver insights into intervention maintenance. Comparative effectiveness studies can evaluate the relative merits of cognitive interventions

and guide healthcare organizations in selecting the most appropriate interventions for their staff members. It is essential to investigate the effectiveness of tailored interventions designed to meet the specific needs of different healthcare professions and specialties. Research focusing on implementing cognitive interventions within real-world hospital settings can identify barriers and facilitators to implementation and thus facilitate the successful integration of such interventions into routine healthcare practices. Exploring the underlying mechanisms through which cognitive interventions affect mental fatigue and related outcomes can offer insights into therapeutic mechanisms. Conducting cost-effectiveness analyses of cognitive interventions can assess their economic impact on healthcare organizations and inform resource allocation decisions. Moreover, investigating the feasibility, acceptability, and efficacy of delivering cognitive interventions through telehealth platforms can expand access and address barriers related to geographical distance and scheduling constraints. Future studies can address these research priorities to advance our understanding of cognitive interventions for promoting staff well-being and resilience in hospital settings.

The current research emphasizes cognitive interventions such as mindfulness programs, online psychological interventions, and telehealth cognitive-behavioral therapy. However, future studies should also explore the potential benefits of alternative and complementary therapies. One promising area is the use of aromatherapy: the therapeutic use of essential oils extracted from plants has been demonstrated to deliver varied psychological and physiological benefits including stress reduction, mood improvement, and cognitive function enhancement (Gonçalves *et al.*, 2024). Studies have indicated that certain essential oils such as lavender, rosemary, and peppermint can alleviate symptoms of mental fatigue and improve alertness and concentration (Koulivand *et al.*, 2013; Sattayakhom *et al.*, 2023; Varney & Buckle, 2012). Integrating aromatherapy into the work environment of healthcare professionals either through diffusers in common areas or personal inhalers could provide an accessible and non-invasive method of supporting mental well-being. Future research should evaluate the efficacy of aromatherapy in conjunction with cognitive interventions to develop a holistic approach to mitigating mental fatigue among healthcare professionals in hospital settings.

## 5. Conclusions

The evidence presented in this study underscores the effectiveness of cognitive interventions in mitigating mental fatigue among healthcare professionals in hospital settings. This study conducted a comprehensive review of diverse

interventions such as mindfulness-based programs, online psychological interventions, and telehealth-delivered cognitive-behavioral therapy. The study results highlight the significant positive impact of such interventions on reducing burnout, stress, and compassion fatigue while enhancing well-being and coping abilities.

The findings of this study underscore the critical role enacted by cognitive interventions in promoting staff well-being and resilience in hospital settings. Cognitive interventions address the multifaceted challenges of mental fatigue among healthcare professionals. Thus, they create healthier work environments, improve patient care outcomes, and foster a culture of support and empowerment within healthcare organizations. Healthcare systems can effectively integrate cognitive interventions into routine practice through continued research efforts and collaborative initiatives. Ultimately, such endeavors will ameliorate the general well-being of healthcare professionals and enhance the overall quality of the care they deliver.

## Acknowledgments

None.

## Funding

None.

## Conflict of interest

The authors declare that they have no competing interests.

## Author contributions

*Conceptualization:* All authors

*Writing – original draft:* Sara Gonçalves

*Writing – review & editing:* All authors

## Ethics approval and consent to participate

The authors state that the article does not require an ethics committee approval as it is a subject of comparison between theories and literature review.

## Consent for publication

Not applicable.

## Availability of data

The data that support the findings of this study are openly available in figshare at <https://doi.org/10.6084/m9.figshare.26335285.v1>.

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<https://doi.org/10.1093/geront/gnx183>

## RESEARCH ARTICLE

Tree-based intervention typologies and  
improvements in refugee displacement regionsSarah H. Juster<sup>1,2\*</sup>, John F. Munsell<sup>1</sup>, Mary Njenga<sup>2,3</sup>, Clement A. Okia<sup>4</sup><sup>1</sup>Department of Forest Resources and Environmental Conservation, College of Natural Resources and Environment, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, United States of America<sup>2</sup>Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF), Nairobi, Kenya<sup>3</sup>Department of Earth and Climate Sciences, Wangari Maathai Institute for Peace and Environmental Studies, University of Nairobi, Nairobi, Kenya<sup>4</sup>Department of Environment and Natural Resources, Faculty of Agriculture and Environmental Sciences, Muni University, Arua, Uganda(This article belongs to the *Special Issue: Exploring the Dynamics and Possibilities of Refugee (Re) settlement Amidst Existing Social, Political and Environmental Tensions*)**Abstract**

Concern about deforestation in contexts of refugee displacement is substantial. Tree-based interventions (TBIs) are efforts to plant trees, conserve trees, and/or facilitate tree regrowth. TBIs are implemented by non-governmental organizations in refugee displacement contexts to address landscape-level deforestation, soil erosion, and biodiversity loss while providing livelihood opportunities to participants. Although humanitarian stakeholders recommend TBIs in refugee-hosting regions, the diversity of TBI models and associated strengths and weaknesses are not well understood. This research focuses on five TBIs implemented in a northwest Uganda refugee settlement that include large-acre woodlot planting, household-level planting of trees yielding short-term products, and conservation site establishment to protect indigenous tree species. Interviews and focus-group discussions with TBI staff revealed that each intervention makes trade-offs in navigating five key challenges associated with TBI implementation in a refugee context: Obtaining access to land, providing short-term livelihood benefits to participants, gaining equitable involvement by gender, achieving environmental conservation goals, and successfully engaging community members. Significant differences were found between the strategies of TBIs implemented at home sites when compared to TBIs implemented at community sites. While TBIs implemented at home sites are intended to provide participants long-term access to tree products with clear user rights and enable women to grow trees alongside ongoing domestic activities, TBIs implemented at community sites can achieve large-scale environmental goals and provide cash-based employment opportunities to participants. An applied integrated landscape approach is recommended to maximize inter-program collaboration and collective benefits across programs, while realizing sustainable TBI impacts within complex socioecological refugee displacement contexts.

**Keywords:** Tree-based interventions; Agroforestry; Refugees; Displacement; Humanitarian integrated landscape approach**\*Corresponding author:**Sarah H. Juster  
(shj22@vt.edu)**Citation:** Juster, S.H., Munsell, J.F., Njenga, M., & Okia, C.A. (2026). Tree-based intervention typologies and improvements in refugee displacement regions. *International Journal of Population Studies*. 12(1):15-31.<https://doi.org/10.36922/IJPS025220105>**Received:** May 30, 2025**Revised:** September 17, 2025**Accepted:** October 17, 2025**Published online:** November 10, 2025**Copyright:** © 2025 Author(s).

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## 1. Introduction

Tree loss in refugee displacement regions is a global concern (Andreotti *et al.*, 2024; Gianvenuti *et al.*, 2022; Hassan *et al.*, 2018; Leiterer *et al.*, 2018). Declines observed in locations such as Daadab, Kenya (Braun *et al.*, 2016), the West Nile sub-region of Uganda (Bernard *et al.*, 2022; Nardi & Runnström, 2024), and refugee-hosting regions of Bangladesh (Rashid *et al.*, 2021; Sarkar *et al.*, 2023) warrant international attention. The magnitude and nature of tree loss differ based on contextual factors such as refugee and host-national population density (Black, 1994), variations in policies that enable or restrict refugee movement and natural resource access (Maystadt *et al.*, 2020), and the extent and history of natural resource dependency among refugees and host-nationals (Black, 1994). In all cases, however, tree loss can exacerbate ongoing environmental challenges (Hagenlocher *et al.*, 2012) and undermine tree-based livelihood opportunities for refugees and host-nationals (Grosrenaud *et al.*, 2021).

Environmental and forestry programs in refugee-hosting regions have gained increasing attention from humanitarian organizations (European Union, 2022; Food and Agriculture Organization of the United Nations [FAO], 2023), and many include what are referred to as tree-based interventions (TBIs) (Duguma *et al.*, 2019). TBIs focus on increasing and conserving tree and shrub cover and improving wood-use efficiency to reduce tree loss. TBIs in refugee landscapes can expand local food, medicine, and fiber production to supplement external aid (Tomkins *et al.*, 2019), reduce energy poverty, and decrease the burden of labor for women through increased access to fuelwood (Watson, 2025), and address social conflict and gender-based violence associated with natural resource scarcity (Adam-Bradford, 2016). TBIs can also improve tree biodiversity conservation, increase shade provision, protect crops from wind damage, and enhance soil fertility (Grosrenaud *et al.*, 2021).

Research indicates that tree cover reductions in regions of human displacement are driven largely by increases in demand for cooking fuel and building material (Hagenlocher *et al.*, 2012), conversion of forests to cropland (Maystadt *et al.*, 2020), and charcoal production, logging, or brick-burning (Naughton-Treves *et al.*, 2007). Numerous studies have demonstrated the benefits of TBIs in addressing these drivers (Adam-Bradford, 2016; Grosrenaud *et al.*, 2021; Moore *et al.*, 2014; Nduwamungu & Munyanziza, 2013; Orr, 1985; Tomkins *et al.*, 2019), but analysis of challenges and opportunities across TBI programs is lacking. Thus, prospects for increasing regional impact through program diversification and inter-organizational collaboration remain poorly understood.

This study addresses gaps pertaining to regionally integrated strategies by investigating five unique TBIs in northwest Uganda's Imvepi Refugee Settlement. Imvepi lies within Uganda's Terego District and is one of six settlements established by the Office of the Prime Minister (OPM) and the United Nations High Commissioner for Refugees (UNHCR) within the West Nile sub-region. Refugees in Imvepi are primarily from neighboring countries of South Sudan and the Democratic Republic of the Congo. Imvepi was selected for this study based on the strength of pre-existing relationships between the research team and settlement personnel, as well as the breadth of implemented TBI programs.

Research objectives are:

- (i) To classify and describe discrete TBI programs within a single settlement
- (ii) To characterize the organizations offering these programs
- (iii) To highlight factors that enable or constrain TBI program success
- (iv) To frame actionable strategies for improving programmatic impact and collaboration in regions of human displacement using an integrated landscape approach (ILA).

This study aims to provide valuable insights for enhancing TBI program efficacy and cooperation among humanitarian organizations in northern Uganda, as well as in other regions of the world where tree loss is addressed in the context of displacement.

### 1.1. Refugee TBIs

Efforts to reduce tree loss in refugee settlements date back to the early 1980s. In 1982, for example, UNHCR formed a consortium of non-governmental organizations (NGOs) to implement a forestry project for increased fuelwood supply and reduced environmental deterioration in the Luuq refugee camp, Somalia (Orr, 1985). A 2000 review of NGO-implemented environmental and forestry-based initiatives in African refugee contexts, or locations of refugee displacement, identified an increasingly diverse array of programming models, including woodlot establishment, provision of fuel-efficient woodstoves, environmental sensitization, and indigenous woodland management (Kakonge, 2000). In 2007, a UNHCR-backed environmental plan committed to a significant escalation of tree planting with a targeted nine million trees planted in human displacement regions across Asia and Africa (Caux, 2007).

Organizations such as UNHCR, international NGOs, and bilateral donors increasingly integrate environmental and forestry initiatives within policy and programming

recommendations. For example, European Union environmental guidelines for displacement contexts highlight forest ecosystem contributions to improved livelihood resilience and reduced social conflict (European Union, 2022). In 2023, FAO partnered with UNHCR and the Government of Uganda to develop a Forest Landscape Management Plan for the Bidibidi Refugee Settlement, which was to serve as a blueprint for forestry-focused plans in other refugee contexts (FAO, 2023). A recent UNHCR technical report highlighted tree planting and reforestation as core nature-based solutions for diverse displacement contexts, particularly when integrated with other initiatives such as urban farming and water resource management in camps and settlements (Ullal & Manoli, 2024). These documents underscore the increasing awareness in the sphere of international development that tree cover loss requires both a targeted and well-coordinated response across diverse stakeholders.

TBIs in refugee contexts are typically grouped into three categories: Tree planting, tree conservation, and facilitated resprouting of trees (Duguma *et al.*, 2019). Tree planting is a central facet of TBIs in displacement contexts. One prominent strategy is the integration of woody perennial species and annual crops within farming systems, or agroforestry (Reij & Garrity, 2016). Agroforestry can yield a sustainable fuelwood source through annual tree pruning and maintenance, as well as provide access to the products and ecosystem services afforded by trees (Kay *et al.*, 2021). Tree planting in refugee contexts can also take the form of plantation or woodlot establishment, with consolidated planting in defined areas to provide timber, fuelwood, and/or environmental services. Tree planting in refugee contexts requires special consideration for the protection of seedlings from animal or human damage, species selection in accordance with local environmental conditions and community preferences, and comprehension of local precipitation patterns to maximize survival (Ullal & Manoli, 2024).

Tree conservation using improved stove technology is a second dimension of TBIs in refugee contexts. Energy and infrastructure access in displacement contexts trail behind water, food, sanitation, health, and shelter in terms of funding and investment. Across global displacement regions, refugees often do not have adequate energy to cover basic electricity and cooking needs (Lehne *et al.*, 2016). Furthermore, most refugees are in developing countries (UNHCR, 2025a), where rudimentary stoves are common and cause respiratory ailments, contribute to greenhouse gas emissions, and place significant demand on forest resources. Improved cookstove technology is central to TBIs in refugee contexts because it can reduce

household fuelwood consumption by 20–30% (UNHCR, 2002). Lorena stoves are a popular and affordable option given their construction using locally available materials such as clay and organic materials (UNHCR, 2002). Another fuelwood conservation measure is the production of charcoal briquettes, molded from charcoal dust and other carbonized biomass materials, which burn as a cleaner and cheaper source of cooking energy (Mendum & Njenga, 2018).

A third common TBI strategy is farmer-managed natural regeneration (FMNR), which involves systematic management and pruning of existing indigenous shrubs and trees. Using coppicing to facilitate stump sprouts, FMNR can sustain highly productive tree and shrub cover across landscapes and help restore ecosystem diversity (Rinaudo *et al.*, 2019). Following establishment, FMNR avoids challenges associated with reforestation, such as obtaining tree seeds and watering seedlings (Reij & Garrity, 2016). FMNR also maintains biodiversity and enables beneficiaries to practice conservation while managing trees for a variety of household products (Grosrenaud *et al.*, 2021). In refugee contexts, FMNR is often paired with other enterprises such as apiculture for value addition and livelihood opportunities (Laird *et al.*, 2021).

TBIs in refugee contexts ultimately reflect the unique challenges inherent to displacement. One is limited land access and land tenure insecurity (Adam-Bradford, 2016; Unruh, 1993). Refugee land holdings in encampments and settlements often are too small or marginal for extensive tree establishment (Grosrenaud *et al.*, 2021). Some refugees access supplemental land through rental or lease agreements; however, these agreements and land use arrangements can change annually (Bohnet & Schmitz-Pranghe, 2019), thereby dissuading tree planting. Furthermore, displaced individuals often view their status as temporary and expect to return to their country of origin, potentially reducing interest in woody perennial investments (Black, 1994).

Another challenge is extreme socioeconomic distress, with refugees consistently experiencing higher poverty rates when compared to nearby host-national communities (Malik, 2023). Given the marginalization and food insecurity faced by refugees, a strong preference for planting fast-growing trees for economic return was a top priority among TBI participants in Cameroon (Moore *et al.*, 2014), Somalia (Orr, 1985), and Uganda (Grosrenaud *et al.*, 2021). Ensuring refugees realize livelihood benefits, either in the form of tree products or cash-earning employment opportunities, is an important TBI principle.

Gender is another important dimension of TBIs in refugee contexts, given that women head a significant

proportion of camp-based refugee households globally (Beltramo *et al.*, 2023). As primary household-level agricultural producers and fuelwood harvesters, women are often disproportionately impacted by land and resource conflict (Kirabo *et al.*, 2011), and exposure to sexual and gender-based violence when traveling long distances to harvest fuelwood is a major concern (Adam-Bradford, 2016; Kumssa *et al.*, 2014). These factors underpin the importance of prioritizing the needs of refugee women in TBIs and engaging them in program design and implementation (Nduwamungu & Munyanziza, 2013). Participation by women also challenges existing gender roles, particularly in regions of sub-Saharan Africa where they are traditionally restricted from land ownership (Masters, 2021; Wel, 2012) as well as tree planting, which is often considered indicative of land ownership (Grosrenaud *et al.*, 2021). In such locations, TBIs require careful navigation of norms to identify opportunities for equitable engagement and empowerment of women.

## 1.2. ILA

This study draws on ILA principles to interpret research results and synthesize participant-identified solutions into a set of strategic recommendations for collaborative tree-based humanitarian assistance programs.

An ILA framework draws on a range of concepts and tools to guide stakeholders and land managers in addressing various social, environmental, and economic challenges at the landscape scale. From an ILA perspective, the landscape is an appropriate spatial unit for addressing such challenges, given that environmental and human systems primarily interact at the landscape scale (Duncan *et al.*, 2021). An ILA framework promotes multifunctionality in the development of holistic practices and policies and is particularly applicable to sustainable management of natural resources and climate change adaptation (Freeman *et al.*, 2015). Landscape approaches are increasingly popular in tropical regions, given the complexity of existing sociopolitical systems and rich ecological diversity (Reed *et al.*, 2017), and they are particularly relevant within refugee-hosting contexts in encouraging solution-building between actors at multiple levels in the provision of developmental and humanitarian services (Schure *et al.*, 2022).

Five core concepts define ILA: (i) Multifunctionality, (ii) Interdisciplinarity/transdisciplinarity, (iii) Sustainability, (iv) Participation, and (v) Complexity (Freeman *et al.*, 2015). ILA multifunctionality is defined as “achieving multiple objectives or functions at the same time” (Freeman *et al.*, 2015, p.6). ILA transdisciplinarity avoids sectoral and siloed approaches through cross-sectoral, multistakeholder approaches. A healthy and productive landscape that

holistically supports long-term environmental and human well-being amid changing social and environmental conditions underpins ILA sustainability. Relationship building is central to ILA participation, which includes both consultation and dialogue with landscape-level stakeholders and the promotion of two-way information exchange across multiple stakeholder groups, among whom power imbalances may exist. The predicate for ILA complexity is that comprehending contextual intricacies and nuance is essential when monitoring and documenting emerging processes and patterns at multiple scales (Freeman *et al.*, 2015).

## 1.3. Refugee resettlement in Uganda

Uganda currently hosts 1.9 million refugees (Government of Uganda & United Nations High Commissioner for Refugees, 2025), which is the largest number by an African nation and the fourth largest globally (UNHCR, 2025b). In part, this is due to Uganda’s proximity to countries enmeshed in protracted civil conflicts, namely, South Sudan and the Democratic Republic of the Congo (Titeca, 2022). Waves of violence following South Sudan’s independence in 2011 continue to enkindle forced migration of South Sudanese refugees to northern Uganda (Titeca, 2022), where South Sudanese now comprise nearly 54% of Uganda’s total refugee population (Government of Uganda & United Nations High Commissioner for Refugees, 2025).

Refugee settlement in Uganda is additionally occasioned by the nation’s relatively liberal policies that provide refugees with freedoms of work and movement within the country (Blair *et al.*, 2022). The centerpiece of Uganda’s model is the Self-Reliance Strategy, which was designed jointly in 2002 by OPM and UNHCR to shift from a relief model of refugee engagement to a developmental strategy (Dryden-Peterson & Hovil, 2004). The Self-Reliance Strategy builds on Uganda’s long-standing practice of distributing arable land within open settlements to refugees, with the goal of enabling refugees to produce their own crops, raise livestock, and/or maintain trees for self-sustenance (Kaiser, 2005). The adoption of liberalized refugee policies has earned Uganda praise from humanitarian bodies such as UNHCR and facilitated the movement of financial aid and international refugee response into the country (Betts, 2021).

Uganda’s robust refugee response and unique policy of land distribution to refugees have created conditions for growth in the number of TBI programs across the nation’s 13 refugee settlements. The presence of multiple and distinct TBI models operating within Ugandan refugee settlements offers an opportunity to compare programming models and explore organizations that

provide them, including relative strengths, challenges, and areas of collaboration. This research used a comparative case-study approach to understand how and why programs are designed and implemented, and to explore whether distinct TBI characteristics may bear distinct programmatic outcomes. Focus group discussions and analysis of initial results with staff of Ugandan TBI programs further informed the conversion of case study results into broad recommendations for successful and sustainable TBI programs and organizational collaboration in Uganda and other refugee displacement contexts.

## 2. Data and methods

### 2.1. Study context

Imvepi Refugee Settlement (Figure 1) is a 53.2 km<sup>2</sup> settlement that was formally established in 2017 to accommodate an uptick of refugees fleeing violence in South Sudan's Equatoria region (Barasa *et al.*, 2022). Imvepi's 74,804 residents are predominantly South Sudanese and are primarily of Kakwa, Kukuu, Madi, and Bari ethnicities. Refugees in Imvepi are 47% male and 53% female (Government of Uganda & United Nations High Commissioner for Refugees, 2025). Regional host-nationals are predominantly Lugbara, and the Terego District host-national population is approximately 230,000 (Hyde-Smith & Nyakana, 2021). While a proxy war between the governments of Sudan and Uganda contributed to significant regional violence throughout the 1990s and early 2000s, northwest Uganda is presently free of major conflict (Gidron, 2022).

Imvepi is located within shallow regions of the Albertine Rift. Soils are primarily clay loam, with native vegetation including grasslands and woodlands. The climate in the West Nile sub-region is tropical, with a bimodal rainfall pattern distributed between two rainy seasons (April–June and August–October). Annual precipitation is 1,250 mm on average, and mean temperatures range from 20°C to 30°C (Barasa *et al.*, 2022). Land cover in Imvepi and surrounding regions is historically categorized as wooded grasslands with dominant tree species including shea nut (*Vitellaria paradoxa*), *Combretum* spp., and stands of African fan palm (*Borassus aethiopum*) (van Breugel *et al.*, 2014).

### 2.2. Sampling and data collection

Five Imvepi TBI programs were purposefully selected based on program scale, intervention diversity, and willingness to participate. The first program is a Uganda-based TBI focused on the provision of tree seedlings and agroforestry training to refugee and host-national households. The second establishes large-scale teak woodlots, distributes tree seedlings to households, and constructs fixed-owner Lorena stoves within refugee and host-national kitchens. The third promotes household-based agroforestry and permaculture interventions, while the fourth focuses on food forest establishment. Finally, the fifth selected program centers on FMNR and apiary management.

Data were collected in organizational offices in Kampala, Arua City, and Imvepi in May and June 2023. Semi-structured interviews were conducted with nine administrative staff personnel from the selected TBI



**Figure 1.** Map of the Imvepi Refugee Settlement boundaries and its location in northwestern Uganda  
Basemap sources: © OpenStreetMap contributors, © Esri (retrieved May 2025).

programs, including country directors and program managers. In addition, seven technical and local staff members were interviewed, including at least one staff member from each TBI program. Of the 16 TBI staff interviewed, 2 were female and 14 were male. Interviews collected detailed, descriptive information on specific programs, organizational characteristics, and strategies for navigating programmatic challenges. Topics specific to the semi-structured interview guide included organizational missions, geographic range of operations, number of TBI participants engaged, recruitment strategies, and funding duration, as well as core challenges, strategies, and opportunities for improving TBIs.

One TBI field site per program was visited to conduct in situ observations pertaining to the nature of interventions and stimulate additional inquiry based on semi-structured interview data. Visits lasted 30–40 minutes and involved documenting intervention features such as species composition, soil and water conservation practices, and ease of access by refugee and/or host-national participants. Secondary data were obtained from implementing NGOs in the form of web pages and program documents. Program documents included monitoring and evaluation reports, field manuals, annual reports, and project briefs. Webpage content and program documents were solicited from research participants at the time of the interview, though sometimes they were provided afterward by email. Webpage content for TBI programs was accessed and downloaded for content analysis, along with program documents and interview transcripts.

To enhance data richness and validity, a focus group discussion was conducted with eight Imvepi-based technical and administrative staff representing study organizations in May 2024. The focus group was held in Arua, a city located approximately 100 km from Imvepi, and travel stipends were provided to all attendees. Analyses of the interview transcripts and programmatic documents were presented to focus group participants. Between presentations, periods of structured and open dialogue occurred, with participants asked to comment on the findings, following the approach described by Lambert and Loisel (2008). Participants were asked to verify the validity of initial research findings and/or contribute important elements that may have been missed through previous forms of data collection. Focus group attendee feedback was recorded using an audio device, transcribed, and integrated into the summative data analysis.

During the focus group discussion, a logic model (Savaya & Waysman, 2005) was used to define and operationalize a 5-year blueprint for achieving desired future TBI conditions and inter-organizational cooperation. Logic

Models provide a framework for articulating short-term, medium-term, and long-term actions that are necessary for strategic change, as well as identifying assumptions and measurable inputs and outputs. Logic Model results represent the participant-identified programmatic actions and inter-organizational cooperation that are necessary for realizing long-term group-identified goals.

### 2.3. Data analysis

Interviews were recorded and transcribed to generate raw data, which were analyzed together with secondary data using ATLAS.ti version 23.2.2 (ATLAS.ti Scientific Software Development GmbH, Germany), a qualitative data analysis package for coding text data. Thematic analysis involved flagging and coding unique and/or recurring concepts across interview transcripts and program documents within ATLAS.ti, including organizational characteristics, activities, program strengths, and challenges. While an a priori set of topics, such as “gender” and “land access,” were deductively selected and coded within texts based on review of pre-existing literature, other topics were inductively identified within the data to emphasize emergent themes. Initial coding of qualitative data thus involved a hybrid approach following Swain (2018), incorporating both theoretical and data-driven processes. Through axial coding, relationships and categories across initial codes were identified and organized.

A comparison table was created to facilitate the comparison of coded themes across programs. Comparison tables allow a researcher to synthesize long narratives by identifying similarities and differences between and within cases, based on the approach described by Goodrick (2014). Comparison tables are created following a process of text retrieval and coding by entering summarized information into table cells. In this case, an attribute table was used, or a table where rows, in addition to columns, represent properties of cases rather than the cases themselves. Comparison occurs by looking across columns as well as across rows to identify differences, associations, and trends according to attribute (Gibbs, 2007).

### 2.4. Ethical approval

Ethical approval for this study was obtained from the Institutional Review Board at the Virginia Polytechnic Institute and State University (23-283). The Research Ethics Committee at Bishop Stuart University in Mbarara, Uganda, also approved the study (BSU-REC-2023-73). Research clearance was also obtained through the Uganda National Council of Science and Technology (NS544ES). Permission to conduct research and operate within Imvepi was granted by the OPM in Uganda.

## 3. Results

### 3.1. TBI programs

Data analysis revealed six distinct TBI program categories: (i) Home-based agroforestry, (ii) Community-based agroforestry, (iii) Fuelwood efficiency, (iv) Woodlot planting, (v) Food forest establishment, and (vi) Community FMNR.

Home-based agroforestry TBIs distribute tree seedlings to refugee and host-national participants for planting near homesteads, along property boundaries, and/or integrated with home-based gardens. Tree species are selected based on compatibility with agricultural crops, or for fruit production, shade, or fuelwood. Some home-based agroforestry programs also include resource recovery and reuse training, which focuses on household soil and water conservation techniques such as repurposing kitchen graywater for irrigating trees and crops, digging trenches and bioswales to improve water absorption in soil, and composting to optimize water and nutrient availability. The goal is to extend the growing season to increase tree and crop survival rates during drought and unreliable precipitation.

Community-based agroforestry TBIs promote cropping in between newly established trees in timber woodlots on host-national land. Newly planted stands are divided into individual tracts, which refugees use for intercropping during a period of 2–3 years. Planting annual crops between juvenile timber trees is most common, but intercropping other tree and shrub species occurs as well. The goal is to increase agricultural production by accessing resources that are unused by timber trees in early stages of stand development, as well as reducing timber tree competitors. Community-based agroforestry is derived from *taungya*, an agroforestry system developed in the early 19<sup>th</sup> century in Myanmar as an efficient approach to rehabilitating forest cover and improving farmer livelihoods (Hemida *et al.*, 2023).

Fuelwood-efficiency TBIs focus on improved access to biomass cooking fuel and enhancing the efficiency of cooking appliances to reduce demand for fuelwood. This includes the fixed-owner (Lorena) stove promotion. Artisans are trained to construct Lorena stoves inside refugee and host-national kitchens with locally sourced grass, sand, and clay. Recipients of stoves are involved in the stove construction process, providing them with a new skill set and the knowledge required to repair stoves in case of breakage over time. Fuel-efficiency programs also promote briquette production using carbonized tree twigs and crop residues, which are bound with soil. Briquettes are either for the purpose of home use or sale.

TBIs focused on woodlot planting involve establishing timber species on one hectare or more of land provided by host-national owners. Planting normally includes a small number of fast-growing timber species, predominantly teak (*Tectonia grandis*). NGOs hire refugees and host-nationals to establish and maintain woodlots for a 3-year period, after which management is transferred to host-national owners or local institutions. Management activities include weeding, trenching to exclude fire, and replanting where mortality occurs. In some cases, refugees can use pruned wood beyond the initial 3-year period.

Food forest establishment TBIs are two-to-three-acre projects designed using six permaculture layers: large tree canopy, small tree canopy, shrub, herbaceous, groundcover, and vining. Multiple layers and three-dimensionality mimic niche occupancy in natural forests and increase multifunctionality using diverse guilds that provide food, fodder, fiber, fuel, and medicine, as well as improve soil fertility. Food forests are planted on land provided by local institutions or host-nationals. Refugee and host-national farmer groups are hired to establish and maintain food forests for institutions, neighboring communities, and individual host-nationals. Soil and water conservation involves integrated water-harvesting structures (e.g., bioswales, boomerang, and half-moons) as well as manuring and mulching.

Community FMNR TBIs provide demonstrations where refugees and host-nationals are trained on systematic pruning and tree and shrub coppicing to encourage species regrowth. Apiaries and fruit trees are integrated to showcase short-term additive enterprise opportunities, which can provide sources of income before FMNR projects yield economic return. FMNR program participants receive apiary training and materials such as beehives, equipment for beehive maintenance, and honey bottling and marketing supplies. FMNR TBIs emphasize community management of conservation sites and apiaries, in particular, co-management between refugees and host-nationals.

### 3.2. TBI organizational characteristics

TBI organizational characteristics included five unique attributes: (i) Mission statements, (ii) Geographic range, (iii) Number of beneficiaries, (iv) Target beneficiaries, and (v) Funding duration (Table 1). TBI programs varied by mission statements and objectives published by the administering organization. Mission statements shape the nature of adopted program activities. Livelihood-oriented missions focused on activities providing short-term material benefits for participants. An environmentally focused missions focus on activities to support biodiversity

**Table 1. Comparison of characteristics of organizations implementing TBIs across promoted activities**

Tree-based interventions	Organizational characteristics				
	Programmatic mission	Geographic range	Number of participants/year	Refugee: host ratio	Duration
Home-based agroforestry	Gender responsiveness, food and energy security, sustainable ecosystems, resilient livelihoods	Settlement	190–300	70:30	4 years
Fuel-efficiency interventions	Energy security, reduced environmental degradation	5 districts	2,000	70:30	4 years
Community-based agroforestry	Energy security, reduced environmental degradation	5 districts	93	70:30	4 years
Community-based FMNR	Food security, sustainable natural resource use, and climate change adaptation	Settlement	667	70:30	3 years
Woodlots	Energy security, reduced environmental degradation	5 districts	1,040	70:30	4 years
Food forests	Resilience and economic development	13 districts	525	30:70	4.5 years

Abbreviation: FMNR: Farmer-managed natural regeneration.

conservation, carbon sequestration, and wind reduction. Common themes existing across the missions of all organizations include ecosystem resilience, human welfare, and host-national and refugee cooperation building. Other common themes are household nutrition, cooking energy security, reduction of environmental degradation, climate change mitigation, and regional economic development.

TBI programs also varied by geographic range and duration of implementation. Three organizations provide TBI programs in concentrated geographic areas. These organizations tend to focus on home-based agroforestry and community FMNR. Two organizations implement TBIs across larger ranges, spanning multiple refugee-hosting districts, and focus on woodlots, fuelwood efficiency programs, community-based agroforestry, and food forests. The largest organizational range covers 13 refugee-hosting districts, and the second largest operates in five refugee-hosting districts, including six refugee settlements. TBI program lengths also varied, with the average program length across organizations being 4 years. Three years is the shortest recorded program, whereas the longest is four and a half years. Three TBIs involve funding for pre-designated durations, whereas two organizations sought continuous funding through crowd-sourcing and additional grants or relied on annual contract renewal.

The food forest establishment TBI engaged the highest number of participants, recruiting a total of 2,355 refugees and host-nationals. One organization delivering a fuelwood-efficiency program reached an estimated 2,000 households per year. The woodlot establishment TBI involved more than 1,000 participants annually. The number of households trained in the community-based FMNR program totaled 2,000 over a 3-year period. Two organizations administering home-based agroforestry interfaced with approximately 150–300 households per

year, while the community-based agroforestry TBI reached approximately 100 households annually. TBIs at four of five organizations aimed to engage 30% of host-nationals among recruited participants, though exact proportions varied due to the location of staff or programs. For instance, participants recruited for woodlot programs were often selected based on proximity to woodlot sites, which affected the proportion depending on proximity to refugee or host-national populations. Only one organization adjusted participant recruitment targets (30% refugee and 70% host-national participation) to accommodate a larger geographic range and refugee-hosting district mission.

### 3.3. TBI operational challenges

Distinct operational challenges emerged relative to five germane TBI challenges: (i) Land access, (ii) Participant livelihoods, (iii) Gender equity, (iv) Environmental conservation, and (v) Community engagement (Table 2). Land access is a common challenge for TBIs, particularly when engaging refugees whose primary landholdings are limited to plots granted by the OPM. Refugees do not technically own these plots, which rarely exceed 2,500 m<sup>2</sup>, but are granted long-term tenure at no cost through land-use agreements negotiated by OPM, UNHCR, and local landowners. Although host-national TBI participants have larger landholdings, they also face land access limitations if a significant proportion of their acreage is under annual crop production.

One strategy for addressing land access challenges is to maximize the productivity of smaller land parcels through intensive application of soil and water conservation practices. Such practices include greywater harvesting and composting, as well as tree establishment on even the smallest and most marginal refugee plots. Another strategy is to negotiate access to external tracts of host-

**Table 2. Comparison of TBI strategies in response to key operational challenges across promoted activities**

TBIs	Operational challenges				
	Land access	Short-term livelihoods	Gender	Environmental conservation	Community engagement
Home-based agroforestry	Maximize participant land use	Tree products for use and sale	TBIs complement household tasks, and women engage at home	Shade and windbreak; soil and water conservation	Local staff hired; community meetings convened
Fuel-efficiency interventions	Maximize efficient tree use	Stove construction training	Reduced firewood demand	Tree conservation	Local staff build stoves, train neighbors
Community-based agroforestry	TBI establishment on host/institutional land	Improved crop yields; tree poles for use and sale	Women gain external land access	Soil fertility and crop protection	Local staff hired; mixed refugee–host groups formed
Community-based FMNR	TBI establishment on host/institutional land	Integrated agroforestry for tree products; Apiary establishment	Apiary training; female leadership roles groups	Biodiversity preservation; pollination	Local staff hired; local leaders engaged; mixed refugee–host groups formed
Woodlots	TBI establishment on host/institutional land	Cash-for-Work income; timber for landowner/institution	Gender thresholds; female staff hired; cash earnings for women	Carbon sequestration; microclimate adaptation	Local staff hired; community meetings; community leaders engaged
Food forests	TBI establishment on host/institutional land	Cash-for-Work income; tree products for landowner/institution	Gender thresholds; female staff hired; cash earnings for women	Diverse species planted; soil and water conservation	District leaders engaged; local staff hired; radio outreach

Abbreviations: FMNR: Farmer-managed natural regeneration; TBI: Tree-based intervention.

national or institutional land for TBI implementation through signing Memoranda of Understanding (MOU) with local landowners and regional and national governmental officials or other relevant stakeholders. For example, one community FMNR program negotiated MOUs to enable groups of refugee and host-national farmers to use one-acre plots of land for FMNR, agroforestry, and beekeeping activities, which are then left to the host-national landowner after programming concludes. A third strategy involves establishing TBIs on publicly available or institutional land. For example, food forests and woodlots are often established on land granted by schools, district offices, and even as green corridors alongside roads.

Providing short-term income and livelihood opportunities to incentivize TBI participation is of high organizational importance, given refugee and host-national socioeconomic insecurity. One TBI livelihood strategy is to distribute tree seedlings that yield short-term tree products for sale or home use. In certain TBI programs, for example, participants harvest the fruits of papaya (*Carica papaya*) and mango (*Mangiferus indica*) or cut tree poles from species such as senna (*Senna siamea*) or melia (*Melia volkensii*) for home construction or sale at UGX 5,000 (equivalent to USD 1.37) per

pole. Even within conservation-oriented community FMNR sites, fast-producing fruit trees along boundaries encourage participants to regularly visit and maintain sites. In addition, community-run apiaries in FMNR sites provide an income source during the early stages when new trees do not yet render sufficient marketable yield.

Cash-for-Work (CfW) is another model for incentivizing TBI participation, particularly with respect to food forests and woodlots. CfW provides cash payments to refugees and host-nationals for TBI activities such as land preparation, tree planting, and maintenance. CfW is an important supplementation to food and humanitarian aid, particularly for youth and women, and can lead to longer-term livelihood opportunities when participants use payments as seed money to open shops or purchase poultry and livestock. Finally, a third livelihood strategy identified across TBI programs is building participant skillsets and employment opportunities through training on the construction and maintenance of fuel-efficient woodstoves.

Ensuring equitable access to TBIs by women is imperative, though programs differ in how this is achieved. Home-based agroforestry programs encourage women to integrate TBIs with domestic activities such as cooking,

cleaning, and childcare. For example, participants learn how to irrigate trees using greywater from household activities. Fuel-efficiency interventions such as briquette production and Lorena stove construction reduce the amount of time women spend searching for fuelwood away from the homestead. TBIs such as woodlot plantings, community-based agroforestry, food forest establishment, and community FMNR, by contrast, require women to leave the homestead. These programs, however, focus on empowering refugee and host-national women by improving land access and providing income. To ensure equitable representation by gender within TBIs, most programs set thresholds when recruiting participants, aiming for a minimum of 50% participation by women. However, some programs fall short on gender targets because women often find it difficult to travel from the homestead for any length of time. All organizations also intentionally include women as community-based staff.

Environmental degradation in refugee-hosting contexts is a significant challenge addressed by TBIs. Like gender equity, associated strategies differ. Small-scale, intensive approaches to soil and water conservation implemented by home-based agroforestry and food forest establishment TBIs address climate change impacts experienced by participants due to increasing short and unpredictable precipitation. TBIs include instruction on water management structures such as bioswales, trenches, and bench terracing to improve growing conditions and soil health. Biodiversity is another conservation priority. For instance, one home-based agroforestry TBI program raises and distributes indigenous tree species such as desert date (*Balanites aegyptiaca*), tamarind (*Tamarindus indica*), and sausage tree (*Kigelia Africana*) to participants.

Biodiversity conservation and wildlife habitat preservation are major priorities for community FMNR programming, which trains participants to manage and protect diverse indigenous tree species within FMNR plots. FMNR programming draws on local ecological knowledge of indigenous tree benefits to encourage community use of medicinal and/or edible non-timber forest products during tree regrowth. Biodiversity is a major challenge for woodlot establishment TBIs, with most plantations growing one or two species of fast-growing, non-native timber trees. Often this is due to the preference of landowners who decide which trees are planted on their land and may reject species perceived as slow-growing. Woodlot establishment TBIs instead focus on larger-scale environmental benefits associated with plantation establishment, such as carbon sequestration, wind modification, and microclimatic improvements.

TBI programs employ various strategies to achieve participant uptake of promoted activities, which is a

prerequisite for program success. All programs hire local staff members to help identify and mobilize participants. Program informants highlighted the importance of local staff in facilitating communication with TBI participants in local languages within both the refugee and host-national communities. Local staff, in some cases, implement TBIs on their homesteads to create demonstration sites, inspiring neighboring participants to adopt TBI activities. Several programs intentionally engage local district-level leadership in the planning and execution of TBIs to ensure activities align with broader goals in the operational context. This prepares local districts to continue activities in the absence of formal programming and organizational support. Hosting community meetings is a common strategy for engaging local leadership and increasing TBI participation. Some programs emphasize community dialogues at the outset of activities to set appropriate land boundaries and foster community approval. Others implement dialogues mid-way through an intervention to identify participant preferences and brainstorm future directions. Radio programming also helps build community awareness and support for TBIs, providing updates on project progress, future activities, and best practices for implementation.

### 3.4. Focus group discussion and logic model

Focus group and logic modeling resulted in five prominent solutions to support overall TBI success and longevity: (i) Integrate TBIs, (ii) Coordinate across TBIs, (iii) Maximize use of funds, (iv) Build relationships, and (v) Monitor and evaluate. Salient discussion topics included selecting tree species favored by participants, offering home-based agroforestry programs focused on intensive water and soil conservation management, and hosting community meetings to ensure planned activities match participant-driven goals. Participants leading community-based interventions highlighted the importance of engaging local landowners and clan representatives in addition to the OPM and district governmental officials when arranging land access to avoid a sense of coercion or disregard among landowners and achieve mutually beneficial arrangements. Significant impediments to successful TBI program implementation in Imvepi included insufficient funding, short funding durations, and increasingly harsh environmental conditions for tree establishment and maintenance. The focus group discussion and logic model results were distilled into five prominent solutions.

## 4. Discussion

The results of this study highlight the significant differences between TBIs, particularly between home-based and community-based programs. Home-based

TBIs tend to focus on agroforestry applications and fuelwood efficiency, whereas community-based TBIs emphasize food forest establishment, woodlot planting, community-based agroforestry, and community FMNR. Aside from one fuelwood efficiency program, home-based TBIs are implemented by organizations with a localized, settlement-based geographic scope and engage a smaller number of participants. In contrast, most community-based TBIs are implemented by programs with broader, district-level geographic coverage that engage larger numbers of participants. One explanation is that large-scale organizations are better positioned to negotiate land access and establish MOUs with governmental stakeholders. Organizational mission statements also appear to influence the scale and nature of TBIs. Home-based TBIs are implemented by organizations whose mission statements emphasize gender responsiveness and household-level food and energy security, whereas mission statements among organizations implementing community-based interventions generally highlight regional and even global goals, including climate change mitigation, reduced natural resources degradation, and regional economic development.

Strategic responses to operational challenges also differ between home-based and community-based TBIs, with each intervention making important trade-offs to achieve programmatic missions. Home-based TBIs may attain longer-term land access and potentially greater TBI permanence by implementing activities on participant home plots; however, it can be constrained by the small size of plots, particularly among refugees. In contrast, community-based TBIs can achieve larger-scale impacts by linking participants to external tracts of land. TBIs on community land, however, may face constrained tenure given the short-term nature of land access agreements.

Home-based TBIs can build short-term livelihood opportunities by supplying participants with fast-growing tree species that yield products for which participants have clear ownership and user rights. These products may be more or less financially valuable depending on participant proximity to local markets, but they can address household-level food security and building material needs. However, user rights to products grown within community-based TBIs can be murky or restricted to only host-national landowners. To compensate, community-based TBIs instead emphasize livelihood opportunities in the form of CfW payments and apiary establishment.

Concerning gender, home-based TBIs are responsive to the needs of women by integrating TBIs with ongoing domestic work at the home site. Conversely, community-based TBIs draw women away from home in a manner that

can be inconvenient, but at the same time may empower them and challenge gender norms through increased access to land and cash-earning opportunities. Home-based TBIs promote environmental conservation through household-level soil and water conservation practices, though they can fall short of large-scale environmental goals achieved by community-based TBIs such as mass carbon sequestration, wildlife habitat protection, and microclimate adaptation. Achieving biodiversity goals is a challenge for home-based and community-based treeplanting programs alike when participants perceive indigenous and/or diverse species to be slow-growing and at odds with supporting short-term livelihood opportunities.

Finally, community engagement strategies such as hiring local staff and conducting community dialogue meetings are common across home-based and community-based TBIs. Home-based TBIs can encourage local staff to utilize their homes as TBI demonstration sites, providing visual evidence to support the uptake of TBIs among neighbors. Local staff is well-positioned to continue promoting TBI activities in the absence of formal programs. Community-based TBIs more often boost community uptake through radio programming and align activities with district-level governmental initiatives in a way that ensures cohesion with ongoing environmental projects and encourages district-level adoption of projects when TBIs conclude.

Findings indicate that home-based and community-based TBIs address both human and environmental health goals, each with associated strengths and weaknesses. That individual TBI programs make trade-offs in balancing unique goals need not be problematic when programs are viewed collectively through the perspective of an ILA, which calls for “the engagement of multiple stakeholders across sectors to better negotiate trade-offs and maximize synergies within the landscape” (Reed *et al.*, 2017, p.481). In the context of an ILA framework, diverse stakeholders can collectively contribute to finding synergies, identifying joint objectives, and accounting for gaps among individual actors (Reed *et al.*, 2016).

ILA frameworks can be most impactful when contextualized and connected to problem-solving within a specific landscape. One method of operationalizing an ILA is to bridge general ILA principles with stakeholder action items as part of an adaptive and iterative process to achieve landscape-level change (Freeman *et al.*, 2015). Five actionable TBI solutions identified during logic model planning align with general ILA core concepts. Examining the interplay is an opportunity to build pathways between grounded, applicable TBI recommendations and broader socioecological outcomes at the landscape scale.

Several TBI programs in Imvepi integrate activities to better account for service gaps. For example, home-based agroforestry programs often promote fuel-efficiency practices among participants to amplify impact by reducing fuelwood demand or encourage FMNR alongside agroforestry and woodlot planting to support the retention of indigenous tree species and biodiversity. TBI programmatic integration aligns with ILA multifunctionality. Multifunctionality can be a significant advantage for TBI programs operating in refugee contexts where the availability of environmental and livelihood interventions falls significantly below demand. The most successful programs may be those catering to multiple human and environmental health needs by blending diverse TBI activities and compensating for weaknesses associated with distinct intervention types. Program integration recognizes that trade-offs and hard choices by individual stakeholders within a given landscape are realistically unavoidable, but wherever possible, “win-win” outcomes are promoted where stakeholders simultaneously achieve multiple goals. Such program diversification may be enhanced through program planning exercises to review the spectrum of available TBI activities and rank activities in accordance with specific program objectives and priorities (Freeman *et al.*, 2015).

TBI programs in Imvepi exhibit inter-organizational coordination through various avenues. One example is mutual procurement or provisioning of planting stock. One organization in this study established a tree nursery between refugee settlements and signed seedling provision MOUs with other organizations, while another established a relationship with the UNHCR and the National Forest Authority, which allowed tree seedling supply from the National Forest Authority nurseries to other TBI programs. Two home-based agroforestry TBIs shared permaculture training materials and conducted joint training with organizational staff and participants. TBI staff currently co-attends relevant livelihood and environmental sector meetings within Imvepi. Inter-program TBI coordination corresponds to ILA transdisciplinarity. Trade-offs within individual programs across a landscape can be reconciled by improving inter-organizational coordination, where diverse stakeholders strategically fill gaps left by another (Freeman *et al.*, 2015). Additional coordination opportunities identified during focus group deliberations include establishing a settlement-based coalition of TBI implementing programs to facilitate knowledge exchange and coordinating activities with non-TBI-focused sectors such as education, health, and sanitation to broaden programming impact.

TBI programs optimize sustainability by maximizing the use of meager funds to achieve lasting impact beyond

3–5-year funding cycles. Among TBIs in Imvepi, one relatively low-cost means of supporting uptake and permanence is to emphasize participant training. Training provides participants with important and marketable skills such as the ability to construct Lorena stoves and prune resprouted trees. These skillsets can lead to livelihood opportunities in the case of refugee repatriation. Tree seedling survival is also critical for improving TBI efficiency, as planted seedlings face a range of threats, including ruminants, drought, fire, depleted soil, and species compatibility. Addressing these challenges involves using thorny shrub species for live fencing, digging fire lines to protect seedlings, promoting water harvesting and compost, ensuring species suitability, as well as selecting socially and culturally acceptable designs that are desired by program beneficiaries. Maximizing TBI funding intersects with ILA sustainability. Strengthening resilience and reducing vulnerability are viewed as critical to supporting the longevity of a landscape to provide environmental services in the context of climatic and sociocultural change (Freeman *et al.*, 2015). Future sustainability opportunities include establishing community-managed tree nurseries within refugee contexts to reduce costs associated with seedling transportation and emphasizing FMNR as an important alternative for achieving tree regrowth without incurring seedling procurement, planting, and management expenses.

There is a strong precedent for wide TBI relationship-building with refugees, local host-nationals, international organizations, and governmental officials when interventions are planned and enacted. Strong relationships with local leaders at the district, sub-county, and village levels facilitate land access and set the stage for local leadership bodies to adopt and maintain TBI strategies. For these reasons, several TBI programs in this study linked participant groups to local government infrastructure and staff. Another critical dimension of relationship-building is fostering TBI partnerships between refugees and host-nationals. Developing mutually beneficial relationships and land access arrangements between refugees and host-nationals can enable ongoing land access following program conclusion. Such examples reflect ILA participation. Outcomes are expected to be strongest in ILA applications when participation across diverse stakeholders is highly collaborative, iterative, and flexible (Freeman *et al.*, 2015). Recommended opportunities to bolster participation are refugee and host-national workshops on the process of drafting formal, written land access agreements to facilitate and protect both parties in cooperative land use arrangements for TBI engagement.

TBIs in Imvepi engage in joint TBI monitoring and evaluation with various stakeholders such as international

agencies, funding bodies, and government partners to increase capacity and critical evaluation. TBI programs implemented by large organizations often are in a better position to conduct monitoring if they already employ personnel specifically for the purpose of conducting monitoring and evaluation. Examples of program dimensions that are collaboratively evaluated include seedling survival, livelihood benefits, and community approval of TBIs. Monitoring and evaluation parallels ILA complexity. In complex refugee-hosting regions, significant intellectual, financial, and human resources are required to effectively monitor and evaluate TBIs, making it a relatively underdeveloped programmatic aspect. Landscape-oriented monitoring and evaluation frameworks, tools, and indices, and participatory approaches that empower and engage program beneficiaries are needed to effectively understand the complex social and environmental factors affecting program outcomes at different scales (Reed *et al.*, 2016). Developing holistic measures of tree health and TBI programmatic success beyond solely measuring seedling survival rates could add important insight into the environmental suitability of selected species, as well as reasons why and whether participants choose to maintain planted species.

Bridging key ILA concepts with stakeholder-identified TBI solutions clarifies key pathways for initiatives to pursue multifunctional, transdisciplinary, participatory, sustainable, and complex responses to social-environmental challenges in refugee-hosting landscapes. Additional research on regional TBI coalition building and coordination is warranted, and may benefit from exploring approaches implemented in other prominent humanitarian sectors, such as water, hygiene and sanitation, nutrition, and education. Furthermore, although TBI programs involved in this study represent various TBIs undertaken within the context of a Uganda refugee settlement, ideal strategies and outcomes may look quite different in self-settled or closed-camp refugee-hosting contexts. Tailored applications of an ILA framework within diverse humanitarian contexts are recommended.

## 5. Conclusion

As tree-cover loss accelerates in diverse regions of refugee displacement, TBI programs are an increasingly common facet of humanitarian organizations focused on human and environmental health. TBIs are especially critical in developing regions where refugees and host-nationals alike depend upon trees and forests for multifunctional livelihood benefits and ecosystem services. While studies on the strengths and challenges of individual TBIs in refugee contexts exist, comparative analysis across multiple, distinct TBI program models does not. This study identified and

compared five discrete TBI programs in the Imvepi refugee settlement located in Northwest Uganda to reveal differences and similarities, to highlight enabling or constraining factors for TBI program success, and to frame actionable TBI solutions for improved programming in regions of human displacement through the application of an ILA.

Results indicate that the goals and strengths of TBI programs in navigating service provision differ, particularly between programs implemented at home sites compared with those implemented at community sites. Home-based TBIs maximize household-level environmental benefits, accommodate participation by women, and yield tree products with clear user rights, while community-based TBIs can offer settlement-wide environmental benefits, provide empowerment opportunities to women, and cash-earning opportunities to refugees and host-nationals alike. Logic modeling with TBI staff revealed opportunities to boost effective provisioning at the landscape level through service coordination and flexibility between programs, as well as between TBIs and local community-based and governmental stakeholders well-situated to adopt and promote TBIs in the absence of external support. Application of an ILA framework positions TBI programmatic diversity as an asset, with distinct approaches collectively responding at different scales to major intersecting challenges in refugee contexts, including extreme poverty, malnutrition, and intensified climate change impacts.

## Acknowledgments

The authors acknowledge the support of their institutions and funders in enabling this study.

## Funding

This research was funded by the Center for Peace Studies and Violence Prevention, the Department of Forest Resources and Environmental Conservation, and the Graduate Research Development Program at Virginia Polytechnic Institute and State University.

## Conflict of interest

The authors declare that they have no competing interests.

## Author contributions

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## Ethics approval and consent to participate

Ethical approval for this study was obtained from the Institutional Review Board at the Virginia Polytechnic Institute and State University (23-283). The Research Ethics Committee at Bishop Stuart University in Mbarara, Uganda, also approved this study (BSU-REC-2023-73), and research clearance was also obtained through the Uganda National Council of Science and Technology (NS544ES). Written consent was obtained from each individual participating in semi-structured interviews and the focus group discussions.

## Consent for publication

Participants provided written consent and agreed to the publication of non-identifying data collected during the semi-structured interviews and focus group discussion.

## Availability of data

Data are available from the corresponding author upon reasonable request.

## Further disclosure

Initial research findings were presented at academic conferences: October 2025, Kigali, Rwanda, 6<sup>th</sup> World Congress on Agroforestry, Agroforestry programs in regions of refugee displacement: Strategies and trade-offs in addressing livelihood and environmental challenges; June, 2024, Stockholm, Sweden, International Union of Forest Research Organizations (IUFRO) World Congress 2024, Characteristics of tree-based interventions in a Uganda refugee settlement; November, 2023, Nairobi, Kenya, 5<sup>th</sup> International Congress on Planted Forests, Comparing tree-based interventions in a northwest Uganda refugee settlement; October 2023, Sherbrooke, Canada, 3<sup>rd</sup> World Conference on Forests for Public Health, tree-based interventions in a northwest Uganda refugee settlement.

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## RESEARCH ARTICLE

## Diplomacy, migration, and employment: The historical approach to Malaysia–Indonesia relations

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## Abstract

Malaysia and Indonesia share long-standing diplomatic relations rooted in common historical, cultural, and linguistic ties, which have fostered cooperation in economic, political, security, educational, and sociocultural affairs. This study examines the economic dimension of these relations, focusing on labor migration. Rather than measuring changes in migration flows, it adopts a historical approach that interprets Memoranda of Understanding and irregular migration issues as instruments of migration diplomacy. Indonesia remains the largest source of migrant workers in Malaysia, helping to address labor shortages in the 3D sectors—dirty, dangerous, and difficult—while remittances contribute to Indonesia's economy. However, disputes over Memoranda of Understanding and the persistence of irregular migration (*pendatang asing tanpa izin*, or illegal foreign migrant) have at times created diplomatic tensions. Despite these challenges, both governments consistently demonstrated a commitment to resolving issues through dialog and cooperation. Historical ties continue to provide a vital foundation for sustaining Malaysia–Indonesia relations and for strengthening their ability to address migration-related conflicts constructively.

**Keywords:** Diplomatic; Migration; Foreign workers; Malaysia; Indonesia**\*Corresponding author:**Mohd Na'eim Ajis  
(naeim@uum.edu.my)**Citation:** Ajis, M.N., Sohaimi, N.S., Arshad, M.R.M. (2026). Diplomacy, migration, and employment: The historical approach to Malaysia–Indonesia relations. *International Journal of Population Studies*. 12(1):32-45.<https://doi.org/10.36922/IJPS025230112>**Received:** June 3, 2025**1st revised:** June 20, 2025**2nd revised:** September 10, 2025**3rd revised:** September 14, 2025**Accepted:** October 21, 2025**Published online:** November 10, 2025**Copyright:** © 2025 Author(s).

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**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## 1. Introduction

Strong diplomatic relations are essential for fostering meaningful cooperation across social, cultural, religious, economic, and political spheres (Muhammad, 2014). This is particularly critical for neighboring states, where unresolved border disputes can escalate into broader diplomatic and security challenges. The geographical proximity of bordering countries also encourages patterns of cross-border migration (Harun, 2009), which—if not managed effectively—can generate tension and undermine stability. Consequently, cooperation is not merely desirable but necessary for advancing national interests in areas such as economic growth, political stability, and security. In the contemporary era, modernization has

further intensified interdependence and integration among states, making bilateral engagement a strategic imperative rather than an option (Irdayanti, 2013).

Malaysia attaches great importance to maintaining strong diplomatic relations by adhering to the principles of negotiation, openness, and cooperation in the economic, social, and political affairs with other countries. One of the countries with which Malaysia shares close diplomatic relations is its closest neighbor, Indonesia (Abdullah *et al.*, 2011). The fraternal relationship between Malaysia and Indonesia has been established since before independence. For example, people from the Malay Peninsula once joined the volunteer forces to support Indonesia's struggle for independence from the Netherlands (Nik Mahmud, 2000). After Malaysia achieved independence in 1957, diplomatic relations between Malaysia and Indonesia were officially formalized. The Malaysian representative, Senu Abdul Rahman, was sent to Indonesia, which became the first country selected as a non-Commonwealth diplomatic partner (Ab Ghani & Paidi, 2010).

The concept of migration diplomacy provides a crucial framework for understanding the intersection between foreign policy and international migration, emphasizing three core elements: (i) interstate relations influenced by migration, (ii) migration as a diplomatic tool, and (iii) the management of migration as an international issue (Tolay, 2022). It describes how states leverage cross-border mobility to influence international relations, connecting migration with security, economic interests, and national identity, while employing bargaining strategies based on their roles as migration-sending, receiving, or transit states (Adamson & Tsourapas, 2019). Migration diplomacy often involves bilateral and multilateral agreements aimed at externalizing borders and managing migration flows, such as visa exchanges for skilled migrants from the Global South and the repatriation of undocumented migrants, alongside policies promoting development and dual citizenship (Wihtol de Wenden, 2023). Overall, migration diplomacy strategically utilizes international migration governance as part of a state's foreign policy, highlighting the role states play in shaping diplomatic relations through migration management (Ahlborn, 2019).

The interdependence of Malaysia and Indonesia in employment matters has not hindered their cooperation but has instead created mutual benefits. Malaysia relies heavily on Indonesian workers to address labor shortages, particularly in low-skilled sectors, while Indonesia views labor migration as a means of addressing domestic unemployment and strengthening its economy through remittances (Balakrishnan, 2013). Reflecting this dynamic, Malaysia has consistently ranked among

the top 10 destinations for international migrants in the Asia-Pacific region and the second highest in Southeast Asia (United Nations, 2013). Several factors contribute to Malaysia's attractiveness as a migration hub, including its geographic proximity to sending countries, political stability, and sustained economic growth (Ajis, 2015). Against this backdrop, examining Malaysia–Indonesia relations through the lens of labor migration is crucial for understanding how both nations navigate the opportunities and challenges of their deep-rooted economic and social interdependence. This study does not evaluate migration flows or quantify the outcomes of agreements on migration numbers. Rather, it adopts a historical–diplomatic approach to evaluate how migration issues became embedded in bilateral relations. In this context, Memoranda of Understanding (MoUs) and irregular migration are viewed less as instruments for regulating flows than as tools of migration diplomacy—mechanisms through which both states negotiate cooperation, assert authority, and manage bilateral tensions.

## 2. Background of Malaysia–Indonesia relations

Following Malaya's attainment of independence in 1957, the Indonesian Foreign Minister, Dr. Subandrio, commemorated this significant milestone in Kuala Lumpur, viewing it as the commencement of a new chapter in Malaysia–Indonesia relations (Muniandy, 1996). Upon Malaya's emergence as a sovereign state, Indonesia demonstrated its respect by instructing Radio Republik Indonesia to refrain from broadcasting the song *Terang Bulan*, which had been adapted into *Negaraku*, the national anthem of Malaya at that time (Sunarti, 2014). Furthermore, Indonesia's support for Malaysia was exemplified through its endorsement of Malaysia's admission into the United Nations. This diplomatic goodwill was reciprocated by Malaysia, which welcomed collaborative engagements with Indonesia across social, cultural, and economic affairs through formal agreements and reciprocal visits by their respective leaders. The cordial relations between the two nations were further reinforced by shared ideological affinities, rooted in historical and fraternal ties (Esa *et al.*, 2022).

Diplomatic ties between Malaysia and Indonesia grew closer with the signing of the Treaty of Friendship on April 17, 1959, which symbolized fraternal relations and sought to strengthen kinship between the two nations (Ab Ghani & Paidi, 2010; Harun, 2009; Nik Mahmud, 2000). The treaty was followed by various cultural and educational exchanges that deepened bilateral cooperation. For instance, Indonesia sent a troupe of artists to Malaya in

November 1960, staging 41 performances over 21 days, and also sent Bing Slamet to Radio Malaya to train local artists. That same year, Malayan teachers visited Indonesia to study its education system, and four Malays received scholarships to undergo civil aviation training at the Jakarta Aviation Academy. In 1961, Indonesia's Minister of Religious Affairs led a delegation to Kuala Lumpur for a Quran recitation competition (Muniandy, 1996). Despite these cooperative initiatives, relations later deteriorated due to personal and political conflicts, culminating in Indonesia's confrontation with Malaysia and the severance of diplomatic ties on September 16, 1963 (Abdul Razak *et al.*, 2013; Nik Mahmud, 2000).

The confrontation marked a turning point in relations between Malaysia and Indonesia, transforming their previously close ties into a period of hostility. During this time, all forms of cooperation were suspended, and tensions escalated through acts of boycott and protest. In Indonesia, for instance, employees of the Chartered Bank—the British-owned Bank—and the Singapore-owned Overseas Chinese Bank launched an anti-Malaysian strike. Similarly, the Airport Workers' Union refused to service aircraft belonging to Malaysia Airways, British Overseas Airways, and Canadian Pacific that landed in Jakarta, as a demonstration against the formation of Malaysia. In retaliation, the President of the Malaysian Railway Workers' Union, Donald Uren, urged Malaysian transport workers to boycott Indonesian vehicles. These confrontations further strained economic cooperation, particularly after Indonesia severed diplomatic ties with Malaysia following the KOTOE meeting on September 21, 1963 (Abdul Razak & Wan Azhar, 2021). Relations gradually improved after the fall of Sukarno and the rise of Suharto in 1966. Under Suharto's leadership in Indonesia and Tun Razak's administration in Malaysia, both countries moved toward reconciliation, strengthening bilateral relations and restoring diplomatic ties that had been disrupted during the confrontation era (Harun, 2006; Yaakub, 2009).

Cooperation between the two countries extended across multiple sectors, particularly employment. Malaysia has long relied on workers from Indonesia in various sectors such as construction, manufacturing, and agriculture. However, after the fall of the Suharto regime in 1998, marking the beginning of the Reform Era, a new chapter in the relationship between the two countries was created when both countries were involved in the conflict over the Sipadan and Ligitan Islands. The international court ruled in 2002 in favor of the Malaysian government. However, the conflict of these two islands caused Indonesians to show their protest and dissatisfaction (Ismail & Govindasamy, 2019; Maksun, 2021). Although the conflict had an

impact on the Indonesian community, the two countries still have a strong relationship in cooperation regarding foreign workers. The dependence of both countries on employment matters does not prevent cooperation from being held in providing benefits to their respective countries. These countries need each other, as Malaysia is in dire need of foreign workers to fill job vacancies, and Indonesia is trying to curb the unemployment problem. In addition, sending its citizens to Malaysia as workers is also seen as a significant contributor to its country's economy through remittances (Balakrishnan, 2013).

### 3. The trends of international migration to Malaysia

The rapid pace of globalization has influenced the economic development of both developed and developing countries. In addition, the effects of globalization have widened the gap between developed and developing countries (Idris & Yussof, 2009). The demand for foreign workers in Malaysia became evident as Malaysia began to develop its economic sector. Malaysia's economic development can be categorized into four phases, starting with the initial phase of independence (1957–1970), the New Economic Policy (1971–1990), the National Development Policy (1991–2000), and the National Vision Policy (2001–2010) (Sayed, 2014). These policies reflect the government's efforts to transform Malaysia into a developed country. For example, Malaysia's economic development during the 1970s, with the implementation of the New Economic Policy (NEP) from 1971 to 1990, introduced export-oriented industrialization and public sector expansion (Esa *et al.*, 2022). The goal of this policy was to eradicate poverty in Malaysia regardless of race and to restructure Malaysian society by addressing racial economic imbalances (Wong, 1988).

The implementation of this policy stimulated growth in industrial sectors, especially manufacturing, followed by trade, services, and government. These sectors expanded primarily in urban areas, creating numerous job opportunities and causing population migration. This migration involved two groups, namely domestic and international migration. Internal (domestic) migration refers to individuals from rural areas migrating to cities to seek better economic opportunities, particularly among the younger generation (Sayed Mahadi & Osman, 2020).

Rapid economic transformation has required foreign workers to meet the increasing demand for labor (Aziz & Saad, 2022). Malaysia is also one of the top countries receiving foreign workers in the Asian region. Malaysia has opened its doors to the arrival of foreigners since the early 20<sup>th</sup> century through the liberal immigration policy introduced by the British Colonial government, with the

entry of immigrants from China, India, and Indonesia (Ahmad *et al.*, 2014; Iruthayaraj & Pappusamy, 2014). The implementation of the NEP served as a mechanism for shaping the Malaysian economy by transforming its economic structure from agriculture to industry (Avila, 2015; Hugo, 1995). The NEP created numerous job opportunities for the local population. However, there were several sectors that locals were reluctant to fill, particularly those involving 3D (dirty, dangerous, and difficult) jobs in rural areas. Vacancies in these sectors prompted the government to recruit foreign workers, including those from Indonesia (Fauziyah, 2015; Robertson, 2009). Indonesia also recorded the highest foreign exchange earnings from Malaysia (Balakrishnan, 2013).

The announcement of the NEP transformed Malaysia into a labor-intensive country, particularly for semi-skilled and unskilled workers. The demographic differences and economic gaps between Malaysia and its neighboring countries contributed to the emergence of a second-generation group of migrants in Malaysia. In the 1970s, many migrants were brought in informally in small numbers to meet labor demands in the rural plantation sector. With sustainable development and the rapid expansion of the industrial sector and economic modernization in Malaysia at that time, dependence on foreign workers increased significantly. Between 1988 and 1997, the Malaysian economy grew rapidly, at approximately 8% per year, and this situation transformed unemployment in the mid-1980s into abundant employment opportunities by the early 1990s (Lim, 1981; Crouch, 1993; Kanapathy, 2006).

Malaysia recorded a low unemployment rate and an increase in the educational attainment of its youth. As the level of education increased, it led to a competitive wage demand among local workers, and many local workers became unwilling to work in low-skilled sectors such as agriculture, construction, and plantations (Abella, 2013). According to the World Bank Report (1995), 14 million new jobs were created between 1987 and 1993, and the labor market growth rate was 3.9%, while the local labor growth rate was 3.1%. This indicates that the Malaysian government's dependence on foreign workers was unavoidable during that period.

Malaysia has experienced a shortage of local labor, especially in the agricultural sector, since the 1970s. Labor shortages occurred in the rubber and oil palm plantation sectors, particularly in southern Johor, land-clearing areas on the east coast of the Peninsula, rice cultivation areas, and the construction industry (Lim, 1996; Said *et al.*, 2002). According to Stahl (1984a; 1984b), labor shortages in the agricultural sector at that time were caused by a shift in plantation crops from rubber to oil palm. Oil palm

plantations do not require a large number of laborers per hectare of land. In addition, structural unemployment among women and children persisted because oil palm plantations required male laborers with greater physical strength compared to that needed for rubber plantations.

The entry of foreign workers into Malaysia occurred in two ways: (i) legally, through a registered agency under the Malaysian Immigration Department, and (ii) illegally, where their entry did not go through any registered agency (Ajis *et al.*, 2014), following the implementation of the New Economic Policy in 1970 (Kassim, 1987). At that time, the number of work permits issued by the Immigration Department also increased from 3,484 in 1985 to 24,152 in 1990 (Kanapathy, 2001). The New Economic Policy attracted foreign investors, particularly in the industrial sector. Therefore, the implementation of the New Economic Policy resulted in a surplus of jobs (S. Othman & Rahim, 2014), especially in the construction and services sectors (Ajis, 2015). The high demand for foreign workers was also due to the reluctance of local citizens to take up jobs in the plantation, manufacturing, mining, and construction sectors (Azed, 2014). According to Kanfur & Mustafa (1998), one of the most significant labor shortages occurred in the plantation sector, as evidenced by a study by the United Planters Association of Malaysia (UPAM), which found that the rubber and oil palm plantation sub-sectors suffered losses of MYR 370 million between 1980 and 1985 due to a shortage of workers in the sector.

According to Kassim (2014), the distribution of foreign worker entry varies across sectors and states in Malaysia because their entry is influenced by economic development, which can be classified into three localities. Peninsular Malaysia has attracted foreign workers to the manufacturing sector due to developments in the industrial and manufacturing sectors at that time, while Sabah and Sarawak have attracted foreign workers to agriculture and plantations because both regions continued to focus on agriculture as an economic activity. Foreign workers find it relatively easy to secure jobs in countries such as Malaysia. This can be attributed to two factors: first, their willingness to accept non-exclusive jobs, such as working in 3D conditions, compared to local workers. This situation leads employers to prefer foreign workers, as they are more willing to work under dangerous and uncomfortable conditions. Second, foreign workers are willing to accept lower wages for unskilled jobs compared to local workers (Athukorala & Devadason, 2011; Robertson, 2009). However, employers must employ foreign workers in accordance with the policies and procedures set by the government, ensuring they hold valid passports and visas and have passed the required health checks (S. Othman & Rahim, 2014).

### 3.1. Indonesian labor migration to Malaysia

Malaysia is a popular destination for foreign workers due to its geographical factors, political stability, and economic development (Ajis, 2015). Of the 15 recognized foreign-labor source countries in Malaysia, Indonesia is the largest sender of foreign labor (Devadason & Meng, 2014; Fauziyah, 2015). The first migration of Indonesians to Malaya before the colonial era is difficult to determine, as there are no detailed records of their migration until the colonial period (Muniandy, 1996). According to Asgar (2012), the entry of Indonesian labor into Malaysia is not recent, as it began in the 19<sup>th</sup> century, during the Dutch East Indies era, around 1887, when they worked as laborers.

During the colonial era, the Javanese community was the third largest migrant group brought into Malaysia after India and China, serving as temporary laborers and also becoming permanent residents (Karim *et al.*, 1999; Sayed, 2014). The influx of Javanese workers increased around 1930. In 1947, the Javanese community was recorded at 307,150 people in Malaya, and by 1957, the number had grown to 2,427,834. These migrants constituted a significant portion of Malaya's population. However, this number fluctuated due to the effects of World War II and the confrontation between Indonesia and Malaysia (Asgar, 2012; Fauziyah, 2015).

In 1970, the number of Indonesian foreign workers migrating to Malaysia increased again due to the modernization that occurred with the implementation of the NEP, which required a large number of foreign workers to fill job vacancies in several major sectors (Fauziyah, 2015; Liow, 2004). Around 1980, the number of Indonesian foreign workers had reached an average of 50,000 people. The Workforce Division at the Embassy of the Republic of Indonesia in Kuala Lumpur released official data reporting that a total of 1,309,480 Indonesians were registered as foreign workers in Malaysia until December 2014 (Jizal *et al.*, 2015). Meanwhile, around 1990, the recruitment of Indonesian foreign workers continued to fill vacancies in the construction, plantation, and domestic sectors due to local labor shortages that occurred in the late 1980s (Liow, 2004). Indonesian foreign workers, or *Tenaga Kerja Indonesia* (TKI), who enter Malaysia are divided into two situations: documented and undocumented. However, the number of undocumented foreign workers exceeds the number of documented workers. However, the exact number of undocumented foreign workers cannot be ascertained, as no agency has complete data on them (Haris *et al.*, 2015).

The presence of Indonesians as workers in Malaysia is driven by pull and push factors (Harun, 2006). Among the pull factors encouraging Indonesians to migrate to Malaysia are the similarity in general demographics

between the two countries; the network of labor agents institutionalized through the 1984 Medan Agreement; the high demand for labor supply in Malaysia; the network of linguistic connections, such as culture and history (Balakrishnan, 2013; Jizal *et al.*, 2015); the proximity of the countries (D. Handayani *et al.*, 2015); ease of communication; the assumption that Malaysia is a country that is easy to enter illegally (Sulistiyono, 2016); and the presence of intermediary networks—such as brokers and labor agencies—in facilitating the flow of immigrants to Malaysia (Balakrishnan, 2013; Fauziyah, 2015).

In addition, according to Kassim (1997), two factors attract TKIs to work in Malaysia. First, the implementation of the NEP created many job opportunities in the industrial and service sectors, prompting local Malaysians to migrate to cities to work in these sectors for higher wages. This policy encouraged Indonesians to fill labor vacancies in the agricultural sector outside the cities. Second, the demand for Indonesian female labor remains high. This is because the NEP created job opportunities in the formal work sector for highly educated Malaysian women. In addition, Malaysian women who are not highly educated are more likely to choose jobs in the industrial sector due to the higher wage benefits. This has resulted in a gap between sectors, which encouraged the recruitment of female workers from Indonesia (*Tenaga Kerja Wanita*) as domestic workers (Azed, 2014; Balakrishnan, 2013; Mei, 2006).

Meanwhile, the identified push factors are the economic and political conditions in Indonesia, which are not sustainable and stable, making it difficult to provide jobs for all its citizens. In addition, the population of Indonesia is also among the highest in the world, exacerbating the unemployment problem (D. Handayani *et al.*, 2015). This unemployment problem has forced Indonesians to migrate to Malaysia and fill the job opportunities available there. Support from Indonesian leaders also influences the migration of Indonesian workers to Malaysia, where, apart from helping to reduce the unemployment problem, the Indonesian government views the sending of Indonesian workers as a way to improve Indonesia's economy through foreign exchange (Mei, 2006).

Among the initiatives of the Indonesian government is the introduction of the Inter-National Employment Program in 1970, which falls under the portfolio of the Ministry of Human Resources. This program is considered successful in overcoming the serious unemployment problem in Indonesia. Among the destination countries for TKI are Malaysia, Saudi Arabia, Japan, Korea, Taiwan, Hong Kong, and Singapore (Fauziyah, 2015). Among the Association of Southeast Asian Nations countries,

Malaysia is a popular destination for TKIs due to historical ties, affinity, culture, easy-to-understand language, and a large diaspora. Singapore is less attractive to TKIs because some consider the country's migration enforcement laws to be very strict (Ahmad *et al.*, 2014).

## 4. Malaysia–Indonesia diplomatic relations in the context of foreign workers: Issues and challenges

Malaysia is the preferred destination for Indonesia to send its workers. Among the factors are historical ties, cultural affinity, and the close border distance between the two countries. Weiner (1985) also stated that a country tends to accept immigrants from another country because of certain historical relationships. In addition, a country tends to allow open entry to foreign immigrants who have close ethnic ties. According to Hugo (1993), during the colonial period, the British treated Indonesian immigrants differently compared to other immigrants from China and India. This was because they shared racial similarities, namely the Malay race, with the population of Malaya at that time. Many Indonesians entered Peninsular Malaysia voluntarily to find work and eventually settled permanently, assimilating into the local culture. Among the early Indonesian immigrants who came to Malaysia were the Minangkabau from Sumatra, the Bugis from Sulawesi, and the Javanese from Java. These groups came to Malaya via sea routes. While the Bugis and Sumatrans initially entered as traders, the Javanese were mostly contract laborers and smallholders (N. Othman, 1986). Several key issues related to diplomatic relations between Malaysia and Indonesia are discussed in the subsequent sections.

### 4.1. Memoranda of Understanding on foreign labor: Managing Indonesia–Malaysia migration relations

In the 1980s, the number of Indonesian foreign workers increased to the point where it became difficult to manage, causing an influx of undocumented Indonesian foreign workers, often referred to as illegal immigrants or *pendatang asing tanpa izin* (PATI). This problem became a focus for both countries, especially Malaysia, due to the increasing number of Indonesian foreign workers who tend to create problems in Malaysia. Consequently, the two countries began to cooperate and engage in diplomacy in managing the entry of Indonesian foreign workers by entering into a bilateral agreement in 1984, namely the Medan Agreement (Azed, 2014; Fauziyah, 2015; Kassim, 2012). The Medan Agreement became the starting point for official Malaysia–Indonesia diplomatic relations in the context of employment. It was signed in 1984 by Malaysia and Indonesia in Medan, Indonesia, as an initiative to establish formal and legal channels for the hiring of

foreign workers. Through the agreement, Indonesia agreed to supply workers according to the number and categories requested by Malaysia from time to time in six employment sectors, particularly in the agricultural and domestic service sectors. As a result, it facilitated the mass entry of Indonesian immigrants into Malaysia (Ajis *et al.*, 2010; Devadason & Meng, 2014; Rashid *et al.*, 2018).

However, the Medan Agreement did not fully achieve its intended goal, as Malaysia began to be flooded with PATI. This was influenced by the increasing demand from employers for unskilled labor at lower cost rates (Kanapathy, 2006). Malaysia and Indonesia also have Diplomatic Notes and MoUs regarding formal and informal workers. These regulations are influenced by international laws such as the United Nations Convention on the Protection of Migrant Workers and their Families (1990), the Convention on the Elimination of Discrimination Against Women, and others (Azed, 2014).

In mid-2004, Malaysia conducted a massive repatriation process of illegal immigrants to Indonesia. This served as a warning from Malaysia to Indonesia regarding the dumping of illegal immigrants in the country. Consequently, in May 2004, Malaysia and Indonesia jointly signed an MoU to outline the procedures that Indonesian citizens must follow to work in Malaysia (Mei, 2006). This memorandum, in 2004, represented an initial step for Malaysia and Indonesia to reduce the number of illegal immigrants. Although this memorandum aimed to curb the entry of illegal immigrants, it was seen as a violation of the rights of foreign workers (Hadi, 2008), as it did not take into account the rights of domestic workers (Rahayu & Ramdlany, 2016; Go, 2007; P. Handayani, 2014). This agreement was formalized by both countries, with Malaysia represented by the Minister of Human Resources, Dr. Fong Chan Onn, and Indonesia represented by the Minister of Manpower and Transmigration, Mr. Jacob Nuwa Wea (Rashid *et al.*, 2018).

As the 2004 MoU was seen as a violation of the rights of foreign workers, especially domestic workers, an amendment was made through the 2006 MoU. It was signed by Malaysia and Indonesia on May 13, 2006, in Bali, Indonesia. This memorandum aimed to strengthen the mechanisms for the agreement and recruitment of Indonesian domestic workers in Malaysia. It outlined several guidelines to qualify Indonesian citizens to work in Malaysia as domestic workers. Among the guidelines, a domestic worker must follow every law, regulation, and policy set by the Malaysian government, especially immigration laws. In addition, domestic workers must meet age qualifications, have knowledge of local culture, possess communication skills, and maintain good health

and mental health before being allowed to work in Malaysia (see <https://www.ilo.org/resource/labour-migration-asia-and-pacific>).

However, the 2006 MoU is considered to have yet to achieve a significant impact on the protection needs of TKIs in Malaysia, especially domestic workers, as the memorandum contains several weaknesses: there are no minimum standard requirements for a job, workers cannot join trade unions, workers cannot keep their passports, and the rights of domestic workers are not fully addressed (Malahayati, 2015).

Therefore, in 2011, another amendment was made by both countries through the 2011 Memorandum Amendment Protocol. The protocol states that Indonesian workers are given the right to keep their passports. Apart from that, this memorandum also addresses the right to a day off, sets the minimum wage, and requires that wages be paid through a bank. Both countries responded positively to this amendment (Rahayu & Ramdlany, 2016). In addition, in April 2022, both countries agreed to sign an MoU regarding the protection of Indonesian domestic workers. The MoU was signed by the Malaysian Minister of Human Resources, M. Saravanan, and the Indonesian Minister of Manpower, Ida Fauziyah, and was witnessed by the Prime Minister of Malaysia. In this MoU, both parties agreed to ensure that all recruitment processes and Indonesian domestic workers protection mechanisms would be implemented comprehensively by the relevant parties, in accordance with policies and legislation in both countries (Zin, 2022).

The protection agreed upon in the MoU covers various aspects, such as wages, which are to be paid at the minimum wage rate of MYR 1,500. In addition, it involves the protection of Indonesian domestic workers in relation to the rights to notice of termination of contract, paid annual leave, weekly rest leave, and social protection, including insurance (Bernama, 2023). In this memorandum, both parties agreed to use the One Channel System for the recruitment of TKIs to work in Malaysia. However, in July 2022, the Indonesian Ambassador claimed that the Malaysian Immigration Department was still using the Maid Online System, which clearly violated the agreed MoU. As a result, Indonesia imposed a temporary freeze on their citizens from working in Malaysia. However, the freeze was lifted when the leaders of both countries successfully resolved the dispute (Prianto *et al.*, 2023). Indonesian Foreign Minister, Retno Marsudi, admitted that throughout Joko Widodo's administration, disputes related to borders and the protection of foreign workers with the Malaysian government were among the diplomatic successes achieved. It is also evidence of the commitment

of both countries to maintaining peace and increasing cooperation in the Southeast Asian region. Although there were some tense situations exacerbated by provocations from certain parties, both countries were able to reach an agreement through diplomacy (Alhadjri, 2024).

## 4.2. Issues concerning the employment of Indonesian migrant workers

Apart from the memorandum issue, problems arising from TKIs also pose a challenge to Malaysia–Indonesia diplomatic relations. This is because the influx of foreign immigrants has created a negative environment and several problems for the destination country. The problems caused by foreign workers are not new to any country. According to Ali (1997), the influx of foreign immigrants in Western European countries has also had a negative impact, although the region used to depend on immigrants from North Africa and Turkey for economic development. In addition, foreign immigrants in Germany and France have also been the subject of sensitive political issues, sometimes leading to riots. According to Cornelius & Tsuda (2004), the increase in illegal immigrants in a country has created a policy gap, which ultimately leads to various consequences that the host country must address. A policy gap occurs when policy outputs cannot achieve the policy goals that have been outlined. The implications that must be addressed are diverse, such as increased enforcement costs, reduced job opportunities for residents, and security threats. In this scenario, the “gap” exists when the government is trying to serve two interests: businesses that demand low-wage workers and a public that may fear cultural change or job competition.

An example of the impact of security threats is the riot among Indonesian workers in Nilai, Negeri Sembilan, in 2002. This incident caused the then-Prime Minister, Mahathir Mohamed, to order a freeze on the recruitment of Indonesian workers, but he withdrew his statement just a few days after announcing it. As a result of the incident, Malaysia reduced the quota for the employment of foreign workers from Indonesia and opened the door to foreign workers from other countries, such as Bangladesh, the Philippines, Sri Lanka, Thailand, and Vietnam (Devadason & Meng, 2014; Kassim, 2012; Khor & Mitra, 2013). A critical examination reveals that immigration raids and declarative policy announcements—such as the former Prime Minister's initial call for a freeze on recruitment—can be interpreted as a form of political theater. These actions perform a symbolic function, staged to project an image of state authority and decisive control to the domestic public, particularly in response to crises that threaten the perception of order. However, the swift retraction of such pronouncements lays bare the performative nature

of these gestures. The change demonstrates that these stringent political stances are ultimately untenable when they conflict with foundational economic structures. The nation's reliance on a pliable, low-cost foreign labor force constitutes a powerful economic imperative that consistently supersedes rhetorical political posturing. This pattern underscores a fundamental policy contradiction: the state's performative enforcement of restriction exists in tension with its tacit sanctioning of a migration system designed to supply essential labor.

Although the contribution of foreign workers is critical to the economic and development aspects of the country, more effective and comprehensive migration control measures need to be implemented to curb the implications of the entry of migrants, especially from Indonesia. This issue of foreign workers is essential to address because both countries need to maintain diplomatic relations in terms of employment due to the mutual dependency in this field. In addition, the issue of foreign workers also tends to be a source of tension for other issues and can affect the relationship between Malaysia and Indonesia (Avila, 2015). Among the issues related to foreign workers are illegal immigrants or PATI (Kassim, 2005), abuse issues, protection and welfare issues, minimum wage issues (Brettner-Litherland, 2016), and threats to local citizens. Issues and implications caused by foreign workers can pose a threat to the receiving and sending countries and are also considered an issue of international security affairs (Liow, 2004).

According to Ahmad *et al.* (2014), the migration of people across national borders (international migration) tends to affect security in the international relations of both countries (sending and receiving countries). The threats caused by international migration can be divided into three dimensions: (i) foreign immigrants can pose a threat to the receiving country in terms of economic well-being, social order, cultural values, religion, and political stability; (ii) migrants also have the potential to create tension and place a burden on bilateral relations, thereby impacting regional and international stability; and (iii) illegal migration tends to have an impact on human security.

The entry of illegal immigrants from Indonesia has been detected since around the 1970s. At that time, most of them worked in the agricultural sector, while some were involved in the construction sector in urban areas. In the 1980s, most of these illegal immigrants began to venture into other sectors in urban areas, such as the service sector, manufacturing, and domestic services (Kassim, 2014). Several factors contributing to the emergence of illegal immigrants in Malaysia include the role of smuggling syndicates, social networks, border

encroachment, close border distances, factors of affinity, historical factors, and overlapping legal systems between documented and undocumented immigrants (Kassim, 1987; Ajis, 2015). According to Asis (2004), irregular migrant entry channels, ineffective migration policies, and insufficient information are also factors facilitating the entry of foreign immigrants. For example, in Indonesia, all processes of sending Indonesian workers in and out are monopolized by *Celo* and *Tekong*. Migration policies are also seen as impractical to implement due to bureaucratic constraints that complicate the process of managing the migration of foreign workers (Rani, 2012). Most foreign workers who enter legally but end up becoming PATI are due to two factors: (i) some employers forget to send them back, or the employers assume that the workers themselves will carry out the repatriation process. There are some situations where employers deliberately contact the authorities to arrest foreign workers whose permits have expired; and (ii) workers themselves, where the foreign workers involved flee before being sent back by the employer because they want to continue working in Malaysia (Ajis, 2015).

As discussed previously, the role of agents, also known as *Celo*, is very influential. According to P. Handayani (2014), among the factors contributing to the influx of PATI in Malaysia is the influence of middlemen such as *Celo* and bureaucratic factors in both Indonesia and Malaysia. She suggested that the process of sending TKI to the destination country should not involve middlemen or agents but should function more as a government-to-government affair. In addition, the bureaucratic aspects and procedures for managing foreign workers abroad by the sending and receiving countries need to be reviewed and implemented more flexibly. This is because some foreign workers, when faced with bureaucratic red tape, will seek help from agents, especially illegal agents, to manage their shipment to the destination country through smuggling. The widespread entry of illegal immigrants has caused various negative effects by creating a sense of insecurity and discomfort for local people. Among the negative effects involving illegal immigrants are settlement problems, impacts on the rights of local people, the outflow of national money, competition for local workers, and the encouragement of criminal activities (Brettner-Litherland, 2016).

This influx of undocumented foreign workers has been considered a criminal activity. Liow (2004) states that Malaysian law enforcement considers Indonesian illegal immigrants a threat to national security. In 2001, a total of 1,051 Indonesian foreign workers were arrested for criminal acts such as rape, theft, robbery, and murder.

In addition, some Indonesian illegal immigrants were detected in possession of firearms, which were successfully seized from their homes. These illegal immigrants' crimes have been detected in Peninsular Malaysia and East Malaysia (Liow, 2004). In fact, some Indonesian illegal immigrants have used fake identity cards to apply to join the Malaysian army. This situation is considered very serious as it involves aspects of national sovereignty, potentially threatening the national defense system (Ajis *et al.*, 2009).

Recently, the Malaysian Maritime Enforcement Agency shot at a boat carrying five Indonesian illegal immigrants, resulting in the death of one individual. Authorities claimed that the boat had rammed a Malaysian Maritime Enforcement Agency patrol boat and that the occupants attempted to attack the authorities with a weapon (Mohamed, 2025). The incident led to a demonstration at the Malaysian embassy in Jakarta, where protesters threw eggs at the embassy building and demanded that the authorities involved be punished (Ayu, 2025). Consequently, the Indonesian Foreign Ministry sent a diplomatic note to the Malaysian government urging a fair investigation into the possible use of excessive force by the Malaysian Maritime Enforcement Agency (Berita Harian, 2025). The incident also involved the intervention of the heads of state of both countries, with the Malaysian Prime Minister assuring that a transparent and thorough investigation would be carried out. He also urged Malaysians not to react in any way to the demonstration at the Malaysian embassy in Jakarta, Indonesia (Muhamad Lokman, 2025).

## 5. Conclusion

Migration diplomacy between Malaysia and Indonesia is grounded in their long-standing historical relationship, which predates independence and is reinforced by cultural, linguistic, and social similarities. Since the 1980s, when Malaysia shifted its economic orientation from agriculture to the industrial sector, Indonesia became the first country to formalize labor migration through an MoU. This institutionalized the supply of Indonesian workers to Malaysia's manufacturing, construction, and plantation sectors, reflecting the mutual dependence of both countries. For Malaysia, Indonesian labor has been essential in sustaining labor-intensive industries and addressing shortages in low-skilled sectors. Conversely, Indonesia views labor migration as a strategy to mitigate unemployment and generate foreign exchange through remittances. This economic interdependence has elevated labor migration to a central aspect of bilateral diplomacy, making it both a necessity and a sensitive issue in the broader context of Malaysia–Indonesia relations.

Despite its benefits, labor migration has also created significant diplomatic challenges. The presence of undocumented workers, weak enforcement of labor rights, and occasional mistreatment of Indonesian migrant workers or TKIs have triggered domestic discontent in Indonesia. Media coverage of abuses has fueled public pressure, at times straining bilateral ties. Moreover, maritime security disputes and cross-border incidents have further complicated the management of migration issues. To address these tensions, both governments have employed MoUs, bilateral negotiations, and diplomatic channels as mechanisms of migration diplomacy. While these agreements provide frameworks for regulating recruitment, employment, and worker protection, their implementation has often been inconsistent. Nonetheless, diplomatic engagement has prevented disputes from escalating, with both governments demonstrating pragmatism in resolving crises for the sake of broader bilateral cooperation.

Migration diplomacy remains a critical tool for managing Malaysia–Indonesia relations. Strengthening its effectiveness requires reforms in three key areas: (i) improving the protection of workers' rights, (ii) enhancing the monitoring and enforcement of bilateral agreements, and (iii) promoting effective dispute resolution mechanisms. By transforming labor mobility from a source of tension into a structured and mutually beneficial arrangement, migration diplomacy can contribute to long-term stability and reinforce the strategic partnership between the two countries. The analysis is situated within the concept of migration diplomacy, which emphasizes how countries use migration-related issues and agreements as instruments in foreign relations. Accordingly, this study does not rely on quantitative migration data, but rather on historical and diplomatic sources to trace how migration was positioned in bilateral negotiations. This study focuses on the diplomatic functions of agreements and MoUs, rather than their statistical impact on migration flows.

## Acknowledgments

None.

## Funding

None.

## Conflict of interest

The authors declare that they have no competing interests.

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## Ethics approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Availability of data

The data presented in this article are derived from publicly accessible secondary sources, including official policies, historical documents, and previous academic studies. All referenced materials are duly cited in the article and available through public databases, government publications, and institutional repositories.

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## RESEARCH ARTICLE

# The role of heritage language maintenance in shaping identity and cohesion among migrant populations: A case study of Saudi Arabia

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## Abstract

Language serves as a vessel for traditions, values, and a shared sense of belonging, linking individuals across both generations and geographical boundaries. This study examined the role of heritage language maintenance in shaping cultural identity, fostering social cohesion, and facilitating integration among first-generation migrant populations residing in the urban areas of Northern Borders province, Saudi Arabia. Using a qualitative case study design, data were collected through semi-structured interviews with 44 participants, selected through purposive sampling from culturally and linguistically heterogeneous backgrounds, including communities from South Asia, Southeast Asia, and the Middle East. Thematic analysis was employed to identify critical patterns and themes, revealing that heritage language maintenance occurred through familial interactions, community gatherings, and digital platforms, stressing intergenerational transmission and cultural engagement. Heritage languages preserve cultural identity and foster a sense of pride, belonging, and shared values. They also strengthened social cohesion within migrant populations, although challenges, such as the dominance of Arabic and limited public usage, complicated broader societal integration. This study elucidates the dual role of heritage languages in building solidarity within migrant communities and the challenges they encounter in broader societal integration. The findings underscore the need for inclusive language policies and locally grounded community initiatives that support intergenerational heritage language use, promote cultural diversity, and enhance social cohesion within the Saudi context.

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**Citation:** Al-khresheh, M.H. (2026). The role of heritage language maintenance in shaping identity and cohesion among migrant populations: A case study of Saudi Arabia. *International Journal of Population Studies*. 12(1):46-66. <https://doi.org/10.36922/ijps.7070>

**Received:** December 5, 2024**1st revised:** January 14, 2025**2nd revised:** April 12, 2025**Accepted:** April 30, 2025**Published online:** May 14, 2025**Copyright:** © 2025 Author(s).

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**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Keywords:** Cultural identity; Heritage language maintenance; Integration; Migrant populations; Social cohesion

## 1. Introduction

Preservation of heritage languages plays a crucial role in shaping the cultural identity and social cohesion of migrant communities. Language functions as a repository of traditions, values, and collective belonging, connecting individuals across generations and geographic divides (Polinsky & Scontras, 2020). For migrant populations, sustaining heritage languages within a new sociolinguistic environment is not only a means of preserving cultural ties but also a foundation for building solidarity and resilience within communities (Muthuswamy, 2023). However, adapting to the dominant language

of the host society often introduces significant social and institutional pressures, which complicate efforts to maintain linguistic heritage (Ortega, 2020). These pressures are institutional and social, shaped by broader perceptions of migrants and their linguistic practices within host communities. Research suggests that negative societal attitudes toward certain linguistic groups can discourage using heritage languages in public or private domains (Polychroniadou & Panicacci, 2024; Rzepnikowska, 2016). Such perceptions can lead to reduced confidence in using these languages and shifting toward dominant languages to gain acceptance or avoid discrimination. People who speak multiple languages often select languages based on perceived social or emotional advantages. As Karan (2011) pointed out, many tend to prefer languages they associate with greater opportunities for success or social acceptance. On the other hand, if a heritage language is seen as carrying negative associations or causing discomfort, it is more likely to be abandoned over time (Cook & Dewaele, 2022; Schmid, 2002). These kinds of personal feelings and judgments about language are not limited to one place; they are common in multilingual communities worldwide, where emotions and identity often shape how people use language.

The relationship between heritage language maintenance, identity, and social cohesion assumes unique dimensions in Saudi Arabia, a nation with a substantial and diverse migrant population. Migrants from South Asia, Southeast Asia, and the Middle East contribute a rich diversity of linguistic and cultural traditions to an Arabic-speaking society in which Arabic dominates education, governance, and public life (Alsahafi, 2022). This linguistic centrality creates a dynamic in which the preservation of heritage languages is simultaneously a cultural necessity and a challenge to societal integration (Mazzaferro, 2018). The ability of migrants to balance these pressures is closely tied to their sense of identity and capacity to build cohesive communities within a linguistically unified host society (Scontras *et al.*, 2015). While Winford's (2003) foundational work on language shift has significantly shaped global understanding of these processes, most existing research remains grounded in Anglocentric contexts or accentuates endangered or marginalized immigrant languages, further confirming the originality and significance of examining these dynamics within the Saudi context.

Despite the growing importance of Saudi Arabia as a destination for migrants, limited research has explored how heritage language maintenance contributes to the retention of cultural identity and fostering social cohesion within this context. While global studies have demonstrated that heritage languages strengthen self-esteem, cultural pride, and communal bonds, the unique sociolinguistic

scene of Saudi Arabia, with its centralized use of Arabic and culturally diverse migrant demographics, offers a distinct lens for examining these dynamics. Investigating the role of heritage languages in this setting is critical for understanding how cultural identity and social cohesion are negotiated in one of the world's most linguistically diverse migrant populations.

## 1.1. Heritage language maintenance and migration dynamics

Heritage language maintenance refers to the sustained use and transmission of ancestral languages within migrant populations, often under significant sociolinguistic pressure from dominant languages (Diskin, 2020). This phenomenon has been a cornerstone of migration studies, given its crucial role in preserving cultural identity and ensuring continuity across generations (Valdés, 2017). At its core, heritage language retention illustrates the intricate interplay between linguistic practices and migration, with language functioning simultaneously as a cultural anchor and mechanism for social adaptation (Mesoudi, 2018).

Several interconnected factors shape the retention of heritage languages in migrant populations. Among these, community support has become pivotal, fostering linguistic spaces where heritage language use is normalized and encouraged. Such spaces often arise in religious ceremonies, cultural gatherings, and shared community activities, revealing the language's functional and symbolic significance (Chondrogianni & Daskalaki, 2023). The role of intergenerational transmission is equally significant, with parents acting as the primary conduit of linguistic knowledge. Nevertheless, external influences, such as the perceived importance of the dominant language for education and career opportunities, frequently mediate this process, often leading to a reduced emphasis on heritage languages in the domestic environment (Chen & Wang, 2023; Tang & Zheng, 2023).

Institutional policies and societal attitudes profoundly affect heritage language preservation. For instance, multicultural societies, such as Canada, often implement frameworks that celebrate linguistic diversity, including educational initiatives and public policies to support heritage languages (Kupolati, 2023). In contrast, monolingual ideologies in other contexts can marginalize these languages, ultimately accelerating their attrition. Adsera & Pytlikova (2015) asserted that institutional frameworks play a significant role in shaping heritage language outcomes. These contrasting environments show the tension between integration and cultural preservation of migrant experiences (Valdés, 2017).

Insights from global research further illuminate the sociocultural and linguistic dynamics underlying heritage language maintenance. Studies conducted in North America have revealed how retaining heritage languages strengthens cultural identity and fosters a sense of belonging among migrants (Fahrudin, 2017). For example, Mexican–American families who continue to use Spanish often report enhanced familial cohesion and cultural pride (Matsumoto & Tokumasu, 2022). Similarly, research from Europe and Australia demonstrates that heritage languages act as both cultural resources and tools for navigating integration within host societies. Bilić *et al.* (2023), in their study on Croatian heritage language maintenance in Argentina, accentuated the dual role of such languages as cultural repositories and instruments of social connection. However, in linguistically homogeneous environments such as Germany, migrants frequently encounter significant barriers, including limited institutional support and societal expectations favoring assimilation, which complicates efforts to sustain their heritage languages (Wang, 2022).

The sociocultural implications of heritage language maintenance extend beyond the migrant communities. These languages enhance community cohesion by preserving cultural heritage and fostering mutual understanding and solidarity (Tseng, 2020). Furthermore, heritage languages contribute to host societies' broader cultural and linguistic diversity, enriching their social fabric and promoting inclusivity. Omar *et al.* (2020) posited that heritage languages possess the potential to serve as both a unifying force within migrant communities and a means of broadening societal acceptance of multiculturalism.

In the Saudi context, heritage language maintenance assumes unique dimensions. The Kingdom's sociolinguistic scene, characterized by a highly diverse migrant population and the predominance of Arabic as the *lingua franca*, presents opportunities and challenges for sustaining heritage languages (Turkistani & Almoaily, 2023). Examining the dynamics at play offers a valuable lens through which to explore the strategies employed by migrant communities, the institutional frameworks they navigate, and the implications for identity and social cohesion in a linguistically centralized yet culturally diverse environment (Al-Rojaie, 2023).

## 1.2. Heritage language, identity, and population integration

Heritage languages possess significant value in preserving the cultural identity of migrant communities, functioning as conduits to ancestral traditions, values, and histories. These languages allow individuals to maintain cultural

distinctiveness while navigating life in a novel societal context. Lam & Catto (2023) stated that heritage languages are crucial identity markers, reinforcing cultural pride and a sense of continuity. Similarly, Leeman (2015) observed that these languages facilitate the maintenance of connections to one's heritage, particularly within transnational environments. However, preserving heritage languages often necessitates balancing the competing demands between cultural conservation and adaptation to the dominant language. Polinsky & Scontras (2020) noted that migrants frequently encounter institutional and societal pressures to adopt the majority language to access opportunities in education, employment, and other public spheres. This dynamic engenders a divide between private and public language use, wherein heritage languages are often confined to familial or community settings. In contrast, the dominant language prevails in formal and societal interactions. Leeman & Serafini (2016) pointed out that this compartmentalization presents challenges for transmitting heritage languages to subsequent generations, an issue further examined by Ortega (2020), who draws attention to the risks of linguistic attrition over time. In addition, multilingual practices, including the use of heritage languages, can foster hybrid cultural identities, which promote belonging but may also lead to emotional instability due to the complexities of navigating multiple cultural frameworks (Panicacci, 2019; Panicacci & Dewaele, 2017).

The capacity to retain a heritage language significantly influences both personal and collective identity. Theoretical frameworks, such as the Complementarity Principle (Grosjean, 2010; 2024) and Bicultural Identity Integration (Benet-Martínez & Haritatos, 2005; Chen *et al.*, 2008), offer valuable perspectives in this regard, suggesting that multilingual individuals often develop hybrid identities shaped by context-specific language use, which may enhance adaptability but also trigger emotional or psychological tensions when integration is uneven. At the individual level, Park & Chung (2023) demonstrated how heritage languages contribute to self-esteem and cultural awareness, assisting individuals in reconciling dual identities. Yakushkina (2021) posited that those proficient in their heritage languages are often better equipped to navigate the complexities of living between the two cultures. Moreover, several studies have examined how personality traits and multilingual engagement are linked to successful acculturation. Migrants who actively use multiple languages tend to exhibit greater adaptability, emotional awareness, and cultural flexibility, which facilitate more positive acculturative outcomes (Panicacci, 2019; Panicacci & Dewaele, 2017). At the communal level, Sáenz-Hernández *et al.* (2021) pointed out that heritage

languages foster a sense of solidarity and trust within migrant networks, strengthen bonds, and promote mutual support. Graham & Howard (2016) further contended that such linguistic practices encourage social cohesion, a critical factor in the resilience of migrant communities.

The significance of heritage languages extends beyond cultural identity and influences broader societal integration. Eaton & Turin (2022) observed that heritage languages contribute to cultural richness and promote inclusivity in societies that value linguistic diversity. Conversely, Ndhlovu and Willoughby (2017) pointed out the challenges encountered in settings that prioritize linguistic uniformity, where heritage languages may be perceived as impediments to integration. Scetti (2021) advocated for policies that carefully balance the preservation of linguistic diversity with the need to foster social cohesion, acknowledging the unique challenges multilingual contexts pose.

In Saudi Arabia, the dynamics of heritage language retention are particularly complex. With Arabic as the dominant language and a highly diverse migrant population, the Kingdom offers a unique setting for examining the interplay between heritage language use, identity, and integration. Raza (2023) elucidated how heritage languages influence identity formation and social belonging within such centralized linguistic environments. Smith (2016) postulated that studying these dynamics can yield broader insights into how communities adapt and maintain cohesion in diverse and linguistically stratified contexts.

### 1.3. Social cohesion and linguistic diversity

Heritage languages play a central role in fostering social cohesion within migrant communities and serve as a conduit for shared identity and collective solidarity. Maleku *et al.* (2019) revealed that linguistic commonality enhances resilience by providing a shared framework for mutual support and community action. Within these networks, heritage languages function as unifying elements, enabling members to maintain emotional and cultural connections amidst the challenges of migration (Muthuswamy, 2023; Polinsky & Scontras, 2020).

Heritage languages also mediate the relationships between migrants and host societies. Loader & Hughes (2017) speculated that these languages facilitate cultural preservation while enabling engagement with broader societal norms, thereby creating pathways for pluralistic coexistence. This dynamic fosters a pluralistic cultural environment in multicultural contexts, where linguistic diversity is valued as a societal asset. Piller (2016) accentuated the role of linguistic diversity in promoting

social justice and equal access, particularly in multicultural settings. Svensson (2023) further asserted that addressing linguistic inequalities is essential to fostering equitable integration, especially in refugee and migrant settlement contexts (Alsaifi, 2022; Ortega, 2020). Little & Kirwan (2019) confirmed the potential of inclusive education to bridge linguistic divides, fostering acceptance and adaptability among young learners.

Despite their contributions, heritage languages often face challenges in contexts dominated by a single language. Schaeffer (2016) observed that linguistic diversity can sometimes be perceived as a threat to social cohesion in settings that prioritize linguistic homogeneity. Institutions such as schools and workplaces frequently prioritize the dominant language, marginalize heritage languages, and limit their functional utility. Wang & Steiner (2015) argued that this marginalization erodes social capital by framing heritage languages as incompatible with societal unity. Guy & Hinskens (2016) discovered how pressures for linguistic coherence within speech communities often conflict with the natural diversity of multilingual populations. Seargeant (2023) expanded on this by examining how linguistic ideologies shape societal attitudes toward diversity, framing heritage languages as either assets or obstacles to integration (Mazzafarro, 2018; Scontras *et al.*, 2015).

For example, Saudi Arabia exemplifies these dynamics. The Kingdom's dominant Arabic linguistic environment, along with its diverse migrant demographics, presents both opportunities and constraints for fostering linguistic diversity. Alshehri & AlShabeb (2024) noted that maintaining heritage languages in Saudi Arabia often depends on grassroots, community-led initiatives, as institutional policies prioritize Arabic for formal functions. Furthermore, Adizovna (2024) revealed the importance of community-driven efforts to preserve linguistic diversity within centralized linguistic environments. Correspondingly, Hopkyns & Van Den Hoven (2022) revealed how multilingual public practice promotes inclusion, even in societies with strong monolingual tendencies. Alhazmi (2023) stated the dynamic nature of language attitudes in rapidly changing societies such as Saudi Arabia, where heritage languages face systemic pressure for assimilation into the Arabic-speaking mainstream.

Beyond national contexts, broader insights into linguistic diversity contribute to understanding social cohesion on a global scale. Moustakas (2023) discussed how addressing underlying inequalities, including linguistic disparities, influenced social cohesion. Similarly, Little & Kirwan (2019) argued that inclusion-oriented approaches can be models for larger societal frameworks,

particularly in education. Hopkyns & Van Den Hoven (2022) extended this argument by illustrating how shared public spaces accommodate linguistic diversity and foster social harmony in multilingual contexts. In Saudi Arabia and beyond, heritage languages represent a critical yet vulnerable element of social cohesion. Recognizing and valuing linguistic diversity as an asset rather than a challenge is essential for creating more inclusive and resilient societies.

#### 1.4. Research gap in the Saudi context

Despite extensive global research on heritage language maintenance and its significance in shaping cultural identity and fostering social cohesion, unique dynamics within the Saudi context remain underexplored. Saudi Arabia's sociolinguistic scene, characterized by its diverse migrant population and the centrality of Arabic as the national language, presents a distinct interchange of challenges and opportunities for preserving heritage languages (Alsahafi, 2022; Turkistani & Almoaily, 2023). While international studies have stressed the importance of community support, intergenerational transmission, and institutional frameworks in sustaining heritage languages (Chondrogianni & Daskalaki, 2023; Diskin, 2020), limited attention has been devoted to examining how these factors function in Saudi Arabia's centralized linguistic environment.

A critical gap exists in understanding the strategies employed by migrant communities in Saudi Arabia to maintain their heritage language. Migrants from South Asia, Southeast Asia, and the Middle East navigate the dual pressures of preserving their linguistic heritage while adapting to Arabic-speaking societal and institutional contexts. Research from other contexts has demonstrated that heritage language maintenance supports cultural pride, strengthens familial bonds, and reinforces community cohesion (Mazzaferro, 2018; Muthuswamy, 2023). However, the extent to which these dynamics operate in Saudi Arabia remains unclear, leaving a significant void in understanding how migrants manage their environments' linguistic and cultural demands (Alsahafi, 2022).

The relationship between heritage language retention and social cohesion in Saudi Arabia warrants further investigation. In multicultural societies, such as Canada and Australia, valuing linguistic diversity has been shown to improve inclusivity and mutual understanding (Kupolati, 2023; Little & Kirwan, 2019). Contrariwise, monolingual-dominant settings often marginalize heritage languages and create barriers to integration (Schaeffer, 2016; Wang & Steiner, 2015). In Saudi Arabia, where Arabic functions as a *lingua franca*, it is essential to examine

how societal attitudes and institutional policies influence heritage language practices and the broader implications for migrant integration and social harmony (Hopkyns & Van Den Hoven, 2022; Svensson, 2023).

Another critical research gap pertains to the role of institutional and policy frameworks in shaping language practice. Unlike contexts where multilingual policies promote linguistic diversity, such as Canada, Saudi Arabia's emphasis on Arabic as a unifying language creates unique challenges for heritage language preservation (Adizovna, 2024; Turkistani & Almoaily, 2023). The absence of formal support for multilingual practices in schools, workplaces, and public institutions limits the functional utility of heritage languages and raises questions regarding their sustainability in such environments (Piller, 2016; Polinsky & Scontras, 2020). This policy environment significantly impacts individual identities and collective social cohesion within migrant communities.

Addressing these gaps is essential to understanding the intersection of heritage languages with cultural identity and social cohesion in Saudi Arabia. Future research could investigate the strategies employed by migrant communities to maintain their heritage languages in the face of systemic pressure, focusing on community-driven initiatives, informal linguistic networks, and intergenerational transmission. Such investigations would provide valuable insights into the persistence of heritage languages while elucidating the broader sociopolitical implications of linguistic diversity in the Kingdom. Exploring these dynamics aims to contribute to the global discourse on heritage language maintenance, offering a comprehensive understanding of the challenges and opportunities inherent in a linguistically centralized yet culturally diverse setting. These findings can inform the development of inclusive and equitable language policies that balance cultural preservation with societal integration.

Building on this context, the present study examines the practices and challenges of heritage language maintenance among migrant communities in Saudi Arabia, focusing on how these efforts shape cultural identity and foster social cohesion. To achieve this, the study addressed the following key research questions:

- (i) What are the key practices and factors influencing heritage language maintenance among migrant populations in Saudi Arabia?
- (ii) How does heritage language maintenance contribute to the retention of cultural identity among migrants in Saudi Arabia?
- (iii) How does heritage language use impact fostering social cohesion within migrant communities and their integration into Saudi society?

## 2. Methods

### 2.1. Research design

This study employed a qualitative case study design to investigate the relationships between heritage language maintenance, cultural identity, and social cohesion among migrant populations in Saudi Arabia. The case study approach was particularly appropriate for this research as it facilitated an in-depth exploration of the lived experiences and social realities of migrants navigating the linguistic demands of an Arabic-dominated environment (Alam, 2021). Focusing on the Saudi context, the design allowed for a detailed examination of the strategies employed by migrants to preserve their heritage languages and the implications of these practices for identity formation and community cohesion.

### 2.2. Participants

This study involved 44 individuals from diverse migrant communities residing in the Northern Borders province in Saudi Arabia, selected through purposive sampling. This methodology was employed to ensure representation across various dimensions, such as nationality, heritage language, age, length of stay, and occupation. This approach simplified the inclusion of a wide range of perspectives pertinent to the study's objectives, particularly in examining heritage language practices, cultural identity, and social cohesion. Although all participants were adult migrants, many parents discussed their children's language use and intergenerational transmission practices. Their reflections offered important insights into how heritage languages are maintained or lost among younger family members within the Saudi context. All participants were based in Arar, a region with limited institutional support for linguistic diversity but active informal networks among migrants.

Demographic data collected during the interviews were subsequently analyzed to provide contextual insights into the participants' backgrounds and experiences (Table 1). A significant proportion of participants identified as Pakistani (31.82%), followed by Indian (22.73%), Bangladeshi (13.64%), Sri Lankan (11.36%), Nepalese (9.09%), Filipino (6.82%), and Indonesian (4.55%). Urdu was the most frequently reported heritage language (27.27%), with Tagalog and Tamil equally represented (15.91% each). The other languages included Bengali (13.64%), Pashto (11.36%), Bahasa Indonesia (9.09%), and others (6.82%). Notably, most participants came from predominantly Islamic countries, where Arabic holds religious significance as the prayer language. This shared religious context may have shaped participants' initial exposure to Arabic and influenced their willingness or ability to interact with the dominant language.

Participants varied in their duration of residence in Saudi Arabia, with the majority (40.91%) having resided in the country for 5 – 10 years, 31.82% having stayed for <5 years, and 27.27% having been residents for more than a decade. The age distribution revealed that nearly half (45.45%) were aged 18 – 29, 34.09% were aged 30 – 44, and 20.45% were aged 45 years or older.

Educational qualifications among the participants exhibited considerable diversity. While 34.09% reported no formal education, 22.73% had an undergraduate degree, 20.45% had a graduate degree, 11.36% had completed high school, and 11.36% held a doctorate. Regarding occupation, manual or unskilled workers constituted the largest group (50.00%), followed by skilled workers (27.27%), professional or managerial workers (15.91%), and students (6.82%).

### 2.3. Instrument

The instrument for this study was designed to collect both demographic information and qualitative insights to ensure a good understanding of heritage language maintenance among migrant populations in Saudi Arabia. It comprised two primary components: a demographic details questionnaire and a semi-structured interview guide (Table A1).

The demographic details questionnaire comprised six items addressing the participants' nationality, heritage language, duration of residence in Saudi Arabia, age, educational qualifications, and occupation. These demographic variables were selected to ensure the diversity and representativeness of the sample while providing critical contextual data for analyzing variations in heritage language practices.

The semi-structured interview guide consisted of six open-ended questions carefully formulated to align with the study's research questions. Specifically:

- The first two interview questions focused on the strategies and challenges associated with heritage language maintenance, directly addressing the first research question on the practices and factors influencing language retention.
- The third and fourth questions explored the role of heritage languages in shaping cultural identity, aligning with the second research question, which examined how language contributes to the retention of cultural identity among migrants.
- The fifth and sixth questions investigated the social and integrative aspects of heritage language use, addressing the third research question on its impact on fostering social cohesion and integration into Saudi society.

**Table 1. Participant characteristics**

Demographic characteristic	Categories	Frequency	Percentage
Nationality	Indian	10	22.73
	Pakistani	14	31.82
	Bangladeshi	6	13.64
	Sri Lankan	5	11.36
	Nepalese	4	9.09
	Filipino	3	6.82
	Indonesian	2	4.55
Heritage language	Urdu	12	27.27
	Tagalog	7	15.91
	Tamil	7	15.91
	Pashto	5	11.36
	Bengali	6	13.64
	Bahasa Indonesia	4	9.09
	Others	3	6.82
Length of stay in Saudi Arabia	<5 years	14	31.82
	5 – 10 years	18	40.91
	More than 10 years	12	27.27
Age	18 – 29 years	20	45.45
	30 – 44 years	15	34.09
	≥45 years	9	20.45
Qualification (educational level)	No formal education	15	34.09
	High school diploma	5	11.36
	Undergraduate degree	10	22.73
	Graduate degree	9	20.45
	Doctorate	5	11.36
Occupation	Student	3	6.82
	Professional/managerial (e.g., teacher, engineer, and healthcare worker)	7	15.91
	Skilled worker (e.g., technician and tradesperson)	12	27.27
	Manual/unskilled worker (e.g., laborer and domestic worker)	22	50.00

Note: Frequency (N=44).

This structured alignment ensured that the data collected were directly relevant to the study's objectives, allowing participants to share detailed personal experiences and perspectives. The open-ended interview questions facilitated the exploration of nuanced themes, providing a rich qualitative dataset to complement the demographic information.

### 2.3.1. Instrument validation

The instrument was validated through a two-step process comprising an expert review and pilot testing to ensure clarity, relevance, and alignment with the study's objectives. A panel of three sociolinguistic experts reviewed the demographic questionnaire and semi-structured interview

guide. They confirmed the importance of focusing on essential demographic variables, such as nationality, heritage language, and duration of residence in Saudi Arabia. Based on their feedback, less critical items were eliminated, and the number of interview questions was reduced from nine to six to enhance focus and mitigate redundancy.

The revised instrument was subsequently pilot-tested with seven participants representing diverse nationalities, heritage languages, and demographics. Minor issues in question-wording were identified and refined to enhance clarity and elicit detailed responses. For instance, open-ended questions were modified to encourage participants to provide specific examples of heritage language maintenance

and its impact on identity and social cohesion. The pilot study confirmed the instrument's efficacy in efficiently capturing relevant data while minimizing the respondent burden. These refinements ensured its reliability in investigating heritage language maintenance, cultural identity, and social cohesion within the Saudi context.

## 2.4. Data collection procedures

Data were collected through semi-structured interviews incorporating demographic questions to provide a context for participants' experiences. Over 3 weeks in November 2024, face-to-face interviews were conducted with participants in accessible locations, including community centers and workplaces. Each interview lasted for approximately 25 min.

Participants were recruited directly by the researcher, who initiated contact during visits to community hubs and workplaces where migrant populations were frequently encountered. Before each interview, the purpose of the study was elucidated, and the participants provided verbal consent to proceed. To ensure the participants' comfort and comprehension of the questions, interviews were conducted in their preferred language. Communication was facilitated primarily in widely spoken languages, such as Arabic and English, in which many participants were proficient. Interviews were conducted in Arabic or English, based on the participant's language proficiency and preference. Arabic and English were selected because they are widely understood among the migrant populations in Saudi Arabia, facilitating effective communication without the need for additional interpreters. No other languages were used during interviews, and code-switching was not employed in the data collection process. When participants experienced linguistic difficulties, an online translation tool was utilized to clarify and ensure mutual understanding.

Interviews were audio-recorded with the participants' consent to ensure accuracy, and field notes were taken to capture contextual details, including non-verbal cues and observations. This methodological approach facilitated the collection of in-depth insights while respecting the participants' linguistic preferences and cultural needs.

## 2.5. Data analysis

The data from the semi-structured interviews were analyzed using thematic analysis, a qualitative method appropriate for identifying, organizing, and interpreting patterns and themes within the dataset. This approach was guided by Lochmiller's (2021) framework, which ensured a systematic and methodical process. The phases encompassed familiarizing with the data, generating initial

codes, searching for themes, reviewing themes, defining and naming themes, and producing the final analysis. The complete interview corpus comprised approximately 65,400 words, derived from 44 transcribed interviews, each lasting around 25 min.

Audio recordings of the interviews were transcribed verbatim to ensure accuracy and capture all nuances in the participants' responses. The transcripts, supplemented by the researcher's field notes, were examined to gain a comprehensive understanding of the data. Initial coding was conducted manually to facilitate the identification of recurring concepts and categories. The coding followed qualitative best practices, including open coding and iterative theme development, as Dörnyei (2007) outlined. These codes were subsequently organized into broader themes that reflected key aspects of the study, such as strategies employed to maintain heritage languages, challenges encountered in language retention, and the significance of heritage languages in shaping cultural identity and fostering social cohesion.

A peer debriefing was conducted to ensure the reliability and validity of the findings. A second researcher independently reviewed the coding and thematic frameworks, and any discrepancies were resolved through discussion and consensus. This collaborative approach enhances the credibility of the analysis. Moreover, the demographic data collected during the interviews were analyzed descriptively, providing contextual insights and elucidating trends across variables, such as participants' age, length of stay in Saudi Arabia, and educational background.

## 3. Results

This section outlines the results of the thematic analysis.

### 3.1. Intergenerational and community-based practices influencing heritage language maintenance

Thematic analysis elucidated various family- and community-level practices influencing heritage language maintenance among participants. Demographic characteristics, including nationality, duration of residence in Saudi Arabia, educational attainment, and occupational status, influenced these practices. The following vital findings elucidate the participants' strategies and challenges, substantiated by verbatim quotations. While both domains were explored, participants primarily described practices rooted in the family setting, especially within parent-child dynamics. Nevertheless, language practices beyond intergenerational settings, such as with spouses, neighbors, and colleagues, also emerged in the

data and reflect broader sociolinguistic behavior. These included interactions with spouses, adult relatives, and community members. Participants who migrated for work often accentuated using their heritage language with co-workers of similar backgrounds, while those who migrated with family tended to speak it primarily within domestic settings.

Participants reported the thoughtful and consistent use of their mother tongue within family environments to preserve their heritage language. A university doctor (Participant 8 [P8], age 40) shared, "First, in our house, we prefer to communicate in our heritage language and also make my children read extra books apart from their curriculum, like story or history books in our native language, to get fluency in the language." Similarly, an Indian participant (P22, age 38, unskilled worker) explained, "Every night, we tell stories about Tamil. It is a way to keep our culture alive in their minds and hearts." These practices reinforced both linguistic skills and cultural identity within the households, ensuring that the language was passed on to the next generation. However, participants reported difficulty maintaining fluency when primarily using languages outside the home. The 40-year-old university teacher (P5) noted, "My kids are not very fluent in our heritage language because, outside the house, they communicate in their second language, English, and due to a lack of exposure to native speakers of our heritage language, they are lagging." Another university teacher (P31, age 44) added, "In writing, they are even more struggling." Participants with multilingual spouses or children who attended international schools often mentioned that mixed-language use sometimes weakened consistent exposure to their heritage language. For instance, a Pakistani participant (P27, age 39, skilled worker) noted, "My wife speaks Arabic better than our native language, so at home, we mix a lot, and the children pick up less Urdu than I hoped." Participants in multilingual households reported that switching between Arabic, English, and their heritage language created inconsistency. In such homes, heritage language use was often situation-specific, reserved for emotional expression or private conversations.

Community gatherings and cultural events provided critical opportunities for participants to practice their heritage languages and connect with others who shared similar linguistic and cultural backgrounds. A Filipino participant (P14, age 36, skilled worker) remarked, "We meet with other Filipino families during birthdays and celebrations. It is a way for us to maintain Tagalog, especially for our children." Informal networks played a crucial role for participants from Sri Lanka and Pakistan. A Sri Lankan participant (P39, age 40, skilled worker) shared, "In our

gatherings, we made sure to speak only Tamil. It allows the younger generation to hear and practice the language in a natural setting." However, participants with shorter stays (<5 years) faced difficulties accessing established community networks, which limited their opportunities to practice their heritage languages regularly. On the contrary, participants with extended stays (>10 years) reported that these networks became stronger over time, providing them with more consistent opportunities to engage with their linguistic communities. Some participants noted fewer opportunities to use their heritage language regularly, particularly those in remote areas or isolated job settings. A Nepalese participant (P7, age 28) shared, "Where I work, I mostly speak Arabic or English, so I do not get to use Nepali much anymore." Others, especially in neighborhoods with strong ethnolinguistic clustering, reported frequent adult-level interactions in their heritage language at local markets, places of worship, and shared housing units. A Sri Lankan female participant (P6, age 33, skilled worker) noted, "In our area, almost every shopkeeper speaks Tamil, so we use it daily even outside the home."

Mobile phones and social media have emerged as essential tools for heritage language maintenance, particularly for participants who face physical barriers to regular interactions with native speakers. Participants frequently used messaging apps, video calls, and social media platforms to engage with family members and cultural content in their native language. A university teacher (P11, age 44) noted, "To overcome this situation, one should find others who speak the same language or use social media in your mother tongue." These tools gave participants access to heritage language content regardless of location. A Bangladeshi participant (P26, age 33, graduate degree holder) explained, "I download Bengali learning apps for my children. They enjoy it, making learning the language more straightforward for them." By leveraging technology, participants created opportunities for their families to practice and improve their native language skills, especially those with moderate to shorter stays (5 – 10 years). Adults also benefited from digital tools, particularly those working night shifts or in isolated settings. Social media groups allowed them to sustain language use through memes, news articles, and religious content in their heritage languages. Contact with home countries also played a role. Participants who maintained frequent communication with relatives abroad through WhatsApp or video calls retained a stronger command of their heritage language, even when local use declined.

Participants expressed significant challenges in balancing their heritage language with the demands

of learning and using Arabic and English, particularly in educational and professional settings. Many parents observed that their children prioritized Arabic and English over their native languages because of these contexts. A Sri Lankan participant (P18, age 39, skilled worker) shared, “My children are fluent in Arabic because of school, but their Tamil is weakening. They only use it when talking to grandparents.” The 40-year-old university doctor (P7) reflected on the complexities of maintaining heritage language fluency in a multicultural setting: “It is challenging to maintain your heritage language while living in Saudi Arabia because we have to interact with many people belonging to different languages and cultures, and that affects one’s mother tongue as well.” These challenges indicate the importance of creating dedicated spaces for heritage language use within families and communities to counteract external linguistic influences. Participants with no formal education often found this balancing act particularly difficult because their ability to navigate Arabic and English environments was limited. While younger participants expressed greater comfort using multiple languages, some older participants reported a gradual shift toward Arabic in private and public interactions, contributing to reduced confidence and occasional language loss.

Educational resources, such as books, movies, and online platforms, are vital in supporting heritage language learning, especially among participants with higher educational levels. A Pakistani participant (P33, aged 29, professional worker) shared, “We watch Urdu dramas together as a family. It is entertaining and helps my children learn new words and phrases.” However, participants with fewer resources or lower educational levels found it challenging to access adequate materials. A Nepalese participant (P19, age 41, unskilled worker) explained, “We do not have many resources in Nepali here. I wish there were books or affordable classes for my kids.” Despite these limitations, the participants confirmed the value of incorporating heritage language materials into their daily lives to support their linguistic and cultural heritage. Participants with shorter stays (<5 years) tended to rely more on online platforms, whereas those with more extended stays revealed the importance of community-based resources. Across generations, the level of access to such resources, combined with social networks and educational background, shaped the extent to which heritage languages were used, retained, or gradually replaced in everyday communication. These findings show that heritage language maintenance is shaped by a complex interaction of age, education, migration purpose, household language composition, and the sociolinguistic context in which migrants live and work.

### 3.2. Heritage language maintenance and cultural identity

Thematic analysis illuminated the significant role of heritage language maintenance in preserving cultural identity among participants. Their native languages functioned as more than communication tools, essential for personal identity, cultural transmission, and fostering familial and communal bonds. The key findings are supported by quotations from participants representing diverse nationalities, residence durations, and educational backgrounds.

Participants emphasized that their heritage language symbolized their cultural roots, serving as a source of pride and belonging. A Pakistani participant (P4, age 42, skilled worker, 15 years in Saudi Arabia) reflected, “Speaking Urdu is not just about language; it is about who we are and where we come from. It keeps our roots alive even when we are far from home.” Similarly, a Sri Lankan participant (P21, age 40, skilled worker, 10 years in Saudi Arabia) stated, “Tamil is part of our identity. I feel connected to my culture and ancestors when I speak it.” An Indian university teacher (P10) elaborated, “Heritage language is an integral part of my self-identity. My heritage language teaches me to respect the people and bridges communities across South Asia and beyond.” In addition, a Pakistani university teacher (P36) shared a personal struggle: “It is very important for personal and cultural identity because when my kids visit their country, they often face bullies from their age fellows as they are not fluent in the native language. Furthermore, due to lack of exposure, they lack cultural awareness compared to kids their age residing in our country.” These examples show how heritage language anchors individuals in their cultural identity, even across generations, while also viewing the struggles faced by migrants to maintain these ties. Participants’ cultural identity varied by education, age, and contact with their home country. Younger and more educated participants often expressed a more adaptive view, while older or less connected individuals described more significant concerns about cultural loss.

Participants described heritage language use within families as vital for fostering solid bonds and passing on cultural values. A Filipino participant (P15, age 36, professional worker, 12 years in Saudi Arabia) remarked, “When I speak Tagalog with my parents, it is not just communication. It is understanding and respect for who they are and what they taught me.” A Nepalese participant (P29, age 30, unskilled worker, no formal education) reflected, “When I teach my children Nepali, I am not just teaching them words. I am showing them how to celebrate our festivals, respect our elders, and carry our

traditions forward.” Community interaction is also critical. A Pakistani university teacher (P2, age 44, 15 years in Saudi Arabia) added, “Using heritage language helps in making the relationship stronger and trustworthy between two people from the same cultural or linguistic background, as compared to someone from a different cultural or heritage language.” These reflections disclose how heritage language fosters familial intimacy and broader social cohesion among cultural groups.

For many participants, their heritage language was a source of pride and a medium for authentic self-expression. A Bangladeshi participant (P23, age 33, graduate degree holder) shared, “I feel proud when I hear my children speak Bengali because it shows they are carrying our culture forward.” An Indian participant (P30, age 38, unskilled worker) reflected, “When I hear Tamil songs or read Tamil literature, it reminds me of the richness of our culture. It is something I want my children to appreciate too.” An Indonesian participant (P12, age 41, skilled worker, 8 years in Saudi Arabia) stressed the comfort and confidence of heritage language use: “Speaking Bahasa Indonesia reminds me of home and helps me stay connected to my family traditions.” These accounts confirm how heritage language allows participants to assert their cultural identity with pride, even in multicultural settings where external influences dominate.

The participants acknowledged the challenges of maintaining cultural identity while navigating a multilingual society. A Sri Lankan participant (P40, age 39, skilled worker, 7 years in Saudi Arabia) noted, “I feel it is hard to keep Tamil alive when everything around us is in Arabic or English. I feel like my children are losing touch with our heritage.” Similarly, an Indonesian participant (P17, age 41, unskilled worker, no formal education) shared, “We do not have many resources in Bahasa Indonesia here. It is a struggle to teach my children the language when surrounded by other languages.” Meanwhile, a Pakistani university teacher (P6) reflected on the difficulties of raising children in a multicultural environment: “Living in another culture, you have to teach your kids every small detail about your culture.” These challenges demonstrate the resilience required to maintain cultural identity in the face of external linguistic and social pressure. Some participants explained that limited contact with their home country, mainly due to work constraints or financial difficulties, made it harder to reinforce cultural values. In contrast, others stayed connected through frequent visits, remittances, or online communication.

Participants described the deliberate use of heritage language to transmit cultural knowledge, values, and traditions to future generations. A Pakistani university

teacher (P13, aged 44, 10 years in Saudi Arabia) shared, “When I teach my children Urdu, I am not just teaching them words. I am teaching them how to respect their elders, celebrate our festivals, and stay connected to our roots.” A Nepalese participant (P35, age 41, unskilled worker) said, “We make sure our children speak Nepali at home so they can carry our traditions forward, even if they live in a different country.” A Bangladeshi participant (P16, age 38, skilled worker) added, “By speaking Bengali, my children learn about our history, our literature, and the values that make us who we are.” Participants who had migrated for long-term employment or family reunification confirmed this responsibility more strongly than those who viewed their stay in Saudi Arabia as temporary. These efforts affirm the importance of intentional language use in preserving cultural identities. Participants with shorter stays (<5 years) often relied on immediate family interactions to achieve this goal. In contrast, those with longer stays (>10 years) revealed the need for community-based efforts to sustain linguistic and cultural heritage.

### 3.3. The role of heritage language in social cohesion and integration

Thematic analysis revealed that the heritage language serves a dual function in promoting social cohesion within migrant communities while influencing their integration into Saudi society. Shared linguistic practices strengthen intragroup bonds, foster trust, and facilitate support networks. However, they also present challenges in adapting to broader sociolinguistic environments. The following key findings were substantiated by diverse participant quotations and were correlated with their respective demographic characteristics. While these shared linguistic practices strengthen inner-group solidarity, they do not necessarily indicate successful integration into the host society. Social cohesion within cultural groups and broader societal integration should be considered related but distinct processes.

The heritage language emerged as a cornerstone of social cohesion within migrant communities, fostering solidarity and a sense of belonging. A younger Indonesian participant (P44, age 29, skilled worker, 4 years in Saudi Arabia) stated, “When I speak Bahasa Indonesia with new friends here, I feel like I belong; it is like finding a home in another country.” Similarly, a Nepalese participant (P1, age 26, recent graduate, 2 years in Saudi Arabia) shared, “Using Nepali helps me connect quickly with others and build friendships. It is easier to start conversations when we share a language.” An Indian participant (P46, age 27, information technology worker, 3 years in Saudi Arabia) explained, “Speaking my language in the gym or with neighbors always opens doors; we exchange more than

just words; we exchange trust.” This was particularly evident among participants with longer stays in Saudi Arabia (>10 years) who relied on linguistic communities to maintain cultural connections. A Pakistani participant (P3, aged 42, skilled worker, 15 years in Saudi Arabia) shared, “In our gatherings, Urdu is the language we use. It brings us together and helps us support each other in this foreign country.” Similarly, a Filipino participant (P28, age 36, professional worker, 5 years in Saudi Arabia) stated, “When we meet other Filipinos, speaking Tagalog instantly builds a connection. It makes us feel like we are part of the same family, even if we did not know each other before.” For participants from mutually intelligible linguistic backgrounds, heritage language extended its impact beyond individual communities. An Indian university teacher (P24) noted, “In my situation, most of the migrant community belongs to the same continent where I come from, and my heritage language is mutually intelligible among these people. So my heritage language helps me make good relationships within my migrant community.” These accounts accentuate how shared linguistic practices create support networks, enhance trust, and strengthen group cohesion in foreign environments. In many cases, participants who migrated for economic opportunities described these social networks as substitutes for limited ongoing contact with their home countries, reinforcing their cultural identity locally. However, such intra-group cohesion primarily supported cultural continuity rather than broader societal integration, which involves sustained engagement with the host culture beyond one’s community.

Heritage languages also play a pivotal role in fostering trust and collaboration, particularly in the workplace and community settings. This was especially pronounced among participants with lower levels of formal education who depended on shared language to navigate daily challenges. A Nepalese participant (P20, aged 41, unskilled worker, no formal education) explained, “When I speak Nepali with someone, it immediately feels like we are on the same side. There is an unspoken understanding and trust that comes with the language.” In workplace settings, heritage language often facilitates teamwork and eases communication. A Bangladeshi participant (P9, aged 38, unskilled worker, 8 years in Saudi Arabia) noted, “Speaking Bengali with my colleagues made work easier. We understand each other better, creating a more comfortable environment.” However, some participants viewed this reliance on heritage language as a potential obstacle to broader integration. A Pakistani university teacher (P1) reflected, “Usage of a heritage language is becoming a reason for delay for learning the language where you are a migrant.” This dual perspective points out the tension between fostering cohesion within groups and adapting

to the demands of new sociolinguistic environments. Older participants and those with less formal education were particularly reliant on these networks, showing how educational level and age shaped both language use and integration challenges. It is important to note, nevertheless, that such inner-group cohesion, while valuable for emotional support, does not necessarily equate to societal integration into the broader host society.

Cultural and religious events provide vital opportunities for heritage language use, reinforcing social unity and cultural preservation. Participants with moderate stays (5 – 10 years) often relied on these gatherings to pass on cultural values and strengthen bonds. A Sri Lankan participant (P34, age 39, skilled worker, 7 years in Saudi Arabia) explained, “During our festivals, we only speak Tamil. It is a way to connect with our roots and each other.” Participants with higher educational levels often organized such events, using them as platforms for cultural expression. A Pakistani university teacher (P25, aged 44, graduate degree holder) noted, “We organized Urdu poetry nights in our community. It is a beautiful way to keep our culture alive while bringing people together.” For participants from newer migrant groups (<5 years), these events also served as opportunities to establish initial connections and build networks in a foreign land. Participants from more culturally homogeneous neighborhoods reported easier access to such events, while those in more linguistically mixed or isolated regions faced difficulties maintaining regular community engagement. Yet, it is important to note that participation in such community-centered events, while promoting intra-group cohesion, does not automatically indicate integration into the wider host society, as these events often remain socially and linguistically insular.

The participants reported the challenges of balancing heritage language use with the need to integrate into Saudi society. This was especially evident among those with longer stays (>10 years), who had to navigate dual linguistic identities. A Pakistani university teacher (P32, age 44, 15 years in Saudi Arabia) remarked, “Speaking Urdu helps us stay connected to our people, but it also creates a divide when interacting with others who do not speak the language.” An Indian university teacher (P37) described both opportunities and limitations in using heritage language for integration: “My heritage language and Arabic language have some common vocabulary that helps to integrate into Saudi society, but because of many differences, it does not always work.” For participants with no formal education, these challenges were more acute due to their limited proficiency in Arabic or English. A Bangladeshi participant (P38, age 38, unskilled worker,

no formal education) stated, “We mostly speak Bengali at home and with co-workers, but outside, it is hard to communicate because we do not speak Arabic well.”

Despite the integration challenges, participants acknowledged the potential of the heritage language to foster cultural exchange and mutual understanding. Participants with higher educational levels often used their heritage language to introduce their culture to others. A Bangladeshi participant (P41, age 33, graduate degree holder, 6 years in Saudi Arabia) reflected, “When I share Bengali words or phrases with my non-Bengali friends, they become curious about our culture. It opens up a dialogue and helps them understand us better.” Participants with shorter stays (<5 years) reported similar experiences using their heritage language to build bridges in new social contexts. A Filipino participant (P43, age 34, skilled worker, 3 years in Saudi Arabia) noted, “Teaching a few Tagalog phrases to my colleagues has helped me make friends and show them what our culture is about.” While these examples demonstrate the role of heritage languages in initiating intercultural exchange, they represent early-stage contact rather than full integration into the host society. Proper integration involves broader engagement with local cultural norms and shared linguistic practices beyond the migrant group.

Table 2 organizes the emerging themes, sub-themes, and illustrative participant quotes to provide a clear overview of the key findings. This summary helps consolidate the core insights related to heritage language maintenance, cultural identity, and social cohesion across different demographic contexts.

## 4. Discussion

This section discusses the findings of this study according to the study’s research questions.

### 4.1. What are the key practices and factors influencing heritage language maintenance among migrant populations in Saudi Arabia?

This study identified the essential practices that influence heritage language maintenance among migrant populations in Saudi Arabia. Participants confirmed the thoughtful utilization of their heritage languages within familial contexts as a primary strategy, engaging in practices such as storytelling and reading literature in their native language to foster intergenerational transmission. These practices resonate with research accentuating the foundational role of families in maintaining linguistic continuity across generations (Lam & Catto, 2023; Valdés, 2017). Community gatherings and cultural events have also emerged as critical venues for practicing heritage languages, enabling participants to establish connections with individuals who share their cultural backgrounds. Such gatherings, as noted by Chondrogianni & Daskalaki (2023) and Matsumoto & Tokumasu (2022), reinforce language practices while serving as cultural anchors that affirm identity and shared heritage. Digital technologies, such as messaging applications, video conferencing, and language-learning platforms, are central to providing access to heritage language content and maintaining linguistic connections across geographical and social barriers. However, participants noted challenges, including the predominance of Arabic in educational and

Table 2. Summary of emerging themes from thematic analysis

Main theme	Sub-themes	Brief description	Illustrative quotes
1. Intergenerational and community-based practices	<ul style="list-style-type: none"> <li>Family language practices</li> <li>Spousal and household dynamics</li> <li>Community gatherings</li> <li>Workplace and neighborhood context</li> <li>Digital tools and home country contact</li> <li>Educational media</li> </ul>	Heritage language is maintained through family routines, multilingual households, local community interactions, digital engagement, and educational content.	<p>“Every night, we tell stories about Tamil. It is a way to keep our culture alive in their minds and hearts.” (P22)</p> <p>“My wife speaks Arabic better than our native language, so at home, we mix a lot, and the children pick up less Urdu than I hoped.” (P27)</p>
2. Heritage language and cultural identity	<ul style="list-style-type: none"> <li>Identity construction</li> <li>Intergenerational transmission</li> <li>Pride and emotional connection</li> <li>Home-country engagement</li> <li>Cultural concerns and perceived erosion</li> </ul>	Participants see heritage language as a key part of cultural identity, pride, and emotional grounding, though contact with home countries varies across participants.	<p>“Speaking Urdu is not just about language; it is about who we are and where we come from.” (P4)</p> <p>“When I hear Tamil songs or read Tamil literature, it reminds me of the richness of our culture.” (P30)</p>
3. Social cohesion and integration	<ul style="list-style-type: none"> <li>In-group bonding</li> <li>Workplace and practical communication</li> <li>Integration challenges and dual identity</li> <li>Neighborhood access and event participation</li> <li>Cultural bridging and intercultural contact</li> </ul>	Heritage language fosters group solidarity and trust, yet may hinder full integration; integration often varies by educational level, age, and social contact.	<p>“Speaking Urdu helps us stay connected to our people, but it also creates a divide when interacting with others.” (P32)</p> <p>“Teaching a few Tagalog phrases to my colleagues has helped me make friends and show them what our culture is about.” (P43)</p>

social contexts, limited exposure to native speakers, and insufficient resources, particularly among those with lower levels of formal education and shorter residence durations. It is worth noting that most of the accounts focused on home-based language use, accentuating the central role of the family unit in heritage language maintenance in this context. Nevertheless, some participants also referred to language use in workplaces, neighborhoods, and communal religious spaces as contributing to heritage language retention, suggesting that public domains can complement home-based efforts. These findings support Adizovna's (2024) and Alhazmi's (2023) arguments that community-initiated and grassroots spaces serve as informal yet effective platforms for sustaining heritage languages, especially where institutional support is absent.

Participants who are parents reported additional challenges in transmitting heritage languages to their children. While families served as important spaces for language preservation, the absence of institutional support, such as heritage language classes and multicultural educational programs, limited opportunities for formal language development among younger generations. This aligns with Ortega (2020) and Schmid (2002), who observed that a lack of structural reinforcement often accelerates the erosion of heritage languages, especially among second-generation migrants. This gap was particularly concerning for parents whose children were increasingly immersed in Arabic and English environments, often at the expense of their native linguistic and cultural identities. Younger migrants and single adults, in contrast, tended to rely on digital communication with relatives abroad or informal conversations with heritage language speakers in shared accommodations and markets, indicating alternative maintenance strategies beyond the family structure. These observations echo Panicacci & Dewael's (2017) findings that language practices among younger adults are increasingly shaped by digital interaction and transnational peer networks, which serve as important tools for sustaining language and identity.

The deliberate use of heritage languages in family settings reveals the importance of intergenerational transmission in preserving linguistic and cultural identities. Families act as stable environments for passing down heritage languages, reinforcing their role as cornerstones of heritage language maintenance (Bilić *et al.*, 2023; Chondrogianni & Daskalaki, 2023). Community gatherings and cultural events complement these efforts by providing informal spaces to reinforce linguistic practices, thus reflecting the cultural and social significance of such activities (Matsumoto & Tokumasu, 2022). The reliance on digital tools demonstrates migrants' adaptability in overcoming barriers to heritage language access, offering

solutions to physical and societal constraints that may hinder native language use.

These findings align with global research examining the essential roles of family interactions, community networks, and digital tools in heritage language maintenance (Adizovna, 2024; Polinsky & Scontras, 2020). Similar to the multilingual contexts in North America and Europe, the dominance of majority languages, such as Arabic in Saudi Arabia, mirrors the challenges observed in other societies where heritage languages are often marginalized (Wang & Steiner, 2015). As noted by Turkistani & Almoaily (2023), Saudi Arabia's sociolinguistic scene presents unique pressures that require creative strategies to balance heritage language preservation with the linguistic demands of integration into the host society. This reflects broader scholarship from Mazzaferro (2018) and Seargeant (2023), who argue that heritage language survival is often contingent upon the intersection of personal agency, community engagement, and the sociopolitical structures migrants must navigate. This stresses the need for future studies to engage more directly with language practices in public and institutional spaces and among adult migrants without children.

#### **4.2. How does heritage language maintenance contribute to the retention of cultural identity among migrants in Saudi Arabia?**

Heritage language maintenance plays a significant role in preserving the cultural identity of migrant populations in Saudi Arabia. The participants identified their native language as an essential connection to cultural roots, fostering a sense of pride and belonging. Within familial contexts, deliberate efforts to utilize heritage languages include narrative transmission, instruction in cultural traditions, and the encouragement of younger generations to communicate in their native tongue. Community interactions, such as cultural gatherings, further reinforce these practices and allow participants to engage with individuals from similar backgrounds. However, the predominance of Arabic and English in educational and social contexts, coupled with limited interaction with native speakers and access to resources, presents significant challenges in maintaining cultural identity through language. These challenges reflect broader concerns raised in the literature, particularly regarding how dominant language environments can marginalize minority languages and disrupt identity continuity (Ortega, 2020; Wang & Steiner, 2015). Beyond the family setting, some participants, especially young adults, described how cultural identity was reinforced through peer connections and shared digital content in their heritage language. These practices were often supported by mobile platforms,

diaspora networks, and regional events not centered on children. These digital and peer-based practices reflect broader observations that heritage language maintenance depends on diverse, context-sensitive uses beyond the home environment, especially among younger generations (Polinsky & Scontras, 2020).

The utilization of heritage languages within familial contexts reflects their importance in transmitting cultural values, traditions, and identity across generations, a practice widely documented in heritage language studies (Chondrogianni & Daskalaki, 2023). Families provide a consistent and controlled environment where linguistic and cultural continuity flourish. Community gatherings complement these efforts by offering spaces where heritage languages are practiced naturally, fostering a shared identity and solidarity among migrants. Participants who maintained frequent contact with relatives or communities in their countries of origin through social media, remittances, or visits also reported a stronger sense of cultural continuity, regardless of their family status. These findings align with Matsumoto & Tokumasu (2022), who featured the cultural and social significance of community-driven language practices. Participants' challenges, including the influence of Arabic and English as dominant languages, mirror the challenges observed in other multilingual contexts. Research by Wang & Steiner (2015) affirmed how the majority of languages often overshadow heritage languages in public domains, confining their use to private settings. In the Saudi context, as Turkistani & Almoaily (2023) noted, the linguistic scene amplifies these pressures, making heritage language preservation a complex but crucial task for maintaining cultural identity. Such pressures also reflect what Schmid (2002) and Cook & Dewaele (2022) describe as emotional and social barriers that can accelerate language shift if the heritage language is viewed as less socially useful or desirable.

These findings resonate with global research that stresses the role of heritage languages in preserving cultural identity and fostering community cohesion (Fahrudin, 2017; Polinsky & Scontras, 2020). Similar to studies conducted in North America and Europe, the participants of this study relied on family and community networks to sustain their cultural roots. Matsumoto & Tokumasu (2022) found that cultural gatherings serve as both linguistic and cultural preservation tools, a theme echoed in the experiences of Saudi participants. Sociolinguistic challenges, such as the dominance of Arabic, reflect the unique dynamics of heritage language retention in Saudi Arabia's centralized linguistic environment, as Khraif *et al.* (2019) noted. Unlike contexts with formal bilingual policies, such as those in Canada, Saudi Arabia lacks

institutional frameworks supporting multilingualism, which places the burden of preservation solely on individuals and communities (Alshehri & AlShabeb, 2024). Nevertheless, it is worth noting that not all identity preservation was tied to traditional family structures. Single adults and younger migrants without children also wanted to retain their cultural identity through personal heritage language use in social media, music, and online discourse (Dewaele & Botes, 2020). This suggests diverse routes to identity reinforcement beyond intergenerational dynamics. This finding supports Panicacci & Dewaele's (2017) and Panicacci's (2019) arguments that heritage language use is tied to familial heritage, personal identity management, and cultural belonging, especially in younger and more mobile populations.

### **4.3. How does heritage language use impact fostering social cohesion within migrant communities and their integration into Saudi society?**

Heritage language use serves a dual function of fostering social cohesion within migrant communities and facilitating their integration into Saudi society. Within their communities, shared linguistic practices promote solidarity, trust, and mutual support. Participants who had resided in Saudi Arabia for more than 10 years pointed out the significance of heritage languages in establishing close-knit relationships and maintaining cultural connections. Community events, cultural celebrations, and religious gatherings provide essential opportunities for engaging with individuals who share their linguistic and cultural heritage, reinforcing a sense of belonging. Younger participants, in particular, described these events as entry points into broader migrant networks, where they could find mentorship and social advice from older community members, easing their initial adjustment into the Saudi context. For example, one young Indian participant shared that attending Tamil-speaking religious events gave him "more confidence to talk to people, ask for help, and find work." However, this inner-group cohesion, essential for emotional support and cultural continuity, should not be conflated with integration into the host society. Participants acknowledged that these bonds often remained socially and linguistically insular. This echoes the findings by Graham & Howard (2016), who asserted that while heritage language strengthens in-group trust, it does not automatically support broader societal engagement.

Concurrently, the role of heritage languages in integrating into Saudi society is more subtle. Some participants observed that the shared vocabulary between their native languages and Arabic facilitated their adaptation to local customs and norms. Younger

participants described using heritage language ties as a stepping stone to social confidence, eventually helping them navigate new environments where Arabic was dominant. However, this facilitation occurred primarily at the interpersonal level and did not always extend to institutional or public participation. Yet, other studies have also reported challenges arising from linguistic differences. Those with limited formal education or shorter residence duration in Saudi Arabia (<5 years) encountered difficulties in meaningful integration, often due to low Arabic proficiency and substantial reliance on their heritage languages for daily communication.

The utilization of heritage languages to foster social cohesion demonstrates their capacity to strengthen communal bonds and shared identities. Linguistic commonality engenders trust and mutual understanding among migrants, as noted in previous studies (Muthuswamy, 2023). Community and religious gatherings function as informal spaces where heritage language use not only reinforces relationships but also cultivates collective resilience, echoing the findings of Matsumoto & Tokumasu (2022). However, the impact of heritage language use on integration reveals a more intricate dynamic. While shared linguistic features between heritage languages and Arabic occasionally facilitate adaptation, linguistic differences often present barriers. For older participants and those living in culturally homogeneous neighborhoods, reliance on heritage language limited their exposure to Arabic, creating barriers to interaction with the host society. Similar dynamics have been observed in multilingual contexts, where minority language use can impede broader societal integration (Ndhlovu & Willoughby, 2017). These challenges are further amplified in Saudi Arabia, where Arabic predominates as a *lingua franca*. Migrants must balance maintaining their linguistic heritage and acquiring Arabic proficiency to meet societal and professional demands (Al-Rojaie, 2023).

These findings align with global research, which stresses the dual role of heritage languages. They foster solidarity and resilience within migrant communities, as noted by Polinsky and Scontras (2020), while also presenting challenges for integration in linguistically centralized environments. Studies from multicultural contexts, such as Canada and Australia, confirm how heritage languages function as cultural bridges within diverse populations (Kupolati, 2023). The dominance of Arabic presents unique integration challenges in Saudi Arabia. The interaction between heritage language retention and Arabic proficiency mirrors patterns observed in other multilingual societies, where heritage languages serve as sources of strength and potential obstacles to broader

integration (Al-Rojaie, 2023). Migrants in Saudi Arabia demonstrate adaptability and resilience, preserving their cultural identity while striving to meet their host society's linguistic demands, reflecting Turkistani & Almoaily's findings (2023). However, this study refrains from claiming that heritage language use directly enhances mainstream integration, as also acknowledged by Ndhlovu & Willoughby (2017), who caution against equating cultural maintenance with full engagement in public institutions. Rather, the findings suggest that while heritage language practices sustain cultural identity and social bonding, integration requires additional linguistic and institutional access. Still, successful integration appears to depend not solely on language retention but also on individuals' ability to navigate dual identities, particularly among younger and more educated participants who expressed greater flexibility in engaging with heritage communities and wider Saudi society.

Building on these findings, it is evident that practical measures are necessary to support heritage language maintenance among migrant communities in Saudi Arabia. These findings disclose the necessity of implementing practical measures to support heritage language maintenance among migrant communities in Saudi Arabia. Policies should prioritize providing resources such as language-learning tools and cultural programs to enhance heritage language use within families and communities. Community-initiated activities, including cultural gatherings and language clubs, offer valuable opportunities to practice heritage languages while fostering a sense of connection and cohesion. Educational institutions can play a significant role by adopting inclusive approaches, incorporating heritage languages into activities, such as narrative presentations and cultural exhibitions. Digital platforms can address the challenge of limited interactions with native speakers by providing families with alternative methods to maintain linguistic connections. A judicious balance is required to address the predominance of Arabic and English, treat heritage languages as essential cultural assets, and acknowledge their roles in facilitating integration into society.

While these findings provide valuable insights into heritage language maintenance among migrant communities in Saudi Arabia, it is important to recognize certain limitations of this study that offer opportunities for future research. This study had some limitations that warrant acknowledgment. The relatively small sample size may not adequately represent the diverse experiences of migrant communities in Saudi Arabia, and reliance on self-reported data introduces potential subjective biases. Furthermore, the study did not follow a full case study design; instead, it relied

on relatively short, semi-structured interviews, limiting the depth of individual narratives. This study did not specifically investigate how participants' religious familiarity with Arabic influenced their integration or language practices. Since many participants were from Islamic backgrounds, this could be a significant factor in shaping their perception of the host language and should be explored in future research. Moreover, more detailed contextual data, such as residence type (urban versus rural), legal status, family presence, and interaction with other migrant or host communities, were not systematically collected. Other relevant demographic and experiential variables, such as participants' racial background, English language use, prior migration experiences, and affective connections with non-coethnic migrants or host communities, were also not included, limiting the broader interpretive scope. These aspects may significantly affect societal integration and language use levels and should be included in future studies. Subsequent research could benefit from larger and more diverse samples and the utilization of observational or longitudinal methods to provide more comprehensive and representative insights. While the qualitative approach yielded rich, detailed findings, incorporating quantitative methods could boost the generalizability of the results and facilitate a broader understanding of heritage language practices. Future studies should also consider using survey-based quantitative approaches to validate these findings on a larger scale. Furthermore, this study primarily focused on family and community contexts, presenting opportunities for future research to explore the roles of educational institutions, workplaces, and institutional frameworks in supporting or impeding heritage language use. Future research should examine the experiences of migrant children, particularly regarding heritage language use in formal education. Parents in this study expressed concern over the lack of institutional support, pointing to a need for studies on how school environments shape intergenerational language transmission in Saudi Arabia. Another limitation is the lack of data on participants' societal integration and multilingual networks. Migrants surrounded by speakers of their heritage language may have greater opportunities for language retention, which future research should investigate more directly. Comparative studies across countries with varying language policies and sociocultural environments can further elucidate the complexities of heritage language maintenance and its broader implications for cultural identity and societal integration.

## 5. Conclusion

This study examined the role of heritage language maintenance in shaping cultural identity and promoting social cohesion among migrant communities in

Saudi Arabia. While the analysis did not include a direct investigation of migrants' attitudes toward the host culture or the development of hybrid identities, the findings offer meaningful insights into how heritage language practices sustain cultural continuity within migrant groups. The data revealed that participants actively nurtured their heritage cultural identity through language use in familial and community settings. Although these practices were primarily inward-facing, they did not indicate disengagement from the broader social context. On the contrary, many participants interacted with the host society in educational, religious, and occupational domains, suggesting that heritage language maintenance and societal participation may coexist. Accordingly, the most significant implication of this study lies in the observation that maintaining one's heritage and cultural identity does not preclude engagement with the local social environment. This suggests an implicit contribution to the diversification of Saudi society, even if broader integration processes were not directly assessed. Future research should incorporate questions that explicitly address migrants' attitudes toward the host culture, intergroup interaction, and identity negotiation to extend the scope of this inquiry.

## Acknowledgments

None.

## Funding

None.

## Conflict of interest

The author declares no conflicts of interest.

## Author contributions

This is a single-authored article.

## Ethics approval and consent to participate

This study was approved by the Research Ethics Committee at Northern Border University. All participants were adults and gave informed verbal consent before participation. Anonymity and confidentiality were strictly maintained.

## Consent for publication

All participants gave informed verbal consent for their anonymized responses to be used in publication. No identifying information or images were collected.

## Availability of data

The data supporting this study are not publicly available due to confidentiality agreements with participants and will not be shared.

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## Appendix

**Table A1. Instrument**

<b>Part A: Demographic Details</b>	
Nationality	.....
Heritage Language	.....
Length of Stay in Saudi Arabia	<ul style="list-style-type: none"> <li>• &lt;5 years</li> <li>• 5 – 10 years</li> <li>• More than 10 years.</li> </ul>
Age	<ul style="list-style-type: none"> <li>• 18 –29 years</li> <li>• 30 – 44 years</li> <li>• 45+years.</li> </ul>
Qualification (education level)	<ul style="list-style-type: none"> <li>• No formal education</li> <li>• High school diploma</li> <li>• Undergraduate degree</li> <li>• Graduate degree</li> <li>• Doctorate</li> </ul>
Occupation	<ul style="list-style-type: none"> <li>• Student</li> <li>• Professional/Managerial (e.g., teacher, engineer, healthcare worker)</li> <li>• Skilled Worker (e.g., technician, tradesperson)</li> <li>• Manual/Unskilled Worker (e.g., laborer, domestic worker)</li> <li>• Unemployed/Homemaker.</li> </ul>
<b>Part B: Interview Questions</b>	
1. What strategies or practices do you use to maintain your heritage language within your family and community?	
2. What challenges do you face in maintaining your heritage language in Saudi Arabia, and what support systems help you overcome them?	
3. How important is your heritage language to your sense of personal or cultural identity? Can you give examples?	
4. Do you feel that maintaining your heritage language strengthens connections with your cultural roots or heritage? Why or why not?	
5. How does using your heritage language impact your relationships within your migrant community?	
6. Do you think maintaining your heritage language affects how you or your community integrates into Saudi society? Why or why not?	

## RESEARCH ARTICLE

Declining consanguinity in the Jhelum  
population of Pakistan's Potohar Plateau:  
Sociodemographic shifts and underlying causesSadia Saleem<sup>1</sup>, Saif Ullah<sup>2</sup>, and Sajid Malik<sup>1\*</sup><sup>1</sup>Department of Zoology, Faculty of Biological Sciences, Quaid-i-Azam University, Islamabad, Pakistan<sup>2</sup>Department of Zoology, University of Chitral, Chitral, Khyber Pakhtunkhwa, Pakistan

## Abstract

Consanguineous unions (CUs) have long been a common practice and remain prevalent in many cultures, including those in North Africa, West Asia, the Middle East, and developing countries such as Pakistan. As Pakistan undergoes a demographic transition, characterized by rapid urbanization, declining fertility, rising educational attainment, and a shift toward nuclear families, traditional marriage patterns are evolving. Within this context, this study examines the trends and determinants of marital unions in Jhelum District, located in the Potohar region of Pakistan, to explore how societal change influences consanguinity. Using a cross-sectional design, 1,432 married women were randomly recruited from independent households, and data were collected on marital histories and demographic characteristics. The prevalence of CUs was 56%, with a corresponding inbreeding coefficient of 0.0336. First-cousin unions were the most common, accounting for 45% of all marriages. Multivariable logistic regression identified seven significant predictors of consanguinity: Extended family type, husband's occupation, wife's literacy level, caste system, parental consanguinity, reciprocal marriage, and short matrimonial distance. Trend analysis revealed a steady decline in CUs across successive marriage cohorts, particularly after 2010. This decline was observed across all tehsils and was accompanied by an increase in age at marriage. The dynamics of consanguinity and its decline hold important implications for public health, including improved reproductive outcomes, reduced infant and maternal mortality, socioeconomic transition, and long-term population health. Although a gradual nationwide reduction in consanguinity is expected, its pace and magnitude are likely to vary regionally based on cultural norms, socioeconomic development, and rural–urban differences.

**Keywords:** Close marriage; Cousin marriage; Reciprocal marriage; Inbreeding coefficient; Demographic transition; Pakistan

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**Citation:** Saleem S, Ullah S, Malik S. (2026). Declining consanguinity in the Jhelum population of Pakistan's Potohar Plateau: Sociodemographic shifts and underlying causes. *International Journal of Population Studies*. 12(1):67-80.

<https://doi.org/10.36922/IJPS025170074>

**Received:** April 22, 2025

**1st revised:** August 2, 2025

**2nd revised:** August 20, 2025

**3rd revised:** September 9, 2025

**Accepted:** November 6, 2025

**Published online:** November 26, 2025

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## 1. Introduction

Consanguinity, defined as the union between individuals who are related as second cousins or closer, is a widespread practice in various cultures and regions worldwide (Bhinder *et al.*, 2019; Bittles, 2010). Studies have identified various cultural and sociostructural aspects associated with the high rate of consanguinity, including

patrilineal solidarity, strengthening of family bonds, dowry practices, and limited autonomy in choosing a partner (Bhinder *et al.*, 2019; Bittles, 2010; Riaz *et al.*, 2016).

The determinants of consanguinity vary across populations. For instance, cultural norms and religious beliefs play a significant role in consanguineous unions (CUs), particularly among populations in South Asia, the Middle East, and North Africa. In Islam, marriages between first cousins are permitted and sometimes encouraged to strengthen family ties (Bittles, 2012). Similarly, in Hindu and Sikh communities in South Asia, CUs are common among certain castes and sub-groups (Reddy, 2005). Arranged marriages between relatives are viewed as a means to strengthen social bonds and mitigate marital conflicts (Nawaz *et al.*, 2021). Consanguinity is more prevalent in rural areas and among less-educated populations. It also correlates with traditional caste or *biradari* systems (Bittles, 2012; Riaz *et al.*, 2016; Tufail *et al.*, 2017). In land-owning families with established agricultural practices and ruling classes, economic stability and the preservation of inheritance are major drivers of CUs. Families often prefer such unions to keep property and wealth within the kinship network (Shaw, 2001). Hence, the global prevalence of consanguinity varies significantly based on cultural, religious, and socioeconomic contexts, making it a subject of immense demographic and public health interest (Bhinder *et al.*, 2019; Jabeen & Malik, 2014). Studying consanguinity is crucial, as it lies at the intersection of culture, demography, and public health. Understanding the patterns and consequences of CUs is essential for guiding genetic counseling, shaping effective public health policies, and designing culturally sensitive interventions, while also providing broader insights into population genetics, marriage systems, and social development.

## 1.1. Literature review

A high rate of consanguinity is associated with increased prenatal and postnatal morbidity and mortality, adverse reproductive outcomes, and genetic disorders (Bener & Mohammad, 2017; Bittles, 2010; Fareed *et al.*, 2017; Nawaz *et al.*, 2021). Studies have shown that CUs carry a 1.5- to 2.5-fold higher risk of infant death compared to non-consanguineous marriages (Bittles & Black, 2010). Furthermore, a meta-analysis of diverse populations demonstrated a twofold increase in congenital anomalies among consanguineous offspring (Sheridan *et al.*, 2013). Similarly, in Arab populations, 6–8% of newborns from CUs have genetic disorders, compared to 2–3% in non-CUs (Al-Gazali *et al.*, 2006). Offspring of CUs also have a higher risk of intellectual disability and developmental delay due to inherited metabolic disorders (Bibi *et al.*, 2024;

Hamamy *et al.*, 2011). Recent studies have shown that certain recessive mutations, which are unmasked by consanguinity, increase susceptibility to malignancies and predispose individuals to cancer (Naffaa & Stolfi, 2021). Therefore, consanguinity represents a significant risk factor for prenatal and postnatal mortality, congenital malformations, and genetic disorders due to the increased homozygosity of deleterious recessive alleles.

A decline in CUs has been observed in Europe and other parts of the world (Fuster & Colantonio, 2004; Shawky *et al.*, 2011). In Spain, consanguinity was common in the 20<sup>th</sup> century and remained stable until the late 1950s, after which it declined rapidly in the following decades; today, it is considered a rare phenomenon (Fuster & Colantonio, 2004). In Jordan, the consanguinity rate was 51% in the 1980s, but declined to 26% by 2018 (Islam, 2021). Similar declining trends have been observed in different populations of India and Pakistan (Malik *et al.*, 2024; Sahoo *et al.*, 2021). Several factors have been identified as contributing to this decline, including improvements in women's education, delayed age at marriage, the transition to nuclear family structures, urbanization that expands the marriage pool and provides greater anonymity in marital choice, rising socioeconomic status, increased female labor force participation, lower fertility that reduces the pool of cousins as potential spouses, and greater awareness of the genetic risks associated with consanguinity and recessive disorders (Becker, 1992; Ottenheimer, 1996; Schellekens *et al.*, 2017; Shawky *et al.*, 2011).

In Pakistan, CUs still account for about 50% of all marriages (Hina & Malik, 2015; Nawaz *et al.*, 2021). However, the prevalence varies substantially across different regions of the country. Recent studies have documented a gradual decline over time, reflecting changing societal norms, increased awareness of genetic risks, and shifts in marriage practices within the Pakistani population (Ahmad *et al.*, 2016; Malik *et al.*, 2024).

## 1.2. Theories of declines in consanguinity

According to the demographic transition theory, as societies move from high to low fertility and mortality regimes, the accompanying social transformations—such as the spread of nuclear family systems, greater female education, and enhanced socioeconomic mobility—reshape traditional kinship and marital practices (Barakat & Basten, 2014; Kirk, 1996; Mair & Anderson, 2024; Notestein, 1945; Shenk *et al.*, 2016; Thompson, 1929). Smaller family sizes (a transition from extended family to nuclear family) and urban migration reduce the traditional reliance on kinship networks for marriage. Empirical evidence from several Middle Eastern, North African, and South Asian settings

demonstrates that urbanization and expanded educational opportunities, particularly for women, are associated with a reduced preference for cousin marriages (Bittles, 2012; Hussain & Bittles, 2000; Islam, 2021; Saadat *et al.*, 2004).

Similarly, the modernization theory posits that urbanization, industrialization, mass education, and a market economy are fundamental and interconnected forces that have shaped the modern world, eroding traditional social practices (Lerner, 1958; Rostow, 1960). These factors are the key drivers behind the transition from traditional, agrarian societies to the complex, globalized world we are experiencing today. Increased mobility, particularly from rural to urban areas, and exposure to diverse social groups, reduces the pool of kin-based marriages (Islam, 2021; Mair & Anderson, 2024). Literacy, particularly female education, influences marriage preferences toward autonomy and companionate marriages, rather than kinship obligations (Blau & Duncan, 1967; Shenk *et al.*, 2016). Furthermore, economic development and structural changes in labor markets promote individual choices in marriage, diminish extended family control over spouse selection, cause a delayed age at marriage, and reduce reliance on kin-based unions (Hamamy, 2012; Islam, 2021; Nalls *et al.*, 2009; Naz *et al.*, 2023; Shenk *et al.*, 2016). The theories of social mobility and individualization (Blau & Duncan, 1967; Islam, 2021; Parsons, 1951) are linked to this, suggesting that with modernization, individuals pursue careers and social mobility beyond family ties.

### 1.3. Reality in Pakistan

Like many other developing countries, Pakistan is undergoing a rapid demographic transition marked by extensive social, economic, and cultural transformation. Over the past few decades, the country has moved from a traditional, high-fertility, and predominantly rural society toward one that is increasingly urbanized, educated, and economically diversified (Pakistan Bureau of Statistics, 2017; World Bank, 2021). This transformation is reflected in several interrelated trends: A steady decline in fertility rates, a rising median age at marriage, a shift from extended to nuclear family structures, and a growing participation of women in education and the labor force (Afreen *et al.*, 2024; Naz *et al.*, 2023).

Urbanization has been one of the most visible indicators of this change, as evidenced by Pakistan's megacities, such as Karachi, Lahore, and Islamabad. This process has altered family living arrangements and social support networks, reducing the dominance of traditional kin-based systems (Afreen *et al.*, 2024; Dyson, 2010). The national surveys conducted at various intervals (i.e., Pakistan Demographic and Health Survey) have revealed

a consistent decline in the total fertility rate over the past three decades, signaling progress toward later stages of the demographic transition (Naz *et al.*, 2023). Furthermore, economic shifts have influenced marriage timing, gender roles, and intergenerational relations—key components of demographic change. The shift from subsistence-based rural livelihoods to urban wage economies has led to the nuclearization of families, as smaller household units are better adapted to modern labor and housing markets (Dyson, 2010; World Bank, 2021).

These demographic shifts are closely linked to evolving marriage practices, and a decline in CUs, as empirically evident in other geographic regions, can therefore be anticipated (Hamamy, 2012; Islam, 2021; Saadat *et al.*, 2004).

### 1.4. Research questions

Based on these theoretical perspectives, it is reasonable to hypothesize that Pakistan will gradually experience a decline in consanguinity, particularly in regions undergoing rapid socioeconomic development. The motivation for this study stems from the recognition that consanguinity, while deeply rooted in cultural and social traditions of Pakistan, is not static and may be influenced by ongoing socioeconomic transformation in the country. Within this framework, the present study examines patterns of different marital union types in the Jhelum District, northern Punjab, and identifies their dynamics and trends over time, a perspective that makes this study novel. By situating consanguinity within the broader paradigms of demographic transition and modernization, this study seeks to illuminate how large-scale societal changes shape and potentially transform deeply embedded marital practices in Pakistan.

## 2. Data and methods

### 2.1. Study population

Jhelum District, located in the Potohar Plateau of Punjab, Pakistan, covers an area of 3,587 km<sup>2</sup> and comprises four subdivisions (tehsils) and 53 union councils. Jhelum District has a total population of 1.38 million, with 61% residing in rural areas (Pakistan Bureau of Statistics, 2017). Punjabi is the primary language spoken. The predominant castes include Rajputs, Jatts, Gujjars, Arains, Maliks, Awans, and Syeds. The district is home to several historically and archaeologically significant sites, including the Khewra Salt Mine, the world's second largest.

For the current study, Jhelum District was selected primarily due to the administrative and logistical support available to carry out data collection and fieldwork. Second, Jhelum District has historically reported a high

consanguinity rate, warranting updated data in light of recent socioeconomic changes and ongoing urbanization, offering a natural setting to explore how modernization intersects with traditional marriage practices. Third, the nearby Potohar districts (e.g., Rawalpindi) show strong *biradari*/endogamy dynamics that sustain consanguineous marriages; Jhelum shares this sociocultural setting, making it an ideal location to examine how local kinship, education, and urbanization shape marriage choices (Fatima & Leghari, 2020). Furthermore, Jhelum is close to Azad Jammu and Kashmir, which has one of the highest consanguinity rates in Pakistan (Jabeen & Malik, 2014). In this context, a large proportion of British Pakistanis trace their roots to the barani zone, which includes the Jhelum, Rawalpindi, and Mirpur districts. Findings from Jhelum have direct implications for the United Kingdom (and Gulf) diaspora, including health services, genetic counseling, and community engagement (Ballard, 2002). Hence, it was worthwhile exploring the consanguinity rate in Jhelum District.

## 2.2. Ethical approval and sampling strategy

This study was approved by the Ethical Review Committee of Quaid-i-Azam University. A cross-sectional design with multistage stratified random sampling was used to ensure representation across three tehsils, rural and urban areas, and different socioeconomic strata of Jhelum District. Within each tehsil, union councils were randomly selected as primary sampling units. In rural areas, households were approached primarily through door-to-door visits, while in urban areas, participants were recruited from public locations such as hospitals, healthcare facilities, schools, and community centers. After obtaining verbal consent, participants underwent face-to-face interviews and completed questionnaires. No participants were prioritized based on age, education, origin, or other demographic variables.

The inclusion criteria were: (i) ever-married women aged 18 years or older, (ii) permanent residents of Jhelum District, and (iii) individuals who were able and willing to provide informed consent. Exclusion criteria included respondents temporarily residing in Jhelum, visitors, and seasonal migrants. Individuals with cognitive impairments or physical disabilities that limited their ability to provide consent or accurately answer questions were also excluded.

Data were collected over 2 years (2019–2021) in multiple phases, with scheduling determined by the availability of field staff, logistical considerations, and seasonal climatic conditions. Fieldwork was suspended for several months in 2020 due to COVID-19-related restrictions and later resumed in accordance with established safety

protocols. The lockdown measures in Jhelum District were comparatively less stringent than those implemented in major metropolitan areas such as Lahore, Karachi, and Islamabad.

## 2.3. Measures

Information was gathered on marital union types and biodemographic and socioeconomic variables. The sample size was calculated using the formula for prevalence studies with an estimated consanguinity prevalence of at least 40%. The definitions of variables were adopted from the Pakistan Demographic Health Survey (Hina & Malik, 2015; Nawaz *et al.*, 2021; NIPS, 2019; Riaz *et al.*, 2016).

All marital union types were grouped into two broad categories: CUs and non-CUs. The CU category included marriages between double first cousins (children of two brothers who married two sisters; i.e., the fathers are brothers and the mothers are sisters), first cousins (children of siblings), first cousins once removed (a marriage between a person and a child of his/her first cousin), and second cousins (children of first cousins). First-cousin marriages were further categorized into four subtypes: father's brother's daughter, father's sister's daughter, mother's brother's daughter, and mother's sister's daughter. The non-CU category comprised marriages between second cousins once removed, distantly related/*biradari* unions, and non-related unions (Bittles, 2010; Jabeen & Malik, 2014). The aggregate of CU types was utilized to estimate the inbreeding coefficient  $F$ , which is a quantitative expression of inbreeding. It is a measure of the probability that two alleles at a given locus in an individual are identical by descent from a common ancestor. It quantifies the degree of genetic relatedness between the parents and thus the level of homozygosity in their offspring (Bittles, 2012).

The participants' tehsil of origin and rural/urban status were obtained from union council records. Tehsils were coded as Dina (1), Jhelum (2), and Sohawa (3), while residence was categorized as urban (1) or rural (2). Family type was defined as either nuclear or extended. Nuclear families consisted of one couple and their children living in the same household, whereas extended families comprised two or more couples across at least three overlapping generations within the same household. Nuclear families were coded as 1, and extended families were coded as 2.

Socioeconomic status and occupations were classified using the standard categories of the Pakistan Demographic and Health Survey (NIPS, 2019). Socioeconomic quartiles were coded as high (1), upper-middle (2), lower-middle (3), and low (4). Occupations of wives were categorized as working women (1) and housewives (2), while occupations

of husbands were grouped as others (1), unskilled manual (2), business (3), skilled manual (4), government jobs (5), and agriculture (6). Literacy was assessed in two ways: (a) formal schooling (literate = 1, illiterate = 2) and (b) number of years of schooling, categorized as  $\geq 13$  years (1), 9–12 years (2), and 1–8 years (3). Caste affiliation was coded as Arrain (1), Butt (2), Gujjar (3), Jutt (4), Malik (5), Mughal (6), Rajput (7), Sayyed (8), and others (9). Parental consanguinity was coded as no (1) and yes (2). Reciprocal marriage (locally called *watta-satta*, that is, exchange marriages between two families; often a brother and sister from one family marrying a sister and brother from another family [Zaman, 2013]) was coded as no (1) and yes (2).

Matrimonial distance between the spouses was also taken as a dependent variable. This variable is a key indicator of underlying sociocultural boundaries. It functions as a proxy for social distance, reflecting the tendency for assortative mating based on education, socioeconomic class, rural/urban divide, and ethnicity within geographically bounded groups. In addition, in a society like Pakistan's, where marriages are often arranged by parents/guardians, and familial networks exert considerable influence over marriage formation, the physical distance between spouses directly reflects the geographic reach and embeddedness of these kinship structures.

Matrimonial distance was converted into four categories designed to reflect sociocultural, geographic, and mobility factors that shape marital decisions, aligning with settlement structures, transportation networks, and kinship norms: the first category, <1 km, represents same-village marriages, where spouses live within walking distance. This category is most common in rural, agrarian communities with limited literacy and socioeconomic mobility, often involving cousin unions due to the tightly knit nature of kinship circles. The second category, encompassing distances of 1–10 km, includes adjacent-village or nearby-town marriages, where travel is feasible on foot or by bicycle. Social ties remain strong due to interconnected kin networks across neighboring settlements, often found in extended family structures. The third category, 10–50 km, indicates district-level or inter-tehsil unions, marking a sociocultural boundary where family networks tend to weaken. These marriages are less likely to be consanguineous but often occur within the same *biradari* (caste/subcaste group), influenced by occupational migration or arranged matches beyond immediate kin. The fourth category, 50+ km, encompasses long-distance, inter-district, or inter-provincial marriages, which are typically exogamous in terms of kinship. These unions are often driven by education, employment

opportunities, or diaspora linkages, signaling broader social and geographic mobility. Matrimonial distance was categorized as <1 km (1), 1–10 km (2), 10–50 km (3), and 50+ km (4).

## 2.4. Statistical analysis

The inbreeding coefficient  $F$  was calculated based on the proportion of CU types within the total marriages in each respective category (Bittles, 2010).

Descriptive statistics were applied to summarize categorical variables, and the significance of deviations from a random distribution was assessed at  $p < 0.05$ . Consanguinity was analyzed as an independent variable, with demographic variables (i.e., dependent variables: tehsil, rural/urban origin, family type, socioeconomic status, wife's occupation, wife's literacy, husband's occupation, husband's literacy, caste system, reciprocal marriage, matrimonial distance) evaluated in relation to it. The odds of CUs were calculated across each dependent variable (and expressed in odds ratios [OR]), with the lowest category taken as the reference. The corresponding 95% confidence intervals (CIs) were calculated. Multivariable analyses were conducted using logistic regression, performed in multiple tiers. Consanguinity, the independent variable, was treated as a dichotomous variable: yes (1) versus no (0), and dependent variables were incorporated into the step-by-step model. Significant variables were retained in the model, and the results were expressed in OR. The analyses were repeated using sampling weights for tehsils to adjust for over- and under-representation of the samples.

Model diagnostics were performed to assess the adequacy and robustness of the logistic regression model (Pagano *et al.*, 2022). Goodness-of-fit was evaluated using the Hosmer–Lemeshow test and pseudo- $R^2$  statistics. Model discrimination was assessed using the area under the receiver operating characteristic curve and classification accuracy. Multicollinearity among predictors was examined using variance inflation factors, with values  $< 5$  indicating acceptable levels. Influential observations and outliers were assessed through standardized residuals, leverage values, and Cook's distance.

Data analyses were performed to assess trends in CUs and marital patterns over time. Participants were stratified by current age, husband's age, and marriage year, grouped into 10-year intervals for analysis. Furthermore, specific types of first-cousin unions were analyzed separately to identify shifts in preferential marital patterns. The average age at marriage was also calculated for each time interval. Trends were analyzed for the total population and were also stratified by the three tehsils. All data were analyzed using GraphPad Prism (version 5) and STATA (version 13).

### 3. Results

#### 3.1. Data structure and rate of consanguinity

A total of 1,432 women from separate households were recruited for the study. The mean age of the participants was  $41.21 \pm 9.73$  years. The representation of individuals from three tehsils—Dina, Jhelum, and Sohawa—was 58%, 24%, and 18%, respectively (Table 1). The participants were predominantly from rural areas (64%), nuclear families (61%), and the low to lower-middle socioeconomic quartiles (75%).

#### 3.2. Consanguinity across sociodemographic variables

Across the tehsils, the prevalence of CUs was comparable in Dina and Jhelum (54% each), whereas Sohawa exhibited a significantly higher proportion (67%) (Table 1). The corresponding inbreeding coefficients were calculated to be 0.0322, 0.0319, and 0.0407, respectively, yielding an overall inbreeding coefficient of 0.0336 (Table 1).

Table 2 shows that the odds of consanguinity were higher in individuals originating from Sohawa tehsil (OR: 1.74; 95% CI: 1.30–2.34), rural areas (OR: 1.13; 95% CI: 0.91–1.41), extended families (OR: 1.43; 95% CI: 1.15–1.78), and the lower-middle socioeconomic quartile (OR: 1.59; 95% CI: 1.01–2.50), in bivariate analyses. The rate of consanguinity was relatively higher in women who were housewives (OR: 1.07; 95% CI: 0.69–1.67) and whose husbands were engaged in agriculture (OR: 1.10; 95% CI: 0.72–1.68). The rate of CUs did not differ significantly with respect to the literacy of participants or their spouses. However, among literate individuals, a declining trend in CUs was evident with increasing literacy levels (Table 2).

The odds of consanguinity were significantly lower in the Arrain (OR: 0.54; 95% CI: 0.32–0.93) and Mughal caste systems (OR: 0.58; 95% CI: 0.35–0.97), in bivariate analyses. The odds of consanguinity were significantly higher in individuals who had parental consanguinity (OR: 3.58; 95% CI: 2.82–4.54) and reciprocal marriages (OR: 5.48; 95% CI: 3.56–8.42) (Table 2). Furthermore, the rate of CUs decreased as the matrimonial distances increased, with the lowest rate observed for distances of 50+ km (OR: 0.26; 95% CI: 0.19–0.37).

In the multivariable model, all variables were incorporated in the analyses. Seven variables were significant predictors of consanguinity: family type, husband's occupation, wife's literacy level, caste system, parental consanguinity, reciprocal marriage, and matrimonial distance (Table 2). The analyses were revised after adjusting for the sampling weights of tehsils according to the census data. The analyses revealed that the predictive

**Table 1. Sample distribution, prevalence of consanguineous unions, and inbreeding coefficient across demographic and socioeconomic variables**

Variables	<i>n</i>	% of sample	% of CUs	Inbreeding coefficients
Total sample	1,432	100	56	0.0336
Tehsil				
Dina	830	58	54	0.0322
Jhelum	347	24	54	0.0319
Sohawa	255	18	67	0.0407
Rural/urban origin				
Urban	511	36	54	0.0305
Rural	921	64	57	0.0353
Family type				
Nuclear	871	61	53	0.0309
Extended	561	39	62	0.0378
Socioeconomic quartile				
Low	430	30	55	0.0339
Lower-middle	646	45	58	0.0344
Upper-middle	270	19	57	0.0339
High	86	6	47	0.0251
Wife's occupation				
Housewife	1,348	94	56	0.0340
Working women	84	6	55	0.0279
Husband's occupation				
Agriculture	118	8	61	0.0377
Government jobs	354	25	59	0.0355
Skilled manual	366	26	56	0.0337
Business	289	20	54	0.0311
Unskilled manual	185	13	58	0.0345
Others	120	8	49	0.0284
Wife's literacy				
Literate	1,019	71	56	0.0334
Illiterate	413	29	56	0.0342
Wife's literacy level				
1 <sup>st</sup> –8 <sup>th</sup>	538	53	61	0.0372
9 <sup>th</sup> –12 <sup>th</sup>	406	40	52	0.0292
13 <sup>th</sup> or above	75	7	49	0.0279
Husband's literacy				
Literate	1,258	88	57	0.0338
Illiterate	174	12	53	0.0323
Husband's literacy level				
1 <sup>st</sup> –8 <sup>th</sup>	416	33	60	0.0358
9 <sup>th</sup> –12 <sup>th</sup>	719	57	56	0.0332
13 <sup>th</sup> or above	123	10	50	0.0305

(Cont'd...)

Table 1. (Continued)

Variables	n	% of sample	% of CUs	Inbreeding coefficients
Caste system				
Arrain	68	5	41	0.0237
Butt	86	6	57	0.0374
Gujjar	150	10	63	0.0379
Jutt	280	20	58	0.0352
Malik	166	12	58	0.0341
Mughal	76	5	45	0.0245
Rajput	356	25	61	0.0369
Sayyed	105	7	50	0.0253
Others	145	10	52	0.0307
Parental consanguinity				
Yes	524	37	75	0.0456
No	908	63	46	0.0267
Reciprocal marriage				
No	1,251	87	52	0.0305
Yes	181	13	86	0.0550
Matrimonial distance (km)				
<1	388	27	76	0.0462
1–10	375	26	52	0.0310
10–50	427	30	48	0.0285
50+	242	17	45	0.0264

Note: Percentages of sample distribution and prevalence of CUs are unweighted.

Abbreviation: CU: Consanguineous union.

strength of the wife’s literacy level on consanguinity increased, and the strength of parental consanguinity and exchange marriage slightly decreased.

### 3.3. Subtypes of consanguineous and non-consanguineous marriages

Table 3 shows that 56% of individuals had CUs. Among the CUs, first-cousin unions had the highest representation at 45%, whereas double first-cousin, first-cousin once removed, and second-cousin unions accounted for 3%, 4%, and 4%, respectively (Table 3). Among the first-cousin unions, father’s brother’s daughter marriages were more prevalent (33%), whereas father’s sister’s daughter, mother’s brother’s daughter, and mother’s sister’s daughter marriages were 21%, 21%, and 24%, respectively. The differences in the distribution of first-cousin union types across the tehsils were not statistically significant ( $p=0.193$ ).

### 3.4. Trends in CUs

The distribution of marriage types according to current age revealed that the rate of CUs was declining with declining

Table 2. Odds ratios of predictors of consanguinity in multivariable logistic models

Variables	Bivariate model <sup>a</sup>	Multivariable model <sup>b</sup>
Tehsil Jhelum (Dina)	1.03	0.94
Tehsil Sohawa (Dina)	1.74***	1.32
Rural origin (Urban)	1.13	0.90
Extended family (Nuclear)	1.43***	1.38*
Socioeconomic low quartile (High)	1.41	1.13
Socioeconomic lower-middle quartile (High)	1.59*	1.08
Socioeconomic upper-middle quartile (High)	1.55*	0.98
Housewife (Working women)	1.07	0.80
Husband’s occupation: Agriculture (Government job)	1.10	0.59*
Skilled manual (Government job)	0.82	0.61*
Business (Government job)	0.88	0.71
Unskilled manual (Government job)	0.98	0.77
Others (Government job)	0.68*	0.59
Wife’s illiterate (Literate)	1.00	1.05
Wife’s literacy level: 1 <sup>st</sup> –8 <sup>th</sup> (13 <sup>th</sup> or above)	1.59*	2.03*
Wife’s literacy level: 9 <sup>th</sup> –12 <sup>th</sup> (13 <sup>th</sup> or above)	1.10	1.44
Husband illiterate (Literate)	0.87	1.07
Husband’s literacy level: 1 <sup>st</sup> –8 <sup>th</sup> (13 <sup>th</sup> or above)	1.45*	1.73*
Husband’s literacy level: 9 <sup>th</sup> –12 <sup>th</sup> (13 <sup>th</sup> or above)	1.26	1.49
Arrain (Jutt)	0.54*	1.40
Butt (Jutt)	0.93	1.67*
Gujjar (Jutt)	1.19	1.11
Malik (Jutt)	1.04	1.06
Mughal (Jutt)	0.58*	0.86
Rajput (Jutt)	1.30	2.03**
Sayyed (Jutt)	0.67*	0.89
Others (Jutt)	0.89	1.44
Parental consanguinity (No)	3.58***	3.39***
Reciprocal marriage (No)	5.48***	4.94***
Matrimonial distance 1–10 km (<1)	0.34***	0.31***
Matrimonial distance 10–50 km (<1)	0.29***	0.33***
Matrimonial distance 50+km (<1)	0.26***	0.29***

Notes: Category in the parentheses is the reference group. Statistical significance determined at  $+p < 0.1$ ,  $*p < 0.05$ ,  $**p < 0.01$ ,  $***p < 0.001$ .

<sup>a</sup>Unweighted model; <sup>b</sup>Weighted model.

age intervals of participants (i.e., younger individuals with less consanguinity), but not with the age of the husband (Table 4). Regarding the marriage year, a declining trend in CUs was observed in the 10-year age interval data (Table 4 and Figure 1A). This declining trend was observed in the total data as well as across three tehsils. Nonetheless,

**Table 3. Subtypes of consanguineous and non-consanguineous marriages**

Variables	Consanguineous union, <i>n</i> (%) <sup>a</sup>				Non-consanguineous union, <i>n</i> (%) <sup>a</sup>			Total, <i>n</i> (%) <sup>b</sup>
	DFC	FC	FCOR	SC	SCOR	DR	NR	
Tehsil								
Dina	16 (2)	375 (45)	24 (3)	32 (4)	0 (0)	139 (17)	244 (29)	830 (58)
Jhelum	13 (4)	134 (39)	26 (7)	16 (5)	0 (0)	63 (18)	95 (27)	347 (24)
Sohawa	9 (4)	140 (55)	10 (4)	12 (5)	1 (0)	35 (14)	48 (19)	255 (18)
Total	38 (3)	649 (45)	60 (4)	60 (4)	1 (0)	237 (17)	387 (27)	1,432 (100)
Rural/urban origin								
Urban	7 (1)	214 (42)	29 (6)	28 (5)	0 (0)	94 (18)	139 (27)	511 (36)
Rural	31 (3)	435 (47)	31 (3)	32 (3)	1 (0)	143 (16)	248 (27)	921 (64)

Notes: <sup>a</sup>Numbers in parentheses refer to proportions of different marriage types among the total marriages in each tehsil and in urban and rural areas; <sup>b</sup>Numbers in parentheses refer to proportions of samples shared by each tehsil and urban and rural areas. Chi-square tests were performed among tehsils ( $p < 0.001$ ) and between rural and urban origins ( $p = 0.0111$ ).

Abbreviations: DFC: Double first-cousin; DR: Distantly related; FC: First cousin; FCOR: First cousin once removed; NR: Non-related; SC: Second cousin; SCOR: Second cousin once removed.

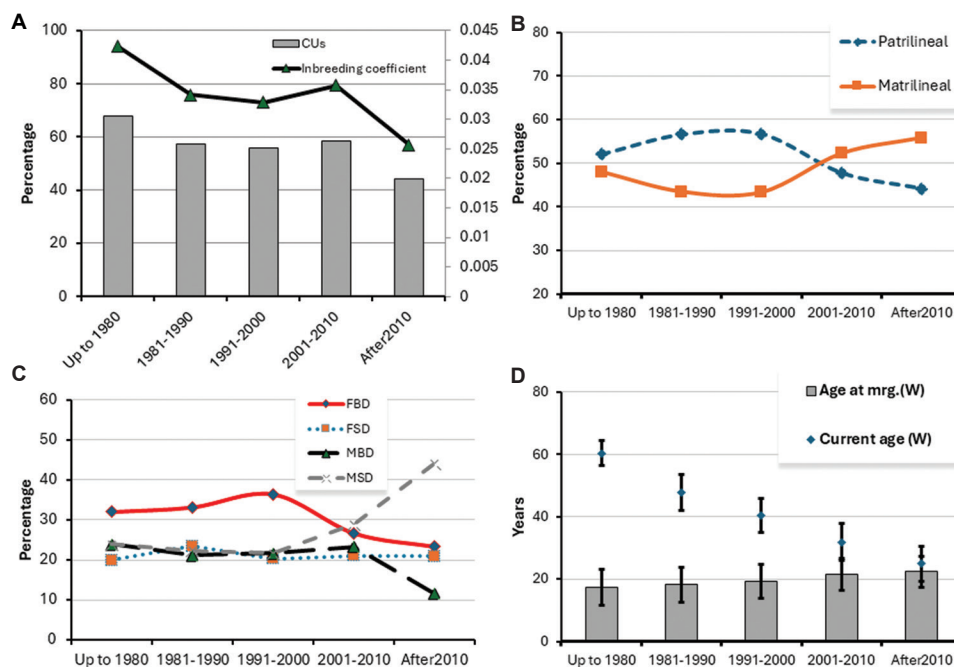
**Table 4. Consanguinity and inbreeding coefficient across age strata and marriage years**

Variables	Consanguineous unions, <i>n</i> (%)		Total marriages, <i>n</i> (%)		Odds ratio	<i>p</i> -value	95% confidence interval	Inbreeding coefficient
Current age (years, wife)								
Up to 30	109	53	204	14	Ref.	-	-	0.0332
31–40	272	55	497	35	1.05	0.098	0.76–1.46	0.0326
41–50	318	57	554	39	1.17	0.329	0.85–1.62	0.0330
51–60	108	61	177	12	1.36	0.136	0.91–2.05	0.0388
Total	807	56	1,432	100				0.0336
Current age (years, husband)								
Up to 30	66	57	116	8	Ref.	-	-	0.0350
31–40	140	55	255	18	0.92	0.720	0.59–1.44	0.0336
41–50	359	59	607	42	1.10	0.650	0.73–1.64	0.0342
51–60	219	54	406	28	0.89	0.573	0.59–1.35	0.0329
Marriage year <sup>a</sup>								
Up to 1980	63	68	93	6	2.67	0.001	1.51–4.70	0.0423
1981–1990	222	58	386	27	1.72	0.010	1.13–2.60	0.0341
1991–2000	361	56	648	45	1.60	0.020	1.08–2.37	0.0329
2001–2010	109	58	187	13	1.77	0.015	1.11–2.83	0.0358
>2010	52	44	118	8	Ref.	-	-	0.0257
Age at marriage (years, wife) <sup>a</sup>								
Up to 20	565	58	974	68	1.63	0.008	1.13–2.34	0.0348
20–25	180	56	323	23	1.48	0.055	0.99–2.22	0.0325
>25	62	46	135	9	Ref.	-	-	0.0275

Notes: <sup>a</sup>Differences in the distribution were statistically significant in the Chi-square test statistics. Ref. refers to the reference.

the marital alliance system underwent drastic changes, and a matrilineal shift accelerated after 1991, but became more pronounced after 2010 (Figure 1B). Further distribution of first-cousin unions revealed that there was a remarkable

decline in father’s brother’s daughter and mother’s brother’s daughter marriages, whereas mother’s sister’s daughter marriages increased significantly (Figure 1C). The age at marriage was observed to increase steadily across time



**Figure 1.** Trend in consanguinity in the Jhelum population. (A) Temporal decline in consanguineous unions (bar graph) and inbreeding coefficient (line graph). (B) Temporal shifts in patrilineal and matrilineal marriages. (C) Temporal changes in first cousin marriage types. (D) Temporal rise in the average age of women at marriage.

Abbreviations: CU: Consanguineous marriage; FBD: Father’s brother’s daughter; FSD: Father’s sister’s daughter; MBD: Mother’s brother’s daughter; Mrg: Marriage; MSD: Mother’s sister’s daughter.

intervals (Figure 1D). Regarding the age of participants, a declining trend in consanguinity was observed with decreasing age intervals (Table 4).

#### 4. Discussion

This study was conducted to quantify and analyze the patterns of CUs in Jhelum District, located in the Potohar Plateau of Punjab, Pakistan, and to examine their sociodemographic determinants. High rates of CUs have been linked to an increased risk of autosomal recessive disorders, higher infant mortality, and adverse reproductive outcomes (Bener & Mohammad, 2017; Bibi *et al.*, 2024; Fareed *et al.*, 2017; Naqvi *et al.*, 2023; Nawaz *et al.*, 2021; Shawky *et al.*, 2011). Pakistan ranks among the countries with the highest prevalence of consanguinity worldwide; however, population-based studies providing detailed sociodemographic analysis remain limited for specific districts such as Jhelum.

The overall frequency of consanguinity in Jhelum District is 56%; however, it varies considerably across the tehsils. It was significantly higher in Sohawa (67%) compared to Jhelum and Dina (both at 54%). A likely explanation for this finding is that Sohawa, which remains predominantly agrarian, has low population density, low literacy, and more entrenched tribal structures where

endogamy is a deeply rooted norm used to preserve family wealth, social status, and kinship ties (Pakistan Bureau of Statistics, 2017). In contrast, Dina and Jhelum are more urbanized and economically diversified, and their lower rates of CUs may reflect greater exposure to diverse social networks and weaker adherence to traditional marriage customs. Consanguinity has generally been inversely related to urbanization, as rural settings are often characterized by social isolation, strong family ties, extended households, lower literacy, early marriages, and shorter birth intervals, all of which favor CUs (Malik *et al.*, 2024; Riaz *et al.*, 2016; Schellekens *et al.*, 2017; Shawky *et al.*, 2011).

A strong predictor of an individual’s choice of a CU is their parents’ marriage type. This study’s findings align with existing literature (Ahmad *et al.*, 2016; Nawaz *et al.*, 2021). It is pertinent to note that exchange marriage is deeply rooted in certain rural and tribal areas of Pakistan, particularly in the provinces of Punjab, Sindh, and Khyber Pakhtunkhwa. Although the contribution of exchange marriage accounted for only 13% of total marital unions, it appears to be a strong predictor of consanguinity.

Another reason for the decline in CUs in the study population could be the increase in matrimonial distance over the years, that is, the distance increased from 25.4 ± 56.7 km in marriages commenced before

1980 to  $68.6 \pm 184.6$  km in marriages commenced after 2010 (data not shown). Matrimonial distance is inversely related to consanguineous marriages—greater distance reduces the likelihood of unions between relatives (Calderón *et al.*, 2018; Nawaz *et al.*, 2021). Higher matrimonial distance decreases the probability of CUs because partners are less likely to be biologically related (Balgir *et al.*, 2013; Reddy, 1988). Rural areas often have extended families with large marriage pools, which increases the likelihood of consanguineous marriages. Urban areas typically experience greater matrimonial distance due to smaller family sizes, migration, education, and diverse social networks, resulting in lower consanguinity.

The multivariable regression analyses revealed that seven variables, that is, extended family type, husband's occupation, wife's literacy level, caste system, parental consanguinity, reciprocal marriage, and very close matrimonial distance (<1 km), were significant predictors of CUs; yet the strongest effects were measured for reciprocal marriage, parental consanguinity, and very close matrimonial distance, in both weighted and unweighted logistic models (Table 2). These findings provide empirical support for both the demographic transition theory and the modernization theory. The demographic transition theory and modernization theory converge on the factors of education, mobility, nuclearization, and urbanization, which collectively contribute to a decline in consanguinity.

The key demographic transitions in Jhelum's population over the past two decades include an increase in the urban population from 18% in 1998 to 29% in 2017, largely due to rural-to-urban migration, which was partly driven by the expansion of military cantonments, the development of industrial zones along the Grand Trunk Road, and the growth of educational hubs. Literacy rates rose from 50% in 1998 to 64% in 2017, while the proportion of the workforce employed in agriculture declined from 35% to 22%. At the same time, there has been a significant outmigration of youth to the cosmopolitan areas of Rawalpindi and Islamabad in search of employment, as well as high levels of international migration, particularly to the Gulf and European countries (Pakistan Bureau of Statistics, 2017).

Conversely, the lower odds of consanguinity in nuclear families and in marriages spanning greater geographic distances reflect the processes of urbanization, mobility, and the weakening of kinship control emphasized by modernization theory. However, the strong influence of reciprocal marriages indicates that despite structural transformations, cultural strategies to preserve kinship solidarity continue to reinforce CUs, highlighting the uneven and context-specific nature of the transition.

The current study revealed a declining trend in CUs over time, as well as with decreasing participant age. The lower rate of consanguinity in younger age groups may be attributed to greater awareness of the potential implications of CUs. This awareness is likely linked to rising literacy levels among younger individuals. A similar pattern was observed with education, as higher educational attainment was associated with reduced rates of consanguinity. In addition, the age at marriage has steadily increased over successive time intervals, and this increase is inversely related to consanguinity rates (Bashir & Nazir, 2022; Malik *et al.*, 2024; Schellekens *et al.*, 2017). With higher literacy, women are increasingly contributing to household income through diverse professions and playing a more active role in decision-making related to marriage. This shift has led to an increase in matrilineal marriages, as women often exhibit a natural inclination toward their own families.

A shift from a patrilineal to a matrilineal system entails a significant reorganization of how families and communities structure kinship, inheritance, and living arrangements. In patrilineal systems, family ties, property, and authority are typically passed down through the male line. In matrilineal systems, descent is traced through women, with couples often living near the wife's family, property passing through the mother's side, and maternal relatives, especially the mother's brothers, assuming important roles. This is a likely scenario in the Jhelum population, where a large number of men have migrated to Europe and Gulf countries for employment (Pakistan Bureau of Statistics, 2017). In the absence of a husband, the role of mother and maternal uncles increases in marital decisions. Similar shifts have been observed in the Kashmir population of Pakistan (Jabeen & Malik, 2014).

Taken together, our study demonstrates that the combined effect of several variables has led to the decline of consanguinity, a finding that aligns with both demographic transition theory and modernization theory (Islam, 2021; Mair & Anderson, 2024; Notestein, 1945; Rostow, 1960). This decline in consanguinity, along with the increase in age at marriage and greater matrimonial distance, reflects broader social transformations associated with fertility decline, higher educational attainment, urbanization, and mobility. These findings align with the demographic transition theory, which posits that shifts in demographic regimes lead to changes in kinship and marital practices. Similarly, the observed cohort shifts support the modernization theory's emphasis on the weakening control of the extended family (i.e., a move toward nuclear families), the rise of individual choice, and the trend toward delayed marriages. Notably, the increase in matrilineal marriages (alongside a decline in patrilineal ones) points

to a restructuring of kinship strategies rather than their complete disappearance. This suggests that the transition is adaptive and context-specific, not a simple linear process.

This study has several potential applications. Foremost is its relevance to public health planning. Quantifying the prevalence and determinants of CUs supports evidence-based policies for community genetic screening programs, similar to initiatives implemented in other high-consanguinity countries such as Saudi Arabia, Iran, and across the Middle East (Abou Tayoun *et al.*, 2021; Al-Gazali *et al.*, 2006; Hamamy *et al.*, 2011). The high CU rate (56%) identified here underscores the need for expanded genetic counseling and prenatal screening services to reduce the burden of recessive disorders, particularly in the socioeconomic groups highlighted by this study. Identifying sociodemographic predictors (e.g., low matrimonial distance, extended family type) enables targeted interventions, including health education campaigns directed toward high-risk groups. Moreover, the decline in CUs among younger cohorts is an important indicator of shifting marriage practices, likely linked to urbanization, education, and changing socioeconomic norms. Understanding CU prevalence is critical for anticipating the future burden of congenital and genetic disorders and for developing preventive strategies. Finally, this study provides a model for similar investigations in other regions with high consanguinity, such as the Middle East and North Africa.

The findings of this study hold significant relevance for a wide range of stakeholders, particularly public health authorities such as the Ministry of National Health Services, Pakistan, and the Punjab Health Department. These insights can guide the development of community-specific health awareness campaigns, reproductive health risk mitigation strategies, and genetic counseling programs. Reproductive health practitioners and maternal and child health workers can utilize these findings to implement targeted screening for at-risk couples and families, enabling early intervention. In addition, genetic counselors and medical geneticists can utilize this research to provide more accurate risk assessments and informed management advice to couples considering marriage.

Beyond the medical field, the study offers valuable insights for sociologists and anthropologists examining family structures and cultural shifts in marriage patterns across South Asia. The data may also inform policymakers and non-governmental organizations working on women's health, child survival, and socioeconomic development, as CUs trends are closely tied to demographic transitions and education patterns. Ultimately, the findings can empower families and community activists to make informed

decisions about marriage, thereby fostering healthier and more sustainable family structures in the long term.

Based on the study findings and in line with international best practices (Abou Tayoun *et al.*, 2021; Bittles & Black, 2010; Shenbagam *et al.*, 2025), we recommend a multi-pronged approach to address the health implications of CUs. First, community-based genetic counseling programs should be implemented with a focus on pre-marital and pre-conception counseling to mitigate risks. Second, healthcare providers—especially physicians—should receive specialized training in prenatal diagnostics to enable early detection of recessive genetic disorders. Third, culturally sensitive awareness campaigns should be developed to educate families with strong endogamous traditions about the potential health risks associated with CUs. In addition, integrating genetic risk education into school/college curricula could empower younger generations to make informed decisions about marriage and reproduction. To track long-term trends, longitudinal surveillance should be established in Jhelum and other high-prevalence regions to monitor CU rates and their correlation with genetic disease burden. Ultimately, intersectoral collaboration among healthcare professionals, educators, and community leaders is crucial to align cultural practices with public health objectives, thereby ensuring sustainable and respectful health promotion strategies.

This study may have the following limitations. As in other epidemiological studies, recall biases may be present in the self-reported data in this study. The study had a sampling imbalance across tehsils, which may have influenced the representativeness of the results. Nevertheless, we applied sampling weights in our analyses, which likely minimized the potential biases from non-representativeness. The recruitment of urban participants primarily from hospitals, educational institutions, and community centers may have introduced potential selection bias. In certain areas, convenience-based sampling was adjusted for the availability of participants, which may have introduced possible logistical bias. Furthermore, this study does not report the fertility record of the respondents. In addition, the impact of CUs on reproductive outcomes, morbidity, and congenital anomalies is not reported here. Nonetheless, the findings of this study may not apply to areas with lower consanguinity rates.

## 5. Conclusion

This study investigates the dynamics of CUs in various bio-demographic variables of the Jhelum population. This study revealed that seven variables (i.e., extended family type, husband's occupation, wife's literacy level,

caste system, parental consanguinity, reciprocal marriage, and matrimonial distance) were significant predictors of consanguinity. The rate of CUs declined over time, and the younger generation shows lower CU rates than the older generation. It is recommended to launch proactive public health measures to sustain and accelerate the decline of consanguinity, particularly by engaging communities, promoting awareness, and integrating genetic services into primary healthcare frameworks. It is anticipated that other populations in Pakistan will witness a gradual decline in consanguinity, especially in economically developing areas, although the pace and extent of this change may vary regionally due to cultural traditions, levels of development, and rural–urban differences.

## Acknowledgments

The authors extend their gratitude to the participants for their voluntary participation in this study.

## Funding

None.

## Conflict of interest

The authors declare that they have no competing interests.

## Author contributions

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*Formal analysis:* All authors

*Investigation:* Sajid Malik

*Methodology:* Sajid Malik

*Project administration:* Sajid Malik

*Resources:* Sajid Malik

*Software:* Sajid Malik

*Supervision:* Sajid Malik

*Validation:* Saif Ullah, Sajid Malik

*Visualization:* Saif Ullah, Sajid Malik

*Writing–original draft:* All authors

*Writing–review & editing:* All authors

## Ethics approval and consent to participate

This study was approved by the Ethical Review Committee of Quaid-i-Azam University, Islamabad, Pakistan (Approval no.: DAS-19, July 3, 2019). Verbal consent was obtained from each subject before participation in data collection.

## Consent for publication

Verbal consent was obtained from the participants to publish their data.

## Availability of data

The data are available from the corresponding authors on reasonable request.

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## RESEARCH ARTICLE

## Income and employment: Evidence from the Indonesian transmigration program

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## Abstract

The transmigration program, first implemented during the colonial era, became one of the biggest international population transfers in history. It aimed to mitigate Java's population burden and promote regional economic expansion away from the island. Although prior literature has often judged the program as ineffective, these findings remain unclear due to their heavy reliance on qualitative assessments and field observations. Additionally, some transmigration villages experienced changes in their employment structures, mainly due to regional trade with neighboring settlements. In this study, the transmigration program is quantitatively examined and evaluated by comparing the income and employment structures of transmigrants who remained with those who chose to leave. Covariate variables were included to explain the factors causing changes in income. A difference-in-difference ordinary least squares and panel data random-effect regression were employed to analyze income changes at the individual level. The sample consisted of 284 individuals who moved between Indonesian Family Life Survey Waves 1, 2, and 3, explicitly citing transmigration as their motivation. This observed gap can be explained by the covariates in each model, highlighting factors such as marital status. The program's success varied among regions and was also influenced by specific conditions within transmigration settlements.

**Keywords:** Transmigration; Income; Employment change; Indonesia; Labor force**\*Corresponding author:**Padang Wicaksono  
(w\_padang@ui.ac.id)**Citation:** Wicaksono, P., Akbar, P.N.G. & Ahmad R. (2026). Income and employment: Evidence from the Indonesian transmigration program. *International Journal of Population Studies*. 12(1):81-90. <https://doi.org/10.36922/ijps.7082>**Received:** December 5, 2024**1st revised:** May 5, 2025**2nd revised:** May 23, 2025**3rd revised:** May 29, 2025**Accepted:** June 6, 2025**Published online:** July 4, 2025**Copyright:** © 2025 Author(s). This is an Open-Access article distributed under the terms of the Creative Commons Attribution License, permitting distribution, and reproduction in any medium, provided the original work is properly cited.**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## 1. Introduction

Transmigration has long been recognized as one of the world's largest state-organized internal population resettlement programs. In Indonesia, the transmigration program aimed to redistribute the population from densely populated islands—particularly Java, Madura, and Bali—to less populated regions such as Sumatra, Kalimantan, and Sulawesi (Legiani *et al.*, 2018; Rustiadi & Junaidi, 2011). This large-scale movement was not only seen as a development initiative to reduce demographic pressure but also as a political tool to foster national integration and unity across Indonesia's diverse ethnic and cultural landscape.

While the government's early rationale emphasized equitable development and economic opportunity, recent literature suggests that the long-term socioeconomic

outcomes of transmigration have varied. Early assessments, such as those by Davis & Garrison (1988), critiqued the program's overreliance on agricultural settlement schemes and its underestimation of regional diversity. Later studies (Laquian, 1982; Murtisari *et al.*, 2022) emphasized that the effectiveness of transmigration varied significantly depending on local governance, market access, and social integration. Although several transmigrant settlements, such as Kota Mubagu, Parigi, and Pringsewu, evolved into economic hubs, others struggled with underemployment, limited infrastructure, and intergroup tensions (Barter & Côté, 2015; Wuryani *et al.*, 2020).

At the same time, internal labor migration has been widely studied as a driver of economic mobility in developing countries. Migration decisions are often influenced by the expectation of higher income and better job opportunities (Borjas *et al.*, 1992; Kennan & Walker, 2011). Panel data studies, including those by Yuliadi & Raharja (2020) and Jia *et al.* (2022), have demonstrated that internal migration—particularly when voluntary or opportunity-driven—can improve individual welfare through better labor market matching and access to non-agricultural employment.

While these studies have provided valuable insights, there remains limited empirical evidence capturing the long-term economic trajectories of transmigrants using rigorous panel data analysis (Bazzi *et al.*, 2016; Khandker *et al.*, 2010). In particular, very few studies have systematically examined differences between transmigrants who remain in their assigned settlements (“stayers”) and those who relocate elsewhere after resettlement (“movers”), despite evidence that mobility plays a critical role in shaping migrant outcomes (Borjas *et al.*, 1992; Jia *et al.*, 2022; Kennan & Walker, 2011). Moreover, much of the existing research overlooks how income and employment outcomes are conditioned by demographic and labor characteristics, such as education level, employment type, and marital status—factors widely recognized in labor economics as key determinants of earnings (Boraas, 2003; Fujii & Hawley, 1991; Hardy & Marcotte, 2020; Mincy, 2009).

Within this context, the present study seeks to advance a more robust and nuanced understanding of the long-term economic impact of Indonesia's transmigration programs. To achieve this aim, the study addresses the following research questions:

- (i) How does income differ between stayer and mover transmigrants? This question includes an analysis of how location choice—remaining in or moving from the resettlement area—affects income outcomes
- (ii) What individual and contextual factors affect changes in income and employment among transmigrants? This

question encompasses a range of sociodemographic and labor-related characteristics, including gender, employment type, educational background, and marital status, all of which are theorized to influence economic adaptation and labor market integration.

Using four waves of individual-level data from the Indonesian Family Life Survey (IFLS), this study evaluates how income and employment patterns evolve among transmigrants. It contributes to the literature in three key ways. First, it applies a panel-data difference-in-differences (DiD) approach—complemented by random-effects (RE) models—to assess income changes over time. Second, it distinguishes between different transmigrant trajectories by comparing stayers and movers, shedding light on the role of spatial mobility in economic adaptation. Third, it incorporates relevant demographic and labor-market covariates to explain variation in income outcomes, offering a comprehensive empirical account of transmigrant welfare.

## 2. Data and methods

### 2.1. Data sources

The study employs a quantitative methodology, relying primarily on secondary data sourced from the IFLS waves of 1993, 1997, 2000, and 2007. The final wave of data, IFLS 2014, is excluded from this study due to the belief that the impact of the DiD approach would have dissipated by that time due to the influence of other income-related factors. The chosen time frame for analysis spans from 1997 to 2000. This study employs earnings, wages, and salaries as measures of income, while job status is ascertained using the IFLS questionnaire.

The IFLS questionnaire contains all the mentioned pertinent data. This questionnaire is part of an ongoing longitudinal survey in Indonesia, which is being conducted by the RAND Corporation, an American global policy think tank. The survey is being carried out in collaboration with the Demographic Institute of the Faculty of Economics and Business, University of Indonesia, Population Research Center, and Center for Population and Policy Studies, both at the University of Gadjah Mada. The provided sample encompasses approximately 83% of the Indonesian population, with over 30,000 individuals residing in 13 regions across Indonesia. The initial data collection for the IFLS commenced in 1993, while the most recent data collection was conducted in 2014. The IFLS encompasses a total of five waves of data.

The IFLS dataset offers several advantages as a panel data source. It maintains longitudinal records of individuals over multiple years, utilizing a person identification system. Notably, a significant proportion of the individuals

observed in IFLS1 were effectively followed and included in subsequent waves of data collection, such as IFLS5. In addition to the panel data's comprehensiveness, the IFLS questionnaires are also highly detailed, encompassing a wide range of household characteristics and variables. For instance, within the context of this study, they include questions on individuals' employment status.

The IFLS questionnaire assessed individual-level income by aggregating responses to questions posed in Book III, namely in section TK, which pertains to employment (IFLS-3, 2000). These questions inquired about salary, income, and wages. The degree of education was determined by referencing Book III, section DL, which pertains to education (IFLS-3, 2000). Gender information was obtained from Book I, section AR, which focuses on the household roster (IFLS-1, 1995). Lastly, marital status was attained from Book I, section AR, which also covers the household roster (IFLS-1, 1995).

The IFLS is a nationally representative longitudinal dataset covering over 30,000 individuals across 13 provinces, representing approximately 83% of the Indonesian population. For this study, we focused on a subsample of 284 individuals who explicitly reported transmigration as their primary reason for relocation during IFLS Waves 1 – 3. While this sample size may appear small, such focused filtering is necessary to isolate transmigrants from other migrant types and has precedent in prior migration studies using IFLS data (Yuliadi & Raharja, 2020). We acknowledged this as a limitation and discussed its implications in the final section of this paper.

## 2.2. Measurements

The process of variable operationalization involves providing a detailed description of each dependent and independent variable utilized in the model.

### 2.2.1. Dependent variable

The sole dependent variable utilized in this study is "logIncome," which represents the logarithm of the monthly income earned by household members during their employment in a certain occupation, measured in Rupiah. In addition, it is important to note that the data from the IFLS may not fully capture all income due to potential gaps within the samples. It is worth mentioning that the concept of income in this context includes both gross income and net profit derived from entrepreneurial endeavors, along with income generated through assets such as rental properties. Income data were collected to analyze the effects of specific independent variables and to examine the influence of dummy independent variables on income levels.

### 2.2.2. Independent variables

There are three independent variables based on the conditions of the treated and control groups, with the main independent variable of interest being the interaction term, which captures the average treatment effect (ATE).

- (i) Time period: A dummy variable that takes the value of 0 for the pre-treatment period and 1 for the post-treatment period, with the post-treatment years defined as 2000 and 2007
- (ii) Treatment: A dummy variable that takes the value of 0 for the comparison group and 1 for the treatment group, defined as individuals from the transmigrant group who moved away from their original settlement—for example, those whose *Kode Kecamatan* (sub-district code) in 2007 differs from that in 2000
- (iii) Interaction term: An interaction term representing the product of the time period and treatment group variables, which captures the ATE in the DiD framework.

### 2.2.3. Control variables

The control variables (covariates) in the regression model were selected based on their theoretical and empirical relevance in explaining income variation among migrants, particularly in the context of labor market outcomes. These variables are commonly used in labor and migration economics (Fujii & Hawley, 1991; Hardy & Marcotte, 2020; Mincy, 2009), and their inclusion allows us to control for key demographic and socioeconomic differences that might confound the effect of transmigration on income. We also acknowledge the potential omission of unobserved contextual variables, such as regional infrastructure quality or community-level support systems, which are not fully captured in the IFLS dataset.

The control variables or covariates were employed to explain the variation in income differences. Four covariates were used, namely education level, gender, employment status, and marital status. Their inclusion is supported by existing literature identifying these as factors affecting income.

- (i) Education level: This variable identified the education level of the household member to understand whether there is an effect of education level among transmigrants. As there are numerous educational levels, this study classified the educational levels into elementary, junior high school, senior high school, and college and university. In general, educational level attainment is linear with higher income (Hardy & Marcotte, 2020), but as previously discussed in the literature review, it is not necessarily the case among transmigrants

- (ii) Gender: The transmigrant variable described here is a dummy variable indicating the household head's gender (male or female). Gender is widely cited as one of the sources of gaps in household income and earnings (Boraas, 2003). Thus, including this variable allows for analysis of whether significant income gaps exist between male and female transmigrants
- (iii) Employment status: The employment status was identified through questions on the jobs of the household members. The employment activities listed in the IFLS are unpaid family worker, self-employed, self-employed with unpaid family worker/temporary worker, self-employed with permanent worker, government worker, private worker, casual worker in agriculture, and casual worker not in agriculture. The use of employment status here was based on Fujii & Hawley (1991), where they analyzed the determinants of self-employment or wage and salary work
- (iv) Marital status: Marital status was identified through questions on the marital status of the transmigrant (individually), which had five classifications: never married, married, separated, divorced, and widow/widower status. Marital status is cited as one of the indicators of earnings, as previously explained by Mincy (2009).

### 2.3. Analytical methods

To evaluate the income dynamics among transmigrants, this study employed two main econometric approaches: DiD ordinary least squares (OLS) regression and panel RE regression. These models were selected to capture both the ATE of mobility and control for unobserved heterogeneity across individuals over time.

The DiD approach estimates the causal effect of migration (post-initial transmigration) by comparing income changes between the treatment group (movers) and the comparison group (stayers) before and after the observation period. This method allows for the control of time-invariant confounding variables and isolates the income effect attributable to spatial mobility. The interaction term between the treatment group and time period (post) was interpreted as the ATE.

In addition, panel RE regression was employed to address unobserved heterogeneity that may be correlated with individual-specific effects but assumed uncorrelated with the explanatory variables. This model leverages the panel structure of the IFLS data by accounting for repeated observations across waves for the same individuals.

Both the OLS and RE models were estimated with and without covariates. Covariates included gender, education level, employment status, and marital status—variables

theoretically associated with labor market outcomes and income variation. Robust standard errors were reported to address potential heteroskedasticity and serial correlation. Both the OLS and RE regression models were estimated with and without covariates. The covariates included gender, education level, employment status, and marital status—variables commonly associated with labor market outcomes and income variability. Descriptive statistics (mean, standard deviation, minimum, and maximum) were presented for key variables to summarize the distribution and central tendencies of the dataset. The statistical significance of estimated coefficients was evaluated using *t*-tests. A *p*-value threshold of 0.05 was considered statistically significant, with levels of significance reported as follows:  $p < 0.01$ ,  $p < 0.05^*$ , and  $p < 0.1$ . To address potential issues of heteroskedasticity and serial correlation, robust standard errors were applied in all model specifications.

All statistical analyses were conducted using Stata 16.1, a widely adopted software for panel data econometrics. Data management and cleaning procedures were also performed in Stata, ensuring consistency in variable coding and treatment group classification across waves. The combination of these analytical techniques provided a rigorous framework for assessing the income trajectories of transmigrants and the economic implications of post-transmigration mobility decisions.

## 3. Results

### 3.1. Descriptive analysis

Based on the data analysis conducted using three waves of the IFLS spanning from 1993 to 2000 (excluding 2007 due to limited variables for comparison), a total of 284 individuals were identified as having moved for transmigration. Notably, these individuals were mutually exclusive in identifying transmigration as their reason for moving.

Figure 1 shows the spatial distribution of transmigrants' origin and settlement regions across Indonesia. It situates the geographic focus of the study by highlighting major locations involved in the transmigration program. As mentioned earlier, it can be observed that the Lampung province served as the primary source of transmigrants, with the exception of the year 2000. In the year 1993, a notable proportion of individuals, specifically 40%, who indicated transmigration as the primary cause for their resettlement, were from the region of Lampung. In the year 2000, South Kalimantan achieved the highest ranking. The predominant provinces of final settlement for ex-transmigrants in 2007 were Lampung, accounting for 30% of cases, and West Nusa Tenggara, accounting for 25% of cases. In general, it is noteworthy that a significant proportion of transmigrants

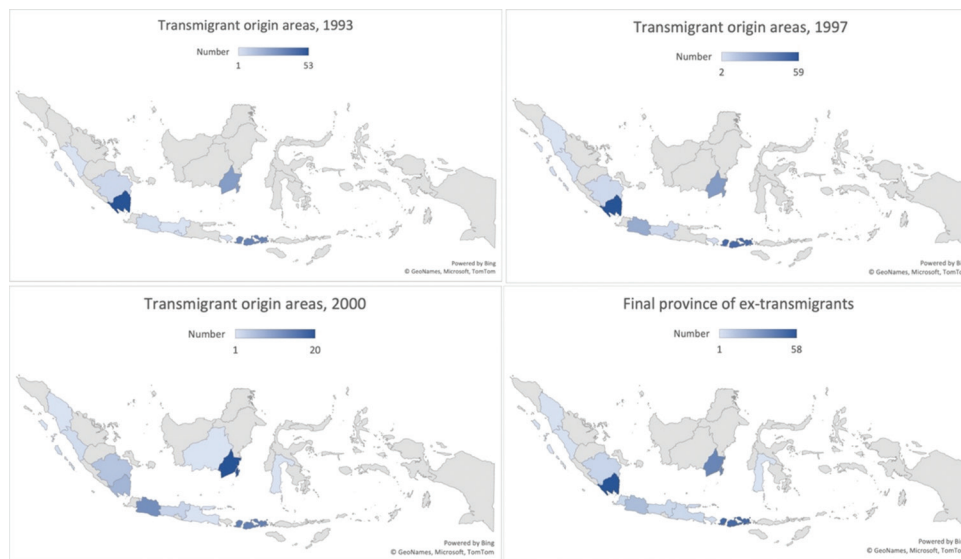


Figure 1. Map of key transmigration origin and destination areas in Indonesia

who settled outside of Java predominantly resided in three specific provinces: South Kalimantan, Lampung, and West Nusa Tenggara. There is a notable prevalence of individuals who have cited transmigration as their reason for residing in the provinces of Java. This phenomenon can potentially be attributed to the presence of returnee transmigrants who have opted to relocate back to their native regions due to adverse circumstances or a lack of suitability in their new settlement places.

Transmigrants were categorized into two distinct categories, namely, the treatment group and the comparison group. The treatment group consisted of transmigrants who had changes in their district codes between 2000 and 2007, referred to as “mover transmigrants.” In contrast, the comparison group comprised transmigrants who remained in the same location throughout the specified time period, known as “stayer transmigrants.” There were 122 and 162 individuals in the treatment and comparison groups, respectively. This implies that a collective count of approximately 122 individuals chose to relocate from their settlement areas throughout the period spanning from 2000 to 2007 due to transmigration.

Further analysis revealed a total of 140 male participants and 142 female participants. In the comparison group, there were 84 male participants and 76 female participants, while the treatment group consisted of 56 male participants and 66 female participants. The overall number of observations was limited to 282 due to the presence of two samples that lacked gender information. Therefore, it can be asserted that the sample exhibited an equal distribution of both male and female participants.

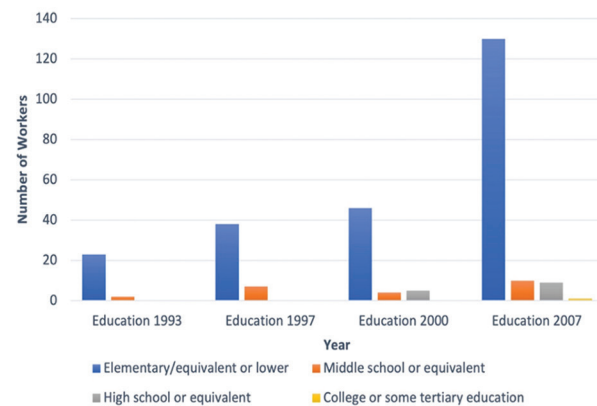


Figure 2. Education level

The majority of the samples across all series possessed an educational background that was limited to elementary school/equivalent or lower (Figure 2). This aligns with previous research as discussed by Todaro (1980), which indicated that a significant number of rural populations in Asia during that period were characterized as landless farmers with limited access to formal education. Hence, as previously elucidated, it is verifiable that a significant proportion of transmigrants have limited educational qualifications, including landless farmers who were selected for relocation from Java. Nevertheless, during the course of the year, there has been a steady rise in the proportion of individuals pursuing higher education, which aligns with the growing population of Indonesia. This trend is reflected in the increasing number of individuals graduating from middle school or attaining higher levels of education on an annual basis.

In relation to an individual's employment status, there are eight distinct classifications. These included self-employment, self-employment with unpaid family labor or temporary work, self-employment with permanent employment, government employment, private sector employment, casual employment in the agricultural sector, and casual employment outside of the agricultural sector (Figure 3). According to the descriptive statistics, a significant proportion of the transmigrants ultimately transitioned into self-employment and unpaid family labor as their primary job statuses. The existing literature posits that individuals residing in transmigration areas often exhibit a preference for entrepreneurship over time due to their interactions with neighboring regions and settlements. This inclination can be attributed, in part, to the challenges associated with unsustainable agricultural practices and adverse environmental circumstances.

In terms of marital status, a significant proportion of transmigrants reported being married, whereas a small minority indicated that they were unmarried. The existing body of literature presents conflicting findings regarding the impact of marital status on migration income. Some studies suggest that marriage can facilitate career advancement for men, leading to increased income. However, it is also

argued that marriage, particularly when followed by childbirth, may lead both parents to prioritize child-rearing responsibilities, temporarily setting aside their careers.

The dependent variable, as observed in the data from 1993, exhibited a range of logIncome values for transmigrants spanning from 3.4 to 11.51, with an average of 6.09 (Table 1). Although initially appearing unclear, a cursory examination of the table revealed a consistent upward trend in the mean income from 1993 to 2007, culminating in a value of 15 in 2007, accompanied by a minimum income level above that of preceding years. The numerical data shown in this observation is not mutually exclusive, as it represents the number of individuals who have indicated transmigration as their motive for relocation in each respective year.

The rise in income over time may be linked to two factors: macroeconomic conditions and improvements in the settlements of transmigrants, which have enhanced the welfare of these individuals. The increase in a region's economy is accompanied by a corresponding rise in the overall well-being of its inhabitants, as measured by income. This phenomenon can be attributed to the sustained expansion of income levels.

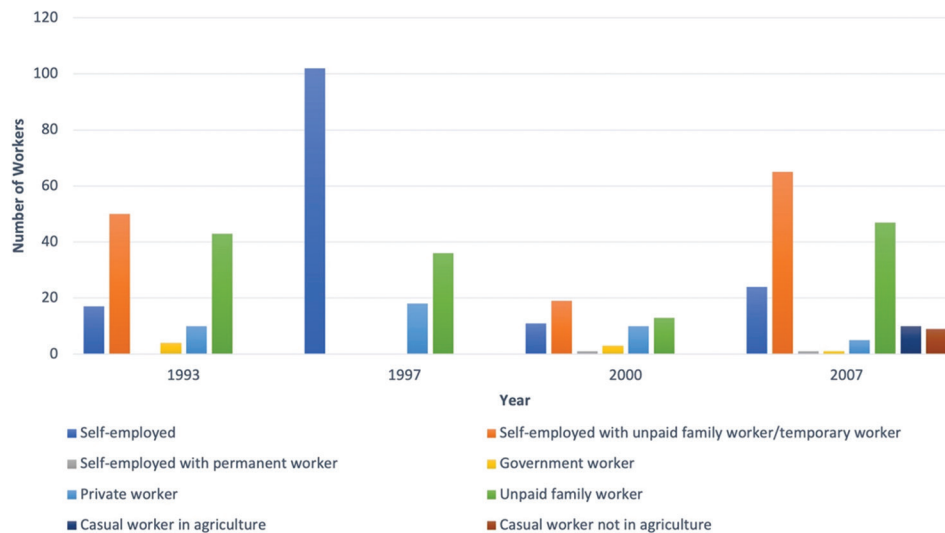


Figure 3. Employment status

Table 1. Summary of log income by survey wave

Variable (logIncome)	Observation	Mean	Standard deviation	Minimum value	Maximum value
1993	83	6.092745	1.297978	3.401197	11.51292
1997	116	13.40288	1.182768	9.21034	17.37086
2000	44	14.07959	1.409223	10.30895	15.95558
2007	119	15.16026	1.382513	11.0021	18.064

3.2. Regression analysis

Table 2 displays the findings of an analysis conducted on individual income levels. The regression analysis was performed for each model, both with and without the inclusion of covariates. The DiD effect was estimated using two methods: OLS regression and panel RE regression.

The charts without covariates displayed the initial disparity between the treated and comparison groups prior to and following the intervention period. Conversely, the data with covariates incorporated variables that are hypothesized to influence the ATE within the model.

The regression analysis presented in Table 2 demonstrates an individual-level OLS regression without covariates. The findings indicate that the DiD estimate between the treatment group and the control group is 1.939. This suggests that the treated group exhibits a statistically significant 1.939-point increase in income compared to the control group. The numerical value is derived by applying the formula in Equation I:

$$(PostTreatment-PreTreatment) - (PostComparison-PreComparison) \tag{I}$$

which yields a statistically significant increase of 1.9 points in income for the treatment group.

The evaluation of the transmigration policy’s efficacy at the individual level can be expeditiously conducted by juxtaposing the disparities in income between individuals who opted for migration and those who remained in their original location. Upon considering the covariates, the analysis of the DiD table and scatterplot demonstrated a noticeable disparity in income between the treatment group (individuals who relocated) and the comparison

Table 2. Difference-in-difference individual-level regression results without covariates

Variables	Ordinary least squares	Ordinary least squares robust
	logIncome	
Treatment, (SE)	-1.235*** (0.421)	-1.235** (0.538)
Post, (SE)	3.624*** (0.425)	3.624*** (0.398)
Treatment (0) × Post (0), (SE)	0.000 (0.000)	0.000 (0.000)
Treatment (0) × Post (1), (SE)	0.000 (0.000)	0.000 (0.000)
Treatment (1) × Post (0), (SE)	0.000 (0.000)	0.000 (0.000)
Average treatment effect, (SE)	1.939*** (0.628)	1.939*** (0.581)
Constant, (SE)	10.925*** (0.286)	10.925*** (0.362)
Observations	362	362
R <sup>2</sup>	0.380	0.380

Note: Statistical significance determined at \*\*\* p<0.01. Abbreviation: SE: Standard error.

group (individuals who remained) in the years subsequent to the intervention (Table 3). Over the course of the study, a notable divergence became evident between the treatment group and the control group. Specifically, after accounting for confounding variables, it was observed that the treatment group had a statistically significant rise of 1.7 points in income compared to those who remained in the control group.

Within the RE regression, the regression results without covariates showed the same value as the OLS regression, with the ATE amounting to 1.939 points higher for the treated group compared to the control group (Table 4).

Meanwhile, RE regression, including covariates, demonstrated the same value as the OLS regression, with an ATE value of 1.74 (Table 5). This indicated that the treated group had a 1.74-point higher income compared to the control group.

Table 3. Difference-in-difference individual-level regression results with covariates

Variables	Ordinary least squares	Ordinary least squares robust
	logIncome	
Average treatment effect, (SE)	1.740**, (0.755)	1.740*, (0.936)
Education level		
Middle school, (SE)	0.907, (0.607)	0.907, (0.576)
High school, (SE)	0.709, (0.715)	0.709*, (0.417)
College, (SE)	2.287, (2.520)	2.287***, (0.529)
Employment status		
Unpaid, (SE)	-1.770***, (0.417)	-1.770***, (0.530)
Self-employed, (SE)	-0.510, (2.285)	-0.510, (0.531)
Permanent worker, (SE)	-1.862, (1.181)	-1.862***, (0.671)
Government, (SE)	-0.903, (0.650)	-0.903, (0.706)
Private, (SE)	-1.622, (1.378)	-1.622*, (0.931)
Agriculture, (SE)	-2.011**, (1.001)	-2.011***, (0.737)
Non-agriculture, (SE)	-2.407***, (0.886)	-2.407***, (0.652)
Gender, (SE)	-0.631, (0.458)	-0.631, (0.434)
Marital status		
Married, (SE)	1.125, (2.323)	1.125*, (0.578)
Separated, (SE)	0.635, (3.288)	0.635, (0.864)
Divorced, (SE)	0.062, (2.579)	0.062, (0.744)
Widowed, (SE)	0.792, (2.493)	0.792, (0.988)
Constant, (SE)	10.417***, (2.359)	10.417***, (0.756)
Observations	191	191
R <sup>2</sup>	0.519	0.519

Note: Statistical significance determined at \* p<0.1, \*\* p<0.05, and \*\*\* p<0.01. Abbreviation: SE: Standard error.

**Table 4. Difference-in-difference individual-level regression results without covariates**

Variables	Random effects regression	Random effects regression
	logIncome	
Treatment, (SE)	-1.235***, (0.421)	-1.235***, (0.420)
Post, (SE)	3.624***, (0.425)	3.624***, (0.337)
Treatment (0) × Post (0), (SE)	0.000, (0.000)	0.000, (0.000)
Treatment (0) × Post (1), (SE)	0.000, (0.000)	0.000, (0.000)
Treatment (1) × Post (0), (SE)	0.000, (0.000)	0.000, (0.000)
Average treatment effect, (SE)	1.939***, (0.628)	1.939***, (0.470)
Constant, (SE)	10.925***, (0.286)	10.925***, (0.297)
Observations	362	362
Number of PIDLINK	200	200

Note: Statistical significance determined at \*\*\* $p < 0.01$ .  
Abbreviations: PIDLINK: Person identification; SE: Standard error.

**Table 5. Difference-in-difference individual-level regression result with covariates**

Variables	Random effects regression	Random effects regression
	logIncome	
Average treatment effect, (SE)	1.740**, (0.755)	1.740**, (0.752)
Education level		
Middle school, (SE)	0.907, (0.607)	0.907*, (0.525)
College, (SE)	0.709, (0.715)	0.709*, (0.408)
Middle school, (SE)	2.287, (2.520)	2.287***, (0.504)
Employment status		
Unpaid, (SE)	-1.770***, (0.417)	-1.770***, (0.542)
Permanent worker, (SE)	-0.510, (2.285)	-0.510, (0.527)
Private, (SE)	-1.862, (1.181)	-1.862***, (0.667)
Non-agriculture, (SE)	-0.903, (0.650)	-0.903, (0.703)
Unpaid, (SE)	-1.622, (1.378)	-1.622*, (0.901)
Permanent worker, (SE)	-2.011**, (1.001)	-2.011***, (0.722)
Private, (SE)	-2.407***, (0.886)	-2.407***, (0.658)
Gender	-0.631, (0.458)	-0.631, (0.397)
Marital status		
Married, (SE)	1.125, (2.323)	1.125*, (0.576)
Separated, (SE)	0.635, (3.288)	0.635, (0.810)
Divorced, (SE)	0.062, (2.579)	0.062, (0.733)
Widowed, (SE)	0.792, (2.493)	0.792, (1.044)
Constant	10.417***, (2.359)	10.417***, (0.672)
Observations	191	191
Number of PIDLINK	135	135

Note: Statistical significance determined at \* $p < 0.1$ , \*\* $p < 0.05$ , and \*\*\* $p < 0.01$ .  
Abbreviations: PIDLINK: Person identification; SE: Standard error.

## 4. Discussion

Our findings reinforce and deepen ongoing debates regarding the long-term economic sustainability of Indonesia's transmigration program. Despite substantial government investments in infrastructure and resettlement support, our analysis indicates that transmigration does not consistently lead to sustained income improvements, especially among settlers who remain in their original locations. These results align with prior qualitative studies by Davis & Garrison (1988) and Laquian (1982), which highlight that the success of transmigration in alleviating poverty is highly context-dependent and often hinges on external factors such as access to education and diverse employment opportunities (Murtisari *et al.*, 2022). This suggests that infrastructure development alone is insufficient, as access to human capital, land rights, social networks, and economic resources are critical mechanisms that facilitate long-term income growth.

In contrast, our findings support emerging literature indicating that opportunity-driven or voluntary migration can produce positive economic outcomes. We observed that transmigrants who relocated from their original settlements experienced income gains, aligning with theoretical insights by Borjas *et al.* (1992) and empirical evidence from Yuliadi & Raharja (2020). These results imply that migration serves as an effective mechanism for income equalization, especially when driven by individual agency and access to new economic opportunities. Our dynamic panel analysis further confirms that mobility facilitates economic adaptation, allowing migrants to leverage non-agricultural employment avenues—an idea supported by Jia *et al.* (2022). This underscores the role of internal migration as a strategic response to labor market constraints, enabling individuals to improve their economic standing through relocation.

Our analysis highlights education as a pivotal determinant of income among transmigrants. Higher educational attainment was positively correlated with increased income, supporting prior research (Davis & Garrison, 1988; Laquian, 1982). Education appears to enhance migrants' capacity to access better-paying jobs and adapt to evolving economic circumstances, serving as a key mechanism for upward mobility. Although the statistical significance was more robust with standard error adjustments, these findings underscore the critical role of human capital development in fostering economic resilience within transmigrant communities.

Employment status also significantly influences income disparities. Transmigrants engaged in government, private sector, or self-employment roles tend to earn higher

incomes, reflecting the development of complex social and economic structures within these communities. The prominence of self-employment indicates a transition toward entrepreneurial activities, aligning with regional economic diversification trends observed in the Lampung province (Bank Indonesia, 2022). These findings suggest that the type of employment serves as a key mechanism for income enhancement, mediated by access to labor markets, entrepreneurial capacity, and local economic opportunities.

While gender showed a negative correlation with income, it was not statistically significant, suggesting an evolving gender dynamic within transmigrant settlements. This may reflect a reduction in traditional gender role rigidity, potentially facilitated by the socioeconomic environment of these communities. Such shifts support literature indicating that migration settlements can serve as spaces for socioeconomic restructuring, promoting more equitable participation across genders (Murtisari *et al.*, 2022).

Marital status was a significant predictor of higher income, consistent with Mincy (2009). Married individuals tend to report higher earnings, owing to resource pooling, shared labor responsibilities, and mutual financial support. This underscores the importance of household and family structures as mechanisms that promote economic resilience, where dual incomes and household cooperation facilitate income growth amid changing economic conditions.

Finally, employing an RE regression to account for unobserved heterogeneity, we found that the positive income effect among transmigrants who migrated again (after the initial settlement) remained robust. This indicates that external factors—such as access to employment, education, and migration decisions—are more influential in shaping economic outcomes than individual-specific traits. These insights emphasize the need for policies that extend beyond infrastructure, focusing on expanding access to education, employment opportunities, and social capital, which are vital for fostering sustainable economic development among transmigrants.

## 5. Conclusions

This study investigates the long-term income outcomes of participants in Indonesia's transmigration program, with particular attention to the divergent trajectories of those who remained in their assigned settlements ("stayers") and those who subsequently relocated ("leavers"). The findings indicate that leavers tend to achieve higher income levels over time, suggesting that voluntary post-program migration functions as an adaptive strategy to

overcome structural limitations in initial settlement areas. Furthermore, the analysis reveals a notable occupational transition among transmigrants, with many shifting from agriculture to self-employment in non-agricultural sectors. This trend underscores the dynamic nature of labor market engagement and supports conceptualizations of migration as a process of search and match, whereby individuals reposition themselves to access more remunerative opportunities.

Despite substantial public investment, the outcomes of the transmigration program appear uneven. The limited economic returns observed in certain regions highlight the program's inability to generate uniform income growth across all settlement areas. These results underscore the necessity for more context-sensitive policy frameworks that recognize regional heterogeneity in economic potential, infrastructure, and labor market conditions.

Two key policy implications emerge from this study. First, spatial mobility—particularly when driven by economic agency—can be a crucial mechanism for enhancing long-term welfare. Second, large-scale, top-down interventions like transmigration may produce suboptimal results if they do not account for local constraints and opportunities. Future development strategies should adopt decentralized, region-specific approaches that better align with local capacities and demographic realities.

While this study provides valuable empirical insights, it acknowledges certain limitations, including sample representativeness and unobserved regional effects. Future research should consider employing household-level longitudinal data and multi-level modeling to further explore income determinants and regional interactions, thereby enriching our understanding of transmigration outcomes.

## Acknowledgments

None.

## Funding

This paper was funded by the Vocational Education Program, Universitas Indonesia (Grant no: PKS-11/UN2.F14.DV/HKP.05.01/2024).

## Conflict of interest

The authors declare they have no competing interests.

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## Ethics approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Availability of data

All data analyzed have been presented in the paper.

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<https://doi.org/10.13106/jafeb.2020.vol7.no11.541>

## RESEARCH ARTICLE

## Adverse childhood experiences and myocardial infarction: Analysis of United States Behavioral Risk Factor Surveillance System (BRFSS) data

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### Abstract

Adverse childhood experiences (ACEs) have been linked to an increased risk of disease in adulthood and a range of other negative health outcomes, including cardiovascular disease (CVD). This study aims to build on previous research on ACEs and CVD by investigating the association between ACEs and heart attack or myocardial infarction diagnosis. Our analysis used cross-sectional data from the 2021 Behavioral Risk Factor Surveillance System (BRFSS) annual survey and ACE Module questionnaires. Responses included data from a national sample of 52,492 adults aged 18 years or older in the United States. ACEs value is a composite score of physical, emotional and sexual abuse, household dysfunction, neglect, and other childhood traumas. The study population had a mean number of 1.75 ACEs (SD 2.25), with 61% experiencing at least one ACE and 17% experiencing four or more ACEs. Almost 6% of adults in the sample reported a previous myocardial infarction (5.7%). Multiple logistic regression analysis demonstrated that, after adjusting for a variety of sociodemographic and health covariates, every one-event increase in the number of ACEs was significantly associated with 6% increased odds of myocardial infarction in adulthood (adjusted odds ratio [aOR] = 1.06, 95% confidence interval [CI] = 1.04 – 1.09,  $p < 0.001$ ). Efforts to decrease the incidence of myocardial infarction and reduce cardiac-related mortality in the U.S. should include policies that reduce the occurrence of ACEs and provide resources for adults to address their childhood traumas.

**Keywords:** Adverse childhood experiences; Trauma; Abuse; Neglect; Heart attack; Myocardial infarction; Family; Parent

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**Citation:** Schoeneck, K., & Wong, R. (2026). Adverse childhood experiences and myocardial infarction: Analysis of United States Behavioral Risk Factor Surveillance System (BRFSS) data. *International Journal of Population Studies*. 12(1):91-101.  
<https://doi.org/10.36922/ijps.4328>

**Received:** July 25, 2024

**Revised:** September 14, 2024

**Accepted:** September 20, 2024

**Published online:** October 14, 2024

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### 1. Introduction

Adverse childhood experiences (ACEs) are potentially traumatic events that occur during childhood (Deschênes *et al.*, 2021; Felitti *et al.*, 1998; National Center for Injury Prevention and Control, Division of Violence Prevention, 2023; Rafiq *et al.*, 2020). ACEs may involve physical, emotional, or sexual abuse, household dysfunction due to substance abuse or serious mental illness, forced separation from parents, neglect, exposure to violence and crime in the home or neighborhood, material disadvantage, homelessness, natural disasters, accidents, or injuries (Deschênes *et al.*, 2021; Felitti

*et al.*, 1998; National Children's Alliance, 2023; Wade *et al.*, 2019). ACEs can trigger prolonged stress responses that result in significant biological changes, which can have lasting health consequences in adulthood (Deschênes *et al.*, 2021; Felitti *et al.*, 1998; National Center for Injury Prevention and Control, Division of Violence Prevention, 2023; Rafiq *et al.*, 2020).

A heart attack or myocardial infarction (MI) occur every 40 s, resulting in approximately 805,000 cases annually in the United States (U.S.) (CDC, 2023a). Among these cases, 605,000 are first-time occurrences while 200,000 occur in individuals with a previous MI history (CDC, 2023a). Furthermore, about 20% of heart attacks are "silent," meaning that the individual is not aware of the damage that has occurred (CDC, 2023a). Coronary artery disease (CAD), a form of cardiovascular disease (CVD), is a complete or partial blockage of at least one of the cardiac arteries (CDC, 2023a). CAD is the leading cause of MI in the U.S., with a mean 30-day mortality rate of 13.6% (CDC, 2023a; Mayo Clinic Staff, 2023). Previous epidemiologic studies on cardiovascular disease have found that the duration of traditional risk factors, such as obesity, smoking, high cholesterol, diabetes, and hypertension, among older individuals is a significant factor in the lifetime risk of developing CVD (CDC, 2023a; Sonu *et al.*, 2019). The higher prevalence of CVD reported among older adults may be partially attributed to prolonged exposure to these risk factors (Sonu *et al.*, 2019).

The previous studies have provided evidence for a link between childhood trauma and adult CVD (Bellis *et al.*, 2019; Bertele *et al.*, 2022; Deschênes *et al.*, 2021; Hughes *et al.*, 2017; Iniguez & Stankowski, 2016; Jiang *et al.*, 2019; Morton *et al.*, 2018; Rafiq *et al.*, 2020; Wade *et al.*, 2019). However, the full mechanism behind this association remains unclear, as traditional lifestyle risk factors (e.g., physical activity, body mass index, smoking, and family history of disease) are only partially accountable for this connection (Deschênes *et al.*, 2021; Martín-Higarza *et al.*, 2020; Wade *et al.*, 2019). The cumulative effect of multiple ACEs over time can disrupt the endocrine, metabolic, immune, or nervous systems, and individuals with ACEs are at greater risk of premature mortality with up to a possible 20-year reduction in lifespan (Goddard, 2021; Hughes *et al.*, 2017; Jiang *et al.*, 2019; Martín-Higarza *et al.*, 2020; Rafiq *et al.*, 2020). The previous studies have reported that childhood trauma increases the risk of cancer, respiratory disease, diabetes, autoimmune disease, gastrointestinal symptoms, poor dental health, obesity, and metabolic syndrome (Deschênes *et al.*, 2021; Hughes *et al.*, 2017; Jiang *et al.*, 2019; Martín-Higarza *et al.*, 2020; Rafiq *et al.*, 2020; Wade *et al.*, 2019). ACEs have been associated with premature cellular aging using telomere length

measurements (Wade *et al.*, 2019). Individuals who have experienced ACEs are more likely to have mental health issues as adults, including PTSD, anxiety, depression, bipolar disorder, eating disorders, sleep disturbances, and short sleep durations (Deschênes *et al.*, 2021; Ford *et al.*, 2017; Giano *et al.*, 2020; Hughes *et al.*, 2017; Jiang *et al.*, 2019; Lin *et al.*, 2021; National Center for Injury Prevention and Control, Division of Violence Prevention, 2023; Wade *et al.*, 2019). The relationship between childhood trauma and worse physical and mental outcomes in adulthood has been observed across low-, middle-, and high-income countries (Bellis *et al.*, 2019; Hughes *et al.*, 2017; Martín-Higarza *et al.*, 2020).

Research has also indicated that ACEs can alter neural circuitry and its responsivity to rewards, resulting in poorer emotion regulation and low self-control, which increases the likelihood of engaging in health-risk behaviors, such as alcohol abuse (Deschênes *et al.*, 2021; Ford *et al.*, 2017; Goddard, 2021; Hughes *et al.*, 2017; Lin *et al.*, 2021; Martín-Higarza *et al.*, 2020). Individuals with at least four ACEs are particularly vulnerable to experiencing these neural changes (Felitti *et al.*, 1998; Hughes *et al.*, 2017; Rafiq *et al.*, 2020). ACEs in childhood can result in a heightened, lifelong physiological susceptibility to social stress, triggering chronic arousal of the stress response system, and an elevated level of inflammation (Bertele *et al.*, 2022; Goddard, 2021; Lee *et al.*, 2023; Martín-Higarza *et al.*, 2020; Metzler *et al.*, 2017; Morton *et al.*, 2018; Wade *et al.*, 2019). Depressed affect and anger were found to be a stronger mediator for explaining the association between ACEs and ischemic heart disease than traditional lifestyle risk factors (Morton *et al.*, 2018; Wade *et al.*, 2019). Chronic inflammation can result in pathological tissue damage, leading to harmful adaptations in cardiovascular structure and function, therefore accelerating heart disease progression in adults who have experienced childhood trauma (Bertele *et al.*, 2022; Morton *et al.*, 2018; Wade *et al.*, 2019).

In the U.S., about 60% of adults reported having experienced at least one type of ACE, and an estimated 618,000 children were subjected to abuse and neglect in 2020 (National Center for Injury Prevention and Control, Division of Violence Prevention, 2023). The widespread occurrence of ACEs and their long-term impact on health implies that they are a significant and underestimated contributor to estimates for the Global Burden of Disease study (Goddard, 2021; Hughes *et al.*, 2017; Lin *et al.*, 2021; Racine *et al.*, 2020).

The present study aims to build on previous research on ACEs and CVD by investigating the association between ACEs and MI diagnosis. We hypothesized that an increase in ACEs is associated with an increase in the probability

of experiencing an MI, after controlling for traditional MI risk factors.

## 2. Materials and methods

We analyzed data collected from the 2021 Behavioral Risk Factor Surveillance System (BRFSS), a nationwide telephone survey in the U.S. that collects health-related information about risk behaviors, chronic conditions, and the utilization of preventative services. Over 400,000 adults are interviewed by state health departments each year with technical and methodological assistance from the U.S. Centers for Disease Control and Prevention (CDC) (CDC, 2018). The BRFSS includes a standardized core questionnaire and certain states may administer additional optional modules.

The 2021 ACEs Module data includes responses from 16 U.S. states (AL, AR, IA, KS, ME, MS, NV, NH, NJ, NY, ND, OH, OR, SC, VA, and WI) (National Center for Health Statistics, 2023). The BRFSS ACEs Module was updated from 11 questions in 2021 to include two additional items, resulting in 13 questions in total (CDC, 2023b). This increase in the number of ACEs considered in the 2021 BRFSS hinders its ability to be merged or aggregated for analysis with the previous years. For study inclusion criteria, we limited the sample population to people who responded to the ACE Module and were aged 18 years and older, resulting in a sample size of 52,492 adults. A breakdown of the study sample size by state and sex is found in Table A1 (Appendix). All data used for this report are available online ([cdc.gov/brfss](https://cdc.gov/brfss)).

The outcome of interest for this study was a positive or negative MI diagnosis. This variable was defined by how participants answered the BRFSS survey question, "Have you ever been diagnosed with a heart attack or myocardial infarction?" The binary outcomes for the dependent variable were "yes" or "no," indicating a positive or negative MI diagnosis, respectively.

The primary independent variable in this analysis was a participant's number of ACEs. This variable was defined using participant responses to the 13 questions of the 2021 BRFSS ACE Module. We recoded each question into a binary variable with yes or no outcomes consistent with the approach outlined by the U.S. CDC and detailed in Table A2 (Appendix). A continuous ACE variable was created by assigning one point for every question to which a participant responded "yes" in the ACE Module. The values for this variable ranged from 0 (no ACEs) to 13 (all ACEs). The continuous ACE variable was then transformed to have a binary outcome for sensitivity analysis. Outcomes for the binary ACE variable were "less than 4 ACEs" and "4 or more ACEs." The cutoff of four

ACEs was determined using results from previous research using BRFSS data (Felitti *et al.*, 1998; Hughes *et al.*, 2017; Rafiq *et al.*, 2020).

Covariates included in the analysis were selected based on the Mayo Clinic's list of MI risk factors. Factors that increase the risk of MI include age, tobacco use, high blood pressure, high cholesterol, obesity, diabetes, metabolic syndrome, family history of MI, inadequate exercises, unhealthy diet, stress, illegal drug use, history of preeclampsia, and autoimmune condition (Mayo Clinic Staff, 2023). Thus, available covariates selected for adjustment included age, smoking history, high blood pressure, high cholesterol, body mass index (underweight, healthy-weight, overweight, and obese), diabetes, and physical inactivity. A race and ethnicity variable and a sex variable were also included in the analyses. High blood pressure (hypertension), high cholesterol (hyperlipidemia), and diabetes variables were defined based on questions about previous diagnoses of these diseases by a doctor, nurse, or other health professional. These covariates were all recoded into binary variables, with possible response options of "yes" and "no." The age variable was separated into six response categories defined as "18 – 24 years old," "25 – 34 years old," "35 – 44 years old," "45 – 54 years old," "55 – 64 years old," and "65 years and older." Race and ethnicity variable response options were "non-Hispanic white," "non-Hispanic African American," "non-Hispanic other race," "non-Hispanic multiracial," and "Hispanic." Sex variable was defined as a respondent's biological sex, with response options of "male" and "female." BMI was calculated based on participant response to questions about approximate height and weight without shoes, using the formula:  $BMI = \text{Weight} / (\text{height} * \text{height})$ . The BMI variable was then broken into four categories defined as, "underweight" or  $BMI < 18.5$ , "healthy weight" or  $18.5 \leq BMI < 25$ , "overweight" or  $25 \leq BMI < 30$ , and "obese" or  $BMI \geq 30$ . Physical inactivity variable was defined based on respondent's answer to the question, "During the past month, other than your regular job, did you participate in any physical activities or exercises?" Possible response options were "yes" or "no." Smoking history was also evaluated as a binary yes-or-no variable and was defined based on respondent's answer to the question, "Have you smoked at least 100 cigarettes in your entire life? (Note: 100 cigarettes = 5 packs)." More detailed information on covariate definitions and recodes can be found in Table A3 (Appendix).

Analyses were conducted using SPSS 28.0 with two-tailed tests and a 0.05 significance level. A *t*-test was used to compare the mean number of ACEs for people with and without an MI diagnosis. Pearson's chi-square tests were used to compare proportional differences of categorical ACE variables between people with and without an MI diagnosis. After adjusting for health and lifestyle covariates,

a multiple logistic regression analysis was utilized to examine if the number of ACEs was associated with MI diagnosis. Multiple logistic regressions were also used to perform sensitivity analyses for the binary version of the ACE measure. The average variance inflation factor (VIF) for the whole regression model was approximately 2.26, indicating no evidence of multicollinearity.

## 3. Results

### 3.1. Sample characteristics

The study population included 52,492 people and sample characteristics are described in Table 1. There were 2976 positive MI diagnoses (5.7%) and 49,278 people without an MI diagnosis (94.3%). The number of people who experienced at least one ACE is 31,960 (61.2%) and 9064 people experienced four or more ACEs (17.3%). The age range of our population skews older, with 61.1% of people being 55 years or older. More females (55.1%) are included in the study than males (44.9%). Most of the study population identifies as non-Hispanic white (81.2%), 10.1% identify as non-hispanic African American, 3.1% identify as non-Hispanic other race, 1.5% identify as non-Hispanic multiracial, and 4.1% identify as Hispanic. The degree of chronic illness for this population includes 43.8% of people with hypertension ( $n = 22,813$ ), 14.4% of people with a diabetes diagnosis ( $n = 7,534$ ), 42.7% of people who have a hyperlipidemia diagnosis ( $n = 19,639$ ), and 35.0% of people with a BMI in the obese category ( $n = 17,181$ ). Less than half the population has smoked five or more packs of cigarettes in their lifetime (41.0%) and one-fourth of people reported physical inactivity (25.1%).

### 3.2. Bivariate analysis

Results from bivariate analyses are included in Table 1. The mean continuous ACE score of people with MI diagnosis (mean = 1.67, SD = 2.21) is lower than that of people without an MI diagnosis by 0.08 adverse events (mean = 1.75, SD = 2.25) and is not statistically significant ( $t[52252] = 1.92, p = 0.055$ ). The association between binary ACEs (4 or more events) and MI diagnosis was also not significant ( $\chi^2[1] = 1.46, p = 0.227$ ). There was a statistically significant relationship between ACE categories (0 – 13) and MI diagnosis ( $\chi^2[1] = 6.58, p < 0.05$ ). Other notable findings included MI diagnosis being higher among people in the overweight (37.8%) and obese (37.8%) categories compared to people in the healthy-weight BMI category (22.7%). There was also a statistically significant relationship between physical inactivity and MI diagnosis ( $\chi^2[1] = 277.3, p < 0.001$ ). MI diagnosis was lower among people without physical activity in the past 30 days (37.9%) compared to people who had physical activity during the previous 30 days (62.1%).

### 3.3. Multiple logistic regressions

The regression model predicting MI diagnosis using the number of ACEs, and respondents' sex, age, race and ethnicity, hypertension diagnosis, hyperlipidemia diagnosis, diabetes diagnosis, BMI, exercise, and smoking history was statistically significant ( $\chi^2[19] = 2750.8, p < 0.001$ ). The regression model correctly predicted 93.7% of the cases, indicating a good model fit. Results from the regression are shown in Table 2.

Controlling for sex, age, race and ethnicity, hypertension diagnosis, hyperlipidemia diagnosis, diabetes diagnosis, BMI, exercise, and smoking history, every one event increase in number of ACEs significantly increases the odds of MI diagnosis by 6% (adjusted odds ratio [aOR]=1.06, 95% CI = 1.04 – 1.09,  $p < 0.001$ ). As age increases, the odds of an MI diagnosis also increase. For example, people that are 55 to 64 years old have significantly increased odds of an MI diagnosis by 16.9 times compared to people aged 18 to 24 years old, all else held equivalent (aOR = 16.88, 95% CI = 4.19 – 68.01,  $p < 0.001$ ). Men had a significant increase in the odds of MI by 108% compared to women, all else held equal (aOR = 2.08, 95% CI = 1.91 – 2.26,  $p < 0.001$ ). People in the obese BMI category had significantly decreased odds of MI by 16% compared to people with a healthy-weight BMI (aOR = 0.84, 95% CI = 0.75 – 0.94,  $p < 0.05$ ). A hypertension, diabetes, or hyperlipidemia diagnosis was associated with significantly increased odds of MI when compared to people without that disease in the study population. Non-hispanic African American people had a significant decrease in the odds of MI by 20% compared to non-Hispanic white people (aOR = 0.80, 95% CI = 0.70 – 0.93,  $p < 0.05$ ).

### 3.4. Sensitivity analysis

Results of the sensitivity analysis with a binary ACEs variable of “<4 ACEs” and “4 or more ACEs” supported the findings from our main analysis. Covariates in the regression model included sex, age, race and ethnicity, hypertension, hyperlipidemia, diabetes, BMI, physical inactivity, and smoking history. Having at least four ACEs significantly increases the odds of MI by 40% compared to people with less than four ACEs (aOR = 1.40, 95% CI = 1.25 – 1.57,  $p < 0.001$ ). Both binary and continuous regression models demonstrated a statistically significant association. Based on this sensitivity analysis, our findings remain robust in that a greater number of ACEs is associated with an increase in the odds of MI.

## 4. Discussion

The findings of our analysis are consistent with the previous studies on the association between ACEs and

Table 1. Sample characteristics

Variable	Whole sample	MI diagnosis		Bivariate test*
		Yes	No	
Sample population (% , n)	52,492	5.7% (2976)	94.3% (49,278)	
Continuous ACEs (mean, SD)	1.75 (2.25)	1.67 (2.21)	1.75 (2.25)	t (52252)=1.92, p=0.055
At least one ACE (% , n)	61.2% (31,960)	58.9% (1754)	61.3% (30,206)	$\chi^2$ (1)=6.58, p<0.050
Four or more ACEs (% , n)	17.3% (9064)	16.5% (492)	17.4% (8572)	$\chi^2$ (1)=1.46, p=0.227
Age (% , n)				$\chi^2$ (5)=1386.7, p<0.001
18 – 24 years old	5.0% (2613)	0.2% (7)	5.3% (2606)	
25 – 34 years old	8.5% (4461)	1.0% (29)	9.0% (4,432)	
35 – 44 years old	11.5% (5991)	2.0% (59)	12.0% (5,932)	
45 – 54 years old	13.8% (7236)	7.0% (207)	14.3% (7,029)	
55 – 64 years old	19.1% (9994)	17.9% (532)	19.2% (9,462)	
65 years and older	42.0% (21,959)	72.0% (2142)	40.2% (19,817)	
Sex (% , n)				$\chi^2$ (1)=301.2, p<0.001
Female	55.1% (28,776)	39.7% (1180)	56.0% (27,596)	
Male	44.9% (23,478)	60.3% (1796)	44.0% (21,682)	
Race and ethnicity (% , n)				$\chi^2$ (4)=61.0, p<0.001
White (non-Hispanic)	81.2% (41,736)	84.8% (2479)	81.0% (39,257)	
Black (non-Hispanic)	10.1% (5208)	8.9% (260)	10.2% (4,948)	
Other race (non-Hispanic)	3.1% (1587)	3.0% (88)	3.1% (1,499)	
Multiracial (non-Hispanic)	1.5% (795)	1.7% (51)	1.5% (708)	
Hispanic	4.1% (2111)	1.5% (45)	4.3% (2066)	
Hypertension (% , n)	43.8% (22,813)	74.6% (2215)	41.9% (20,598)	$\chi^2$ (1)=1217.8, p<0.001
Diabetes (% , n)	14.4% (7534)	34.6% (1029)	13.2% (6505)	$\chi^2$ (1)=1042.0, p<0.001
Hyperlipidemia (% , n)	42.7% (19,639)	68.1% (1923)	41.0% (17,716)	$\chi^2$ (1)=794.9, p<0.001
BMI (% , n)				$\chi^2$ (3)=40.9, p<0.001
Underweight	1.4% (704)	1.7% (49)	1.4% (655)	
Healthy-weight	27.9% (13,680)	22.7% (655)	28.2% (13,025)	
Overweight	35.7% (17,501)	37.8% (1088)	35.5% (16,413)	
Obese	35.0% (17,181)	37.8% (1088)	34.8% (16,093)	
Physical inactivity (% , n)	25.1% (13,074)	37.9% (126)	24.3% (11,948)	$\chi^2$ (1)=277.3, p<0.001
Smoking history (% , n)	41.0% (21,321)	60.3% (1786)	39.8% (19,535)	$\chi^2$ (1)=482.6, p<0.001

Notes: \*Chi-square test for categorical variables and t-test for continuous variables.

Abbreviations: ACE: Adverse childhood experience; BMI: Body mass index; MI: Myocardial infarction.

cardiovascular disease in adulthood. A greater number of ACEs was found to be significantly associated with an increase in odds of MI, only after controlling for various traditional MI risk factors (age, tobacco use, high blood pressure, high cholesterol, obesity, diabetes, and physical inactivity). An analysis performed by Deschênes *et al.* (2021), using ACEs as an ordinal variable demonstrated a dose-response effect for CVD, similar to the one observed in this study for MI diagnosis. A network analysis done by Lee *et al.* (2023) using 2020 BRFSS data similarly found a connection between ACEs and coronary artery disease

later in life for both men and women. Sexual orientation was not found to be significantly associated with MI in our study population [ $\chi^2(4) = 8.48, p = 0.08$ ], and its inclusion as a covariate in the multiple logistic regression model for MI diagnosis did not alter our results. A large increase in odds for older age groups was expected for this outcome, as MI incidence increases with age (CDC, 2023a; Mayo Clinic Staff, 2023).

Efforts to reduce adult incidence of MI and cardiac-related mortality in the U.S. should include policies and programs that address childhood abuse and neglect, and

**Table 2. Multiple logistic regression of association between ACEs and MI diagnosis**

Variable	aOR	p-value	95% CI
Number of ACEs	1.06	<0.001	1.04 – 1.09
Sex			
Female	(Reference)	(Reference)	(Reference)
Male	2.08	<0.001	1.91 – 2.26
Age			
18 – 24 years old	(Reference)	(Reference)	(Reference)
25 – 34 years old	2.97	0.146	0.68 – 12.89
35 – 44 years old	4.48	<0.050	1.09 – 18.45
45 – 54 years old	10.41	<0.050	2.57 – 42.13
55 – 64 years old	16.88	<0.001	4.19 – 68.01
65 years and older	28.52	<0.001	7.09 – 114.78
Race and ethnicity (% , n)			
White (non-Hispanic)	(Reference)	(Reference)	(Reference)
Black (non-Hispanic)	0.80	<0.050	0.70 – 0.93
Other race (non-Hispanic)	1.19	0.169	0.93 – 1.54
Multiracial (non-Hispanic)	1.24	0.204	0.89 – 1.72
Hispanic	0.88	0.453	0.63 – 1.23
Hypertension	1.94	<0.001	1.76 – 2.14
Diabetes	1.89	<0.001	1.72 – 2.07
Hyperlipidemia	1.77	<0.001	1.62 – 1.93
BMI			
Underweight	1.78	<0.001	1.28 – 2.49
Healthy-weight	(Reference)	(Reference)	(Reference)
Overweight	0.91	0.104	0.82 – 1.02
Obese	0.84	<0.050	0.75 – 0.94
Physical inactivity <sup>a</sup>	1.44	<0.001	1.32 – 1.57
Smoking history <sup>b</sup>	1.66	<0.001	1.53 – 1.81

Notes: <sup>a</sup>Reference group comprises people with physical activity in the past 30 days; <sup>b</sup>Reference group comprises people that have smoked <100 cigarettes during their lifetime.

Abbreviations: ACE: Adverse childhood experience; aOR: Adjusted odds ratio; BMI: Body mass index; CI: Confidence interval; MI: Myocardial infarction.

work to improve the resiliency of people with ACEs. Resiliency programs often include trauma-centered care and the development of problem-solving and coping skills (Ford *et al.*, 2017; Goddard, 2021; Hughes *et al.*, 2017; Lin *et al.*, 2021; Whitfield, 1998). Skill development will hopefully lead to a decrease in overall ACEs and diminished consequences for future health outcomes. Resources should also be provided to improve mental health resources for all Americans to deal with the high prevalence of ACEs among adults. Enabling and encouraging people to address childhood traumas could help to decrease the association between ACEs and disease. ACE-related cardiovascular

disease can be further reduced through the implementation of screening tests for cardiometabolic dysregulations in adults with ACEs.

However, there is a concern over the use of the current ACE questionnaire as a screening tool. Anda *et al.* (2020), among others, have highlighted that the ACE score is not an objective standardized measurement and was designed to be a tool for facilitating research, not to screen adults for childhood traumas. Mental health practitioners have also cautioned against universal screening for ACEs, as it may cause retraumatization, especially without trauma-centered follow-up care (Racine *et al.*, 2020). Many researchers have also previously noted the numerous potentially traumatic childhood experiences that are not included in the ACE questionnaire, such as a school shooting or being a victim of bullying (Anda *et al.*, 2020; Finkelhor, 2020; Goddard, 2021; Iniguez & Stankowski, 2016; Lee *et al.*, 2023). Despite these challenges, screening for ACEs should continue due to the association of childhood trauma with adult physical health, and the method should be updated and adapted better to represent the actual burden of ACEs on the public.

Public awareness about the important work of Children’s Advocacy Centers (CACs) should be increased. CACs are level 1 emergency response centers defined by the Children’s Bureau. In 2021, they helped over 380,000 child victims of abuse and offered science-backed counseling and therapy services to more than 200,000 children to help them recover from trauma and avoid the lifelong impacts of abuse (National Children’s Alliance, 2023). CACs also provided abuse prevention education to over 2 million people in 2021 (National Children’s Alliance, 2023). CACs have a coordinated team of experts in various disciplines who hold offenders accountable and help children and families heal comprehensively. They offer specialized evidence-based mental health treatments, case management, forensic interviewing services, forensic medical evaluations, victim advocacy and support, and community education and outreach (National Children’s Alliance, 2023).

There are several limitations of this study that could hinder the strength of our findings. The BRFSS survey design could introduce multiple types of bias that would affect the validity and generalizability of the results. One form of possible bias is selection bias, which may distort the odds ratio analysis if the study population does not accurately reflect the target population. Moreover, the study population was mostly white and non-Hispanic, potentially limiting the generalizability of these findings to other races and ethnicities. Another possible bias is related to non-response, as information on ACEs was only collected in 16 of the 50 states, making it unclear if this

data represents the whole country. In addition, similar to how data were collected in other ACE studies, information about childhood traumas is gathered through self-reporting by the participants, and given the highly sensitive nature of this kind of information, there is probably a high likelihood of under-reporting. The aggregate ACE variable also does not consider the severity, chronicity, or type of ACEs, which can significantly impact the effect of ACEs on an adult's life and health (Lee *et al.*, 2023). Another limitation of this study is that we do not have access to patient medical records and are therefore unable to verify MI diagnosis clinically.

This study supports and strengthens previous research about the relationship between ACEs and cardiovascular disease, by focusing on a singular cardiovascular outcome, MI diagnosis. The covariates used in this analysis are relevant to the likelihood of experiencing an MI and include the most commonly associated risk factors. Information for this study was sourced from the BRFSS, which collects health-related information from adults, improving the reliability and generalizability of these findings. Future research should examine the interaction effects between ACEs and sociodemographics (*e.g.*, age group and sex) to determine their impact on MI incidence.

## 5. Conclusions

Our findings support an association between ACEs as a potential risk factor of MI in adulthood. Due to the growing evidence showing the impact of ACEs on health outcomes and behaviors, the BRFSS should consider integrating the ACE Module into the standard questionnaire to help with collating more data for relevant analyses. Future research on this topic should be carried out with more racially and ethnically diverse populations, as well as with underrepresented groups such as incarcerated or unhoused individuals to gain a better understanding of how people are being impacted by childhood trauma.

## Acknowledgments

None.

## Funding

None.

## Conflict of interest

The authors declare that they have no competing interests.

## Author contributions

*Conceptualization:* All authors

*Formal analysis:* Kelsey Schoeneck

*Investigation:* All authors

*Methodology:* All authors

*Writing – original draft:* All authors

*Writing – review & editing:* All authors

## Ethics approval and consent to participate

This project was determined to be exempt from IRB approval by the Institutional Review Board of Upstate Medical University (project code 2171155-1; date of approval March 7, 2024). Ethical review and approval were waived for this study because it meets IRB exemption category #4(i), identifiable private information or identifiable biospecimens used in this study are publicly available. Patient consent for this study was not required due to the approval of IRB exemption. There was no potential harm inflicted upon subjects, and the data used contain no identifiable information.

## Consent for publication

Not applicable.

## Availability of data

This study uses public data, which can be obtained through the CDC and is publicly available at [www.cdc.gov/brfss/annual\\_data/annual\\_2021.html](http://www.cdc.gov/brfss/annual_data/annual_2021.html).

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Appendix

Table A1. Study sample size by state and sex

State	Female (n, %)	Male (n, %)	Total (n, %)
Alabama	2229 (7.7)	1459 (6.2)	3688 (7.0)
Arkansas	2324 (8.0)	1625 (6.9)	3949 (7.5)
Iowa	3777 (13.1)	3638 (15.4)	7415 (14.1)
Mississippi	2213 (7.7)	1503 (6.4)	3716 (7.1)
Nevada	1027 (3.6)	839 (3.6)	1866 (3.6)
New Hampshire	2810 (9.7)	2174 (9.2)	4984 (9.5)
North Dakota	2395 (8.3)	2440 (10.3)	4835 (9.2)
Oregon	2094 (7.2)	1885 (8.0)	3979 (7.6)
South Carolina	3710 (12.8)	2891 (12.2)	6601 (12.6)
Virginia	3775 (13.1)	3045 (12.9)	6820 (13.0)
Wisconsin	2533 (8.8)	2106 (8.9)	4639 (8.8)
Total (n, %)	28887 (100)	23605 (100)	52,492 (100)

Table A2. Definition and recoding of ACE Module for continuous ACE variable

#	ACE Module questions	Outcome values*	Recoded outcome values
1	“Did you live with anyone who was depressed, mentally ill, or suicidal?”	Yes No	
2	“Did you live with anyone who was a problem drinker or alcoholic?”	Yes No	
3	“Did you live with anyone who used illegal street drugs or who abused prescription medications?”	Yes No	
4	“Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?”	Yes No	
5	“Were your parents separated or divorced?”	Yes No Parents not married	(Yes) → Yes (No, Parents not married) → No
6	“How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?”	Never Once More than once	(Once, More than once) → Yes (Never) → No
7	“Not including spanking, (before age 18), how often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Was it—...”	Never Once More than once	(Once, More than once) → Yes (Never) → No
8	“How often did a parent or adult in your home ever swear at you, insult you, or put you down?”	Never Once More than once	(Once, More than once) → Yes (Never) → No
9	“How often did anyone at least 5 years older than you or an adult, ever touch you sexually?”	Never Once More than once	(Once, More than once) → Yes (Never) → No
10	“How often did anyone at least 5 years older than you or an adult, try to make you touch them sexually?”	Never Once More than once	(Once, More than once) → Yes (Never) → No
11	“How often did anyone at least 5 years older than you or an adult, force you to have sex?”	Never Once More than once	(Once, More than once) → Yes (Never) → No

(Cont'd...)

**Table A2. (Continued)**

#	ACE Module questions	Outcome values*	Recoded outcome values
12	“For how much of your childhood was there an adult in your household who made you feel safe and protected? Would you say never, a little of the time, some of the time, most of the time, or all of the time?”	Never A little of the time Some of the time Most of the time All of the time	(Never, A little of the time) → Yes (Some of the time, Most of the time, All of the time) → No
13	“For how much of your childhood was there an adult in your household who tried hard to make sure your basic needs were met? Would you say never, a little of the time, some of the time, most of the time, or all of the time?”	Never A little of the time Some of the time Most of the time All of the time	(Never, A little of the time) → Yes (Some of the time, Most of the time, All of the time) → No

Notes: \*All questions also included “Don’t know/Not sure” and “Refused” answer options; these values were coded as missing.  
Abbreviation: ACE: Adverse childhood experience.

**Table A3. Definition and recoding of covariates**

Covariate	BRFSS variable label	Outcome values*	Recoded outcome values
Age	Age of respondent	18 – 24 years old; 25 – 34 years old; 35 – 44 years old; 45 – 54 years old; 55 – 64 years old; 65+years old	
Gender	Sex of respondent	Male; Female	
Race and ethnicity	Five-level race/ethnicity category	Non-Hispanic White; Non-Hispanic Black; Non-Hispanic other race; Non-Hispanic multiracial; Hispanic	
High blood pressure	Have you ever been told by a doctor, nurse or other health professional that you have high blood pressure?	Yes; Yes, but female told only during pregnancy; No; Told borderline high or pre-hypertensive or elevated blood pressure	(Yes) → Yes (Yes, but only during pregnancy; No; Told borderline high or pre-hypertensive or elevated blood pressure) → No
High cholesterol	Have you ever been told by a doctor, nurse or other health professional that your cholesterol is high?	Yes No	
Diabetes	Ever told you had diabetes?	Yes; Yes, but female told only during pregnancy; No; No, pre-diabetes or borderline diabetes	(Yes) → Yes (Yes, but female told only during pregnancy; No; No, pre-diabetes or borderline diabetes) → No
BMI	Four-categories of BMI	Underweight Healthy-weight Overweight Obese	
Physical inactivity	During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?	Yes No	
Smoking history	Have you smoked at least 100 cigarettes in your entire life? - Note: 5 packs=100 cigarettes	Yes No	

Notes: \*All questions also included “Don’t know/Not sure” and “Refused” answer options; these values were coded as missing.  
Abbreviations: ACE: Adverse childhood experience; BMI: Body mass index; BRFSS: Behavioral Risk Factor Surveillance System.

## RESEARCH ARTICLE

## The impact of layoffs on dietary and drinking behaviors across the life course: Evidence from China (1989 – 2011)

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## Abstract

Existing research on the health impact of job loss has predominantly focused on developed economies, often overlooking how these effects manifest in developing countries, particularly over the long term. To address this gap, our study explores the impact of layoffs on dietary diversity and alcohol consumption among workers during China's economic transitions from 1989 to 2011. Using longitudinal data from the China Health and Nutrition Survey spanning over two decades and applying fixed-effects models, we analyzed the temporal and career-stage-specific effects of job loss. Our results indicate that layoffs led to a significant reduction in dietary diversity, a key indicator of dietary quality and food insecurity, with the effect being most pronounced shortly after job loss and tapering off over time. In contrast, alcohol consumption increased following layoffs. Mid-career workers experienced the greatest decline in dietary diversity, late-career workers faced increased risks of alcohol consumption, and early-career workers were more likely to engage in heavy drinking. These findings highlight the complex interplay between financial constraints, psychological stress, and lifestyle choices. This study highlights that layoffs adversely affect workers at all career stages, though the specific health behaviors impacted differ by career stage. Our findings provide valuable evidence for the development of policies and interventions tailored to different worker groups and offer insights into the dynamics of transitional and post-transitional China.

**Keywords:** Layoff; Dietary diversity; Drinking behavior; Heavy drinking behavior; Life-course approach; State-owned enterprises; China

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**Citation:** Song, Q., Lim, E., Zhang, N.J., & Friedman, E.M. (2026). The impact of layoffs on dietary and drinking behaviors across the life course: Evidence from China (1989 – 2011). *International Journal of Population Studies*. 12(1):102-116.  
<https://doi.org/10.36922/ijps.3937>

**Received:** June 13, 2024**Revised:** October 26, 2024**Accepted:** December 4, 2024**Published online:** December 23, 2024

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**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## 1. Introduction

In recent decades, workers have increasingly faced the risk of involuntary job loss, such as layoffs, a trend exacerbated by the coronavirus disease 2019 pandemic, particularly in less developed countries (Bottan *et al.*, 2020; Kalleberg, 2009; Standing, 2011). Job loss can cause financial strain and trigger a stress process marked by loss of identity, anxiety, and social and psychological strain (Fiori *et al.*, 2016; Pearlin *et al.*, 1981). The

detrimental effects of layoffs on physical health outcomes, such as worsened self-rated health, cardiovascular diseases, and accelerated mortality, are well-documented (Baumann, 2015; Brand *et al.*, 2008; Burgard *et al.*, 2007; Gallo *et al.*, 2004; Jahoda *et al.*, 1971; Newman, 1988; Sullivan & von Wachter, 2009). However, the specific mechanisms through which being laid-off “gets under the skin” vary across contexts and remain unclear (Brand *et al.*, 2008). One potential mechanism involves engagement in unhealthy behaviors, such as excessive drinking and poor diet, which may change after layoffs due to coping strategies or as a result of financial strain. Health behaviors are therefore critical for understanding how layoffs affect individual health (Nizalova & Norton, 2021). Examining these behaviors in both the short and long term and across different life and career stages, provides an opportunity to assess how the economic and psychosocial effects of job loss unfold over the life course. This investigation, in turn, can inform policies and interventions aimed at supporting those most adversely affected by layoffs.

Empirical evidence regarding the effect of job loss on health behaviors has primarily come from high-income countries, focusing on issues such as heavy drinking (Golden & Perreira, 2015; Khlal *et al.*, 2004; Mossakowski, 2008; Schunck & Rogge, 2010; Virtanen *et al.*, 2008). Studies from the United States and Northern and Western Europe link unemployment with heavy drinking, while job loss in France and Germany is associated with smoking and psychoactive drug use (Khlal *et al.*, 2004; Mossakowski, 2008; Schunck & Rogge, 2010; Virtanen *et al.*, 2008). Interestingly, some evidence from the Organization for Economic Co-operation and Development countries suggests that unemployment can, in certain cases, promote health-enhancing behaviors due to increased discretionary time, leading to more physical activity and reduced consumption of alcohol and cigarettes (Catalano *et al.*, 2011; Leino-Arjas *et al.*, 1999; Ruhm, 2005).

However, the overwhelming focus on high-income countries overlooks the impact of job loss in middle- and low-income countries, which often lack robust social welfare systems, such as food stamps, to mitigate adverse effects. In these countries, with their unique economic and social contexts, health behaviors in response to job loss may differ. For instance, the absence of a public safety net could lead to significant changes in health behaviors, including dietary diversity – a key indicator of overall dietary quality and food insecurity (Verger *et al.*, 2021).

## 1.1. Present study

This research aims to bridge the gap by evaluating how job loss affects eating and drinking behaviors, specifically

dietary diversity and alcohol consumption, in the context of transitional China from 1989 to 2011. This study is among the first to investigate the impact of involuntary job loss on dietary diversity. In many developing countries, dietary diversity is a key component of dietary quality and a general indicator of food security (Verger *et al.*, 2021). Poor dietary diversity is linked to malnutrition, increased cardiovascular risk, mental health problems, cognitive decline, and accelerated mortality (Azadbakht *et al.*, 2006; Chen *et al.*, 2011; Huang *et al.*, 2015; Nithya & Bhavani, 2017; Otsuka *et al.*, 2016; Rathnayake *et al.*, 2012; Rawat *et al.*, 2013). Alcohol consumption is generally associated with a variety of adverse health outcomes, including various types of cancer, metabolic syndrome, and mortality (Åberg *et al.*, 2023; Goel *et al.*, 2018; Li *et al.*, 2014; Xu *et al.*, 2015; Zhong *et al.*, 2022). A recent study has further linked alcohol consumption to 61 types of diseases among Chinese men (Im *et al.*, 2023). Moreover, excessive alcohol consumption not only harms physical health but is also associated with mental health disorders and the deterioration of family and social relationships (Leonard & Eiden *et al.*, 2007; Strayer *et al.*, 2023; Tuithof *et al.*, 2014).

A developing, low-welfare context provides a unique opportunity to examine eating and drinking behaviors under economic constraints, offering insights into how financial stress directly influences lifestyle choices. First, layoffs act as a financial shock, imposing budgetary constraints on individuals and their families (Couch *et al.*, 2011; Drydakis, 2015; Schmieder *et al.*, 2010; Schmitz, 2011). This financial pressure may lead displaced workers to become more frugal in their shopping habits, often reducing their purchase of costlier food items, which could impact dietary diversity (Walls & Matita, 2023). This phenomenon is less likely to be observed in economically developed and high-welfare countries with robust safety nets and lower levels of food insecurity. Second, layoffs can lead to a loss of social status, identity, and social networks (Baumann, 2015; Brand *et al.*, 2008), initiating a stress process that may result in increased loneliness and depressive symptoms (Brand *et al.*, 2008; Browning *et al.*, 2006; Burgard *et al.*, 2007; Pearlin, 1989). Despite financial constraints, individuals experiencing these stressors and adverse mental health outcomes may turn to alcohol consumption, including heavy drinking, as a coping mechanism. Therefore, a developing country setting and the simultaneous study of eating and drinking behaviors provide a comprehensive understanding of how displaced workers navigate the dual pressures of economic hardship and psychological stress, and how these factors interact in such contexts. This holistic approach illuminates the trade-offs and decisions displaced workers face, highlighting the

interconnectedness of economic and psychosocial factors in shaping health behaviors.

Another contribution of this study is its incorporation of a life course perspective, examining how the timing of job loss throughout the life span influences health behaviors. This approach distinguishes between short-term, medium-term, and long-term effects. Life course theory suggests that the consequences of job loss vary depending on when it occurs in an individual's life (Elder Jr., 1985). The timing of job loss shapes displaced workers' experiences and their capacity to cope or adjust to new economic and mental stressors. Job loss during mid-career can pose significant economic strain, a stage when workers may face age discrimination in the labor market, be perceived as less productive, have more difficulty learning new skills, possess shorter time horizons, and encounter greater difficulty finding new employment, all of which contribute to employment precarity (Chan & Stevens, 2001; Lippmann, 2008; Stier & Endeweld, 2015). This life stage is also when many workers have familial financial responsibilities, further intensifying their economic insecurity.

Considering drinking behaviors from a life course perspective reveals additional complexity. Early-career job displacement is more normative, allowing individuals to more easily accept and integrate new roles and employment opportunities. In contrast, late-career displaced workers face a more challenging labor market, which could increase their risk of alcohol use and heavy drinking. However, as these individuals approach retirement, the pressure to secure reemployment diminishes, potentially mitigating this risk (Gallo *et al.*, 2000). Conversely, job displacement early in one's career may set individuals on a disadvantaged trajectory, leading to precarious jobs and adverse conditions that heighten stress and increase the risk of alcohol consumption, particularly among young adults who may have fewer financial obligations and greater susceptibility to stress-related drinking (Hussong *et al.*, 2001). Limited research suggests that early-life job loss can influence later-life drinking behaviors. For instance, Maclean (2015) reported that a higher employment rate at the time of school leaving the state is associated with a higher probability of binge drinking at age 40. In Ukraine, Nizalova & Norton (2021) found that the effect of job loss on alcohol consumption was most pronounced among young adults (under age 30) and older adults (age 65+). By situating individual constraints and choices within specific temporal contexts, the life course approach allows us to explore whether changes in health behaviors are transient or enduring.

This study focuses on the case of massive layoffs at state-owned enterprises (SOEs) in transitional China from 1989

to 2011. We pose three key research questions: First, how did layoffs impact workers' dietary and drinking behaviors? Second, do these effects vary across short, medium, and long terms? Finally, do the effects of layoffs on health behaviors differ depending on the career stage at which job loss occurred? Specifically, our analysis distinguished between early, mid, and late career stages. In subsequent sections, we contextualize the layoffs within transitional China, explaining how this unique setting enhances our causal estimate. We then outline our hypotheses through the lens of the life course approach. To address potential biases arising from individual characteristics that may predispose workers to layoffs, we used fixed-effect models in our analysis (Allison, 2009).

## 1.2. The context: Massive layoffs in transitional China (from 1989 to 2011)

Before the 1990s, SOEs in China provided life-long employment, high social status, and comprehensive benefits, creating a stable employment environment (Lin & Bian, 1991). However, starting early 1990s and intensifying toward the late 1990s, China implemented aggressive reforms aimed at transitioning to a market-driven economy. These reforms resulted in significant workforce reductions in SOEs through forced bankruptcies, privatization, and downsizing, leading to widespread layoffs (Solinger, 1999). Estimates suggest that between one-third and over two-thirds of the total SOE workforce was laid off during this period (Solinger, 2001).

Following layoff, many former SOE employees entered a precarious private labor market, often facing challenges due to low educational levels and a lack of transferable skills (Solinger, 2002). Many workers were re-employed as precarious wage laborers, with undefined working hours, no insurance, and no formal labor contracts. In the absence of a robust public social safety net, these workers experienced high financial insecurity and stress, contributing to increased depressive symptoms and even suicidal ideation (Bian, 2002; Chai, 2014; Cheng & Beresford, 2012; Lu, 1989; Xu *et al.*, 2002). By 2011, most SOEs had either completed their transformations or closed down. The massive layoffs had ended, and the market transition entered a new phase. This period also marked the beginning of improvements in the private labor market in urban China, which became more regulated. As employers in the private sector began offering more competitive pay and benefits, leaving SOE jobs became more of a voluntary behavior. Concurrently, the government expanded its social welfare system, providing some economic and psychological relief to former displaced workers. The focus of this study is on the reform period from 1989 to 2011.

This reform period offers a unique context for assessing the effects of job loss on health behaviors. Previous studies have often struggled with endogeneity and selectivity issues, where unobserved individual traits influencing health behaviors (e.g., heavy drinking) may also impact performance and increase the likelihood of being laid off. This reverse causality can bias the results of association studies. In contrast, the quasi-experimental nature of these layoffs – driven by external policy changes rather than individual characteristics – minimizes such biases, providing an exogenous case in assessing the impact of layoffs on health behaviors.

### 1.3. Hypotheses

Dietary diversity, which refers to the variety of primary food groups, is predominantly influenced by economic factors and aligns with the budget constraint hypothesis. Economic strains and a sense of economic insecurity may prompt saving behaviors, leading to reduced consumption of less affordable food items and, consequently, reduced dietary diversity (Hypothesis 1a). However, over time, as public welfare improves and economic conditions evolve in urban China, displaced workers may experience some economic relief, thereby restoring their dietary diversity to previous levels. Thus, we anticipated this effect to be observed only in the short term (Hypothesis 1b), but not in the medium and long terms. While purchasing alcoholic drinks can also impose an additional financial burden on families, drinking may serve as a stress-coping strategy that displaced workers resort to after job loss. Consequently, we hypothesized an increase in alcohol consumption following layoffs (Hypothesis 2a). Similar to dietary diversity, we anticipated the effect of alcohol consumption to be significant only in the short term (Hypothesis 2b), and not in the medium and long terms. Heavy drinking, being particularly responsive to psychological shocks and strains, was expected to increase following layoffs (Hypothesis 3a). This effect was anticipated to be observed in the short term (Hypothesis 3b), but not in the medium and long terms.

The timing of job loss influences displaced workers' experiences and their ability to cope with new economic and mental stressors. As noted earlier, job loss can pose significant economic strain during mid-career, a stage at which workers may face age discrimination in the labor market. This life stage is also when many workers have familial financial responsibilities, further intensifying their economic insecurity. Thus, we hypothesized the impact of job loss on workers' dietary diversity to be stronger in mid-career than in other career stages (Hypothesis 1c). Regarding drinking behaviors, although early-career job displacement is more normative, unemployment at this stage may set

individuals on a disadvantaged trajectory with precarious jobs and adverse conditions, increasing stress and risk of alcohol consumption. If this is the case, we anticipated the effect of job loss on drinking (Hypothesis 2c) and heavy drinking behaviors (Hypothesis 3c) to be stronger in early career than in other career stages.

## 2. Data and methods

### 2.1. Data

This study used data from nine waves of the China Health and Nutrition Survey (CHNS) – 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009, and 2011 – spanning over 20 years. The most recent wave with available dietary data is from 2011. The CHNS is a longitudinal survey that investigates economic, sociological, demographic, and health factors at the individual, household, and community levels across China (Popkin *et al.*, 2010). It employs a multistage, random cluster sampling method to select household samples from nine provinces, encompassing approximately 4,600 rural and urban households and about 19,000 participants. The demographic, health, and household data from the CHNS are consistent with other nationally representative studies, ensuring their comparability and reliability (Song, 2017; Zimmer *et al.*, 2010).

State-owned enterprises are generally defined as state-owned and large collective-owned enterprises, as both provide similar welfare benefits to their employees and underwent comparable reform policies in urban China (Gu, 1999). Our analysis focused on urban “hukou” holders aged 18 and older who were employed at state- or large collective-owned enterprises between 1989 and 2000. These individuals were considered “at risk” for job loss during the major reform periods from 1989 to 2011. Respondents who left SOEs during or after the 2006 wave were not classified as laid-off, as the massive layoff period had largely ended by that time. The “hukou” system is the household registration system in China, which assigns each individual a rural or urban “hukou” based on their place of origin. Only individuals with an urban “hukou” have access to full-benefit employment, so we excluded rural “hukou” holders to focus on full-benefit temporary SOE workers.

We specifically examined individuals who worked in SOEs between 1989 and 2000 and held an urban “hukou” when they first participated in the survey. This observation resulted in a sample of 2,684 respondents. We then restricted the sample to those aged 18 or older at the time of their first survey participation, resulting in 1,986 respondents. After excluding individuals without valid nutritional information, the final sample consisted of 1,809 respondents. Following the exclusion of respondents

with missing covariates, the final analytic sample consisted of 1,782 respondents, yielding 6,145 person-year observations.

## 2.2. Measures

We examined three types of health behavior outcomes. For dietary diversity, food intake was reported to CHNS investigators over a 24-h period for three consecutive days. We included respondents who had valid dietary intake data for any given year from 1989 to 2011. Each food item was categorized based on the Chinese Food Composition Tables. Following the modified FANTA Household Dietary Diversity Score Indicator Guide from the Food and Agriculture Organization of the United Nations (Kennedy *et al.*, 2013; Swindale & Bilinsky, 2006), we identified 16 food groups. These groups included: cereals and cereal products (e.g., rice, wheat); white roots and tubers (e.g., white potatoes, white yams); Vitamin A-rich vegetables and tubers (e.g., pumpkins, carrots); dark green leafy vegetables (e.g., spinach, amaranth); non-leafy, non-tuber vegetables (e.g., tomatoes, eggplants); Vitamin A-rich fruits (e.g., mango, apricot); other uncommon fruits; organ meats (e.g., liver, heart); flesh meats (e.g., beef, pork); eggs; fish and seafood; legumes/nuts/seeds; dairy products; oils; sweets; and spices/beverages (e.g., black pepper, tea). Each of the 16 food groups received a value of 1 when consumed. We then aggregated these values to compute a summary score for dietary diversity over the 3-day period. This score ranges from 1 to 15, where a score of one indicates the consumption of only one food group, and a score of 15 reflects the consumption of 15 different food groups during the specified period. Drinking behavior was assessed based on whether participants had consumed any alcoholic beverages (i.e., wine, beer, or Chinese liquor) in the past year (1 = Yes, 0 = No). Heavy drinking was defined as the consumption of more than 336.01 g of alcohol per week, following previous studies in the Chinese context (Liu *et al.*, 2019).

We defined SOE displaced workers as participants who, in the survey waves from 1989 to 2000, reported working at SOEs and, in subsequent waves (1991 – 2004), reported any of the following: (i) Employment at a non-SOE; (ii) unemployment; (iii) retirement before reaching the legal retirement age (i.e., 60 for men, 55 for women in senior or managerial positions, or 50 for women in other positions); or (iv) continued employment at an SOE without receiving regular wages in the past year or having a second job. While the CHNS is the only available panel data covering the entire span of the transitional period, it does not provide specific reasons for job loss. Evidence from the period, however, suggests that voluntary job shifts from SOEs were rare due to the significantly better employment benefits

at SOEs and the workers' generally low education levels and lack of transferrable skills (Davis, 1992; Lai, 2001; Liu, 2003; Zhou *et al.*, 1997). We discuss the potential biases related to this data limitation in the limitations section of this manuscript.

We further explored the heterogeneous effects of job loss by examining the number of years after job loss and the life stage at which job loss occurred. The year after job loss was calculated by subtracting the year in which job loss occurred from the year of the current survey wave. The year of the job loss was considered as the year immediately preceding the observation of job loss in the data. Given that the relationship between the years since job loss and health behaviors was not linear, we categorized this variable into three phases: short-term (<5 years after job loss), medium-term (5 – 9 years after job loss), and long-term (ten or more years after job loss). We adopted a five-year threshold for short-term effects, as the majority of relevant research has focused on this period (Bloemen *et al.*, 2018; Browning *et al.*, 2006; Drydakis, 2015; Stevens & Schaller, 2011; Strully, 2009). A 10-year span was chosen for long-term impact based on studies examining the extended outcomes of job loss (Couch *et al.* 2011; Nizalova & Norton 2021; Schröder 2013). The career stage at job loss was categorized as early-career (35 years or younger), mid-career (36 – 45 years), and late career (46+ years), following earlier literature defining career stages in urban China (Cui *et al.*, 2017; Singh *et al.*, 2010). Our analysis of the distribution of age across different career stages at job loss and the length of time since job loss reveals a diverse age range within each category. This diversity indicates that job loss categories do not cluster within specific age groups, thereby minimizing concerns about multicollinearity in our models.

## 2.3. Covariates

We included several time-varying covariates in our analysis: participants' age, quadratic age, marital status, education level, household income (in Chinese yuan), number of people in the household, working status, medical insurance, and survey waves dummies. Marital status was treated as a categorical variable with three categories: 1 = *Never-married* (reference group), 2 = *Married*, and 3 = *Divorced/separated/widowed*. Education level was also included as a categorical variable with three categories: 1 = *Primary school or lower* (reference group), 2 = *Middle school*, and 3 = *Upper middle/technical school/university or higher*. We combined upper middle/technical school and university or higher into a single category due to the low percentage of university graduates (4% of the sample). Participants' household income per capita was calculated as the log-transformed value of the total household

income (from all sources) divided by the number of people in the household, adjusted for inflation to 2015 values (range: 0 – 12.86). The number of people in the household was treated as a continuous variable. Working status was categorized into three groups: (i) Working, (ii) Retired, and (iii) Neither working nor retired (reference group) in the current survey wave. Medical insurance was a dichotomous variable indicating whether participants had any medical insurance or not (1 = *Yes*, 0 = *No*). Survey waves were included as dummy variables to account for temporal variations.

### 2.4. Analytic strategy

We first performed two-way linear fixed-effects models to analyze the effects of job loss, the temporality of job loss, and the timing of job loss on dietary diversity. Subsequently, logistic fixed-effects models were used to assess the risks of alcohol consumption and heavy alcohol consumption, respectively. Fixed-effects models enabled us to examine the relationship between job loss and changes in health behaviors while controlling for time-invariant individual confounders (Allison, 2009). We tested the models with cluster-robust standard errors, and the results remained consistent. Survey wave dummies were included to control for temporal variations that might independently influence the results, beyond the effects associated with age. This approach further reduced potential biases arising from individual characteristics that could predispose workers to layoffs. In addition, we conducted supplementary analyses on the overall effect of job loss on the consumption of each specific dietary type, with statistically significant results provided in the Supplementary File.

### 3. Results

The descriptive statistics (Table 1) across person-years show, on average, the sample scored approximately nine on the dietary diversity score (range: 1 – 15). Approximately 35.34% of participants consumed alcohol, and 11.08% engaged in heavy drinking in the past year. The majority (73.80%) of the person-years involved in job loss from SOEs, with 23.33% experiencing short-term job loss, 28.02% medium-term job loss, and 22.44% long-term job loss. The percentage of displaced workers in our sample is higher than national estimates, likely due to the oversampling of individuals from Northeast China in the CHNS. This region experienced the most significant SOE layoffs during the reform era (Chiu & Hung, 2004). In addition, a small number of workers who voluntarily left SOEs may have further inflated this percentage. The distribution of career stage at job loss was relatively even: 22.67% were in early career, 23.81% in mid-career, and 27.32% in late career. The majority of the participants

**Table 1. Descriptive statistics of sample characteristics**

Parameter	Mean, %	SD
Dietary diversity	9.11	1.1
Drinking	35.34	
Heavy drinking	11.08	
Job loss	73.80	
Time since job loss <sup>a</sup>		
Short-term	23.33	
Medium-term	28.02	
Long-term	22.44	
Career stage at job loss <sup>b</sup>		
Early-career	22.67	
Mid-career	23.81	
Late-career	27.32	
Age	46.84	12.4
Marital status		
Never-married	7.13	
Married	85.97	
Divorced/separated/widowed	6.90	
Education level		
Primary school or lower	31.68	
Middle school	37.77	
Upper middle/technical school/university or higher	30.55	
Per capita household income inflated to 2015 (log-transformed)	8.76	1.02
Number of people in the household	4.29	1.62
Any medical insurance	48.09	
Working status		
Not working	29.42	
Working	56.96	
Retired	13.62	

Notes: N=6,145 person-years, representing 1,782 individuals.

<sup>a</sup>Short-term: 0 – 4 years, mid-term: 5 – 11 years, long-term: more than 12 years. <sup>b</sup>Early-career: 35 years and younger, mid-career: 36 – 45 years, late-career: 46 years and older.

Abbreviation: SD: Standard deviation.

(85.97%) were married across the years, and approximately 69% had an education level of middle school or lower. It is important to note that these statistics are based on person-year units, and the percentages – particularly those related to layoff status, dietary habits, and drinking behaviors – should be interpreted as aggregates across different time periods.

Linear fixed-effects models predicting dietary diversity (i.e., the number of dietary groups) are shown in Table 2. The results indicate that, overall, job loss reduced the

**Table 2. Coefficients and standard errors from fixed-effects models predicting dietary diversity**

Parameter	Model A			Model B			Model C		
	$\beta$	<i>p</i>	(SE)	B	<i>p</i>	(SE)	$\beta$	<i>p</i>	(SE)
Job loss	-0.18	0.05	(0.09)						
Years after job loss <sup>a</sup>									
Short-term				-0.20	0.04	(0.10)			
Medium-term				-0.14	0.29	(0.13)			
Long-term				-0.18	0.34	(0.19)			
Career stage at job loss <sup>b</sup>									
Early-career							-0.24	0.05	(0.12)
Mid-career							-0.37	0.00	(0.11)
Late-career							0.10	0.43	(0.13)
Age	-0.06	0.58	(0.10)	-0.06	0.60	(0.10)	-0.05	0.62	(0.10)
Age-squared	-0.00	0.38	(0.00)	-0.00	0.45	(0.00)	-0.00	0.09	(0.00)
Marital status <sup>c</sup>									
Married	0.07	0.62	(0.15)	0.08	0.59	(0.15)	0.07	0.64	(0.15)
Divorced/separated/widowed	-0.30	0.14	(0.20)	-0.29	0.15	(0.20)	-0.28	0.17	(0.20)
Education level <sup>d</sup>									
Middle school	-0.19	0.86	(0.11)	-0.02	0.87	(0.11)	-0.02	0.82	(0.11)
Upper middle/technical school/university or higher	0.33	0.02	(0.14)	0.33	0.02	(0.14)	0.33	0.02	(0.14)
Per capita household income inflated to 2015 (log-transformed)	0.01	0.65	(0.03)	0.01	0.62	(0.03)	0.01	0.62	(0.03)
Number of people in the household	0.04	0.06	(0.02)	0.05	0.06	(0.02)	0.04	0.06	(0.02)
Any medical insurance	0.05	0.42	(0.07)	0.05	0.41	(0.07)	0.04	0.54	(0.06)
Working status <sup>e</sup>									
Working	-0.00	0.98	(0.07)	-0.00	0.97	(0.07)	0.01	0.87	(0.07)
Retired	0.06	0.57	(0.10)	0.06	0.59	(0.11)	0.03	0.77	(0.10)

Notes: <sup>a</sup>Short-term: 0 – 4 years, mid-term: 5 – 11 years, long-term: more than 12 years. <sup>b</sup>Early-career: 35 years and younger, mid-career: 36 – 45 years, late-career: 46 years and older. <sup>c</sup>Reference category is unmarried. <sup>d</sup>Reference category is lower than middle school. <sup>e</sup>Reference category is not working and not retired. Wave dummies were included as controls but are omitted from the table. Abbreviation: SE: Standard error.

dietary diversity score by 0.18 points ( $p = 0.047$ ), on average, *ceteris paribus*, supporting Hypothesis 1a. The reduction was primarily observed in the short-term ( $\beta = -0.20$ ,  $p = 0.04$ ), but was not evident in the medium or long terms, aligning with Hypothesis 1b. This reduction in dietary diversity was particularly pronounced among displaced workers who experienced job loss in mid-career ( $\beta = -0.37$ ,  $p = 0.00$ ). Early-career job loss also decreased dietary diversity, although this effect was marginally significant ( $\beta = -0.24$ ,  $p = 0.06$ ). A comparison of the coefficients in Model C shows that mid-career job loss has a stronger impact on dietary diversity than late-career job loss, although the difference between early-career and late-career job loss is not significant. This observation partially supports Hypothesis 1c. Table S1 presents results for the three types of food most sensitive to workers' job loss status: uncommon fruits, non-leafy and non-tuber vegetables, and fish and seafood.

Regarding the risks of alcohol consumption (Table 3), job loss marginally increased the odds of alcohol consumption among laid-off workers (odds ratio [OR] = 1.36,  $p = 0.10$ ), providing some (though not statistically significant) support for Hypothesis 2a. Although the odds ratios for job loss decreased over time – from 1.26 in the short-term to 0.93 in the long-term, on average, *ceteris paribus* – the standard errors were too large to draw definitive conclusions. In terms of career stage, late-career job loss marginally increased the risk of alcohol consumption (OR = 1.60,  $p = 0.07$ ). Based on results from Model C, no significant differences were observed among the coefficients for different career stages. Therefore, neither Hypothesis 2b nor Hypothesis 2c was supported. Regarding heavy drinking (Table 4), we did not observe an effect of job loss on heavy drinking overall, which does not support Hypothesis 3a. The odds ratios for short-term effects decreased slightly from 1.18 to 1.03 for the long term, on

**Table 3. Coefficients and standard errors from fixed-effects models predicting alcohol consumption in the past year**

Parameter	Model A			Model B			Model C		
	OR	p	(SE)	OR	p	(SE)	OR	p	(SE)
Job loss	1.36	0.10	(0.25)						
Years after job loss <sup>a</sup>									
Short-term				1.26	0.26	(0.25)			
Medium-term				1.13	0.66	(0.31)			
Long-term				0.93	0.85	(0.37)			
Career stage at job loss <sup>b</sup>									
Early-career							1.31	0.28	(0.32)
Mid-career							1.25	0.34	(0.29)
Late-career							1.60	0.07	(0.42)
Age	0.57	0.02	(0.14)	0.58	0.02	(0.14)	0.58	0.02	(0.14)
Age-squared	1.00	0.00	(0.00)	1.00	0.00	(0.00)	1.00	0.00	(0.00)
Marital status <sup>c</sup>									
Married	1.15	0.62	(0.33)	1.14	0.64	(0.33)	1.16	0.61	(0.34)
Divorced/separated/widowed	1.12	0.78	(0.47)	1.10	0.82	(0.46)	1.14	0.75	(0.48)
Education level <sup>d</sup>									
Middle school	1.51	0.07	(0.34)	1.52	0.07	(0.35)	1.50	0.07	(0.34)
Upper middle/technical school/university or higher	1.55	0.14	(0.47)	1.57	0.13	(0.47)	1.54	0.15	(0.46)
Per capita household income inflated to 2015 (log-transformed)	1.11	0.09	(0.07)	1.11	0.09	(0.07)	1.11	0.09	(0.07)
Number of people in the household	0.99	0.86	(0.05)	0.99	0.84	(0.05)	0.99	0.85	(0.05)
Any medical insurance	0.88	0.36	(0.12)	0.89	0.37	(0.12)	0.88	0.33	(0.12)
Working status <sup>e</sup>									
Working	1.58	0.00	(0.24)	1.58	0.00	(0.24)	1.59	0.00	(0.24)
Retired	1.10	0.66	(0.25)	1.10	0.66	(0.25)	1.09	0.71	(0.25)

Notes: <sup>a</sup>Short-term: 0 – 4 years, mid-term: 5 – 11 years, long-term: More than 12 years. <sup>b</sup>Early-career: 35 years and younger, mid-career: 36 – 45 years, late-career: 46 years and older. <sup>c</sup>Reference category is unmarried. <sup>d</sup>Reference category is lower than middle school. <sup>e</sup>Reference category is not working and not retired. Wave dummies were included as controls but are omitted from the table. Abbreviations: OR: Odds ratio; SE: Standard error.

average, *ceteris paribus*; however, large standard errors prevented drawing conclusions about the temporality of these effects. Therefore, Hypothesis 3b was not supported. Early-career job loss significantly increased the odds of heavy drinking ( $OR = 2.09, p = 0.047$ ). A comparison of the coefficients in Model C indicates that early-career job loss has a stronger impact on heavy drinking compared to mid-career job loss, although the difference with late-career job loss is not significant. This observation partly supports Hypothesis 3c.

Considering that working status post-layoff might mediate the association between job loss and health behaviors, we excluded working status from the models and compared the results (Tables S2–S4). Specifically, for drinking behavior, the association became statistically non-significant when current working status was not controlled for. Since working predicts a higher likelihood of

drinking, this suggests that, if not for the higher likelihood of drinking among those who were employed, job loss might have had a more pronounced impact on increasing drinking behavior among displaced workers. This finding indicates that the higher likelihood of drinking among subsequently employed individuals may mask the more substantial effects of SOE job loss on drinking behavior.

Other notable findings are worth noting. A larger household size was associated with higher dietary diversity, suggesting that larger families may encourage greater consumption of a variety of foods in China. Higher educational attainment was also associated with greater dietary diversity. This association persisted even after accounting for household income, underscoring the important role of education in influencing individuals' nutritional status.

We further analyzed the sample by gender due to potential gender differences in dietary and drinking

**Table 4. Coefficients and standard errors from fixed-effects models predicting heavy drinking in the past year**

Parameter	Model A			Model B			Model C		
	OR	p	(SE)	OR	p	(SE)	OR	p	(SE)
Job loss	1.23	0.40	(0.30)						
Years after job loss <sup>a</sup>									
Short-term				1.18	0.52	(0.31)			
Medium-term				1.11	0.77	(0.40)			
Long-term				1.03	0.96	(0.53)			
Career stage at job loss <sup>b</sup>									
Early-career							2.09	0.05	(0.78)
Mid-career							0.94	0.81	(0.26)
Late-career							1.20	0.57	(0.40)
Age	0.55	0.05	(0.17)	0.55	0.05	(0.17)	0.51	0.03	(0.16)
Age-squared	1.00	0.00	(0.00)	1.00	0.00	(0.00)	1.00	0.00	(0.00)
Marital status <sup>c</sup>									
Married	0.76	0.46	(0.28)	0.76	0.46	(0.28)	0.66	0.29	(0.26)
Divorced/separated/widowed	0.95	0.92	(0.52)	0.93	0.90	(0.52)	0.83	0.74	(0.47)
Education level <sup>d</sup>									
Middle school	1.43	0.23	(0.43)	1.45	0.22	(0.44)	1.47	0.21	(0.44)
Upper middle/technical school/university or higher	1.18	0.66	(0.44)	1.19	0.64	(0.45)	1.24	0.57	(0.47)
Per capita household income inflated to 2015 (log-transformed)	0.96	0.60	(0.07)	0.96	0.60	(0.07)	0.96	0.62	(0.07)
Number of people in the household	0.96	0.49	(0.06)	0.96	0.49	(0.06)	0.96	0.49	(0.06)
Any medical insurance	1.03	0.86	(0.17)	1.03	0.85	(0.17)	1.02	0.92	(0.17)
Working status <sup>e</sup>									
Working	1.26	0.21	(0.23)	1.26	0.21	(0.23)	1.27	0.20	(0.23)
Retired	0.97	0.91	(0.28)	0.97	0.92	(0.28)	0.94	0.83	(0.27)

Notes. <sup>a</sup>Short-term: 0 – 4 years, mid-term: 5 – 11 years, long-term: more than 12 years. <sup>b</sup>Early-career: 35 years and younger, mid-career: 36 – 45 years, late-career: 46 years and older. <sup>c</sup>Reference category is unmarried. <sup>d</sup>Reference category is lower than middle school. <sup>e</sup>Reference category is not working and not retired. Wave dummies were included as controls but are omitted from the table. Abbreviations: OR: Odds ratio; SE: Standard error.

behaviors between men (50.4% of the sample) and women (49.6% of the sample). Results (Tables S5–S10) show that the negative association between job loss and dietary diversity was observed for both male and female workers, with the impact being more pronounced among males. Meanwhile, the effects of job loss on the diets of female workers during the mid-career stage remained significant. In terms of drinking risks, the association with job loss was more evident among women. For men, however, job loss appeared to be primarily associated with an increased incidence of heavy drinking in early careers.

#### 4. Discussion

The world is transitioning from an era of job security to one marked by work precarity, where layoffs increasingly lead to job instability, chronic joblessness, and underemployment (Kalleberg, 2009; Standing, 2011;

Weaver, 2015). Consequently, being laid off may have significant implications for workers' daily routines and health behaviors. While existing research predominantly focuses on the impact of job loss on health behaviors in developed welfare states, it often overlooks how these effects manifest in developing countries, the types of health behaviors that may be particularly sensitive to job loss in these contexts, and how these effects may vary over time and across career stages. This study leverages over two decades of prospective data to investigate dietary diversity – a health behavior that has yet to be thoroughly examined in the context of job loss – as well as alcohol consumption and heavy drinking behaviors among workers during the large-scale layoffs in transitional China. We also examined how the timing of job loss influences health behaviors across the life course. Benefiting from the exogenous nature of the policy-driven layoffs and utilizing fixed-

effects models, we provide an improved estimate of the causal effects of layoffs on health behaviors.

Our findings make several key contributions to the literature. First, this is one of the first studies to identify the effect of job loss on health behaviors in a developing country setting. This context allowed us to examine a previously underexplored health behavior – dietary diversity – which is particularly sensitive to layoffs in less-developed and low-welfare countries. Our results indicate that layoffs led to a decrease in dietary diversity among displaced workers, who eliminated foods such as uncommon fruit, non-leafy and non-tuber vegetables, and seafood from their daily diets. These food items are typically considered expensive and luxury dietary choices in China (Su & Wang, 2019; Zhang *et al.*, 2021). This dietary shift likely reflects financial coping strategies in a context with limited social welfare, where laid-off workers and their families reduced their food expenses to cope with financial instability. By reducing their consumption to more basic food types, these workers inadvertently expose themselves to risks associated with lower dietary diversity, such as malnutrition, cardiovascular risks, depression, cognitive decline, and increased mortality (Azadbakht *et al.*, 2006; Chen *et al.*, 2011; Huang *et al.*, 2015; Nithya & Bhavani, 2018; Otsuka *et al.*, 2016). Fruits and non-leafy and non-tuber vegetables such as tomatoes, bell peppers, eggplants, cauliflowers, and asparagus provide essential antioxidants, minerals, and nutritional benefits (Abruzzese *et al.*, 1995; Gürbüz *et al.*, 2018; Passam *et al.*, 2007). Meanwhile, fish and seafood are key sources of high-quality animal protein, amino acids, and vitamins (Li *et al.*, 2021; McManus & Newton, 2011). The exclusion of these nutrient-dense foods from diets, as a direct consequence of layoffs, can adversely affect both the physical and psychological health of Chinese workers.

Second, our results shed light on how social contexts shape the long-term effects of layoffs. The reduction in dietary diversity was most pronounced in the early years following job loss, with these effects diminishing over time. From 1989 to 2011, when large-scale layoffs were prevalent, the private sector offered limited job opportunities with low wages, and the public safety net was underdeveloped, which heightened financial constraints and instability for displaced workers (Bian, 2002; Lu, 1989). However, as China's economy rapidly developed, improvements in the urban welfare system and enhanced employment opportunities and benefits in the private sector gradually alleviated these financial pressures (Dong, 2009; Meng *et al.*, 2015). Regarding the timing of job loss, mid-career workers experienced the most significant reduction in dietary diversity, especially compared to those in the

late-career stage. This group likely suffered from greater underemployment and employment precarity due to age discrimination in the job market (Lu, 2009). In addition, layoffs during mid-career often coincide with a life stage that includes substantial family responsibilities, such as childcare, further exacerbating financial instability. As families often share meals, this reduction in dietary diversity could extend to the entire household, potentially affecting the nutritional status of children and even contributing to stunting (Arimond & Ruel, 2004; Rah *et al.*, 2010).

Third, due to the study's focus on a developing country context and its simultaneous examination of eating and drinking behaviors, the contrasting results between these behaviors in response to job loss emphasize two distinct pathways of effect, as reflected in the different health outcomes. If financial strain and insecurity had been the sole influence, we might have observed a reduction in both alcohol consumption and heavy drinking, as financial limitations could lead to reduced alcohol purchases. However, our findings indicate an increase in the risk of alcohol consumption following job loss, underscoring the significant role of psychosocial stress as a driver of drinking behaviors (Brand *et al.*, 2008; Browning *et al.*, 2006; Burgard *et al.*, 2007; Pearlin, 1989). While displaced workers may have scaled back their food budgets, they may have also turned to alcohol as a coping mechanism to manage stress. These contrasting patterns suggest that, under the stress induced by job loss, workers may prioritize drinking over maintaining a healthy diet.

Early-career displaced workers may experience prolonged employment insecurity and stress due to their early entry into the precarious labor market. This group, which includes many young adults, is more likely to engage in binge drinking as a coping mechanism (Hussong *et al.*, 2001; Maclean, 2015), thereby increasing their risk of heavy drinking. Our findings are generally consistent with previous studies conducted in different contexts (Maclean, 2015; Nizalova & Norton, 2021). The implications of heavy drinking among early-career displaced workers are particularly concerning. Excessive alcohol consumption can lead to significant social family problems, such as marital conflict, family violence, and child neglect (Leonard & Eiden, 2007). These consequences can exacerbate the already considerable stress and struggles faced by displaced workers and their families, potentially creating a vicious cycle of stress and harmful coping behaviors.

#### 4.1. Limitations

This study has several limitations. First, while the CHNS data represent the only available panel data covering the entire duration of transitional China and extending to

relatively recent times, it does not distinguish between voluntary and involuntary job loss. Although existing literature suggests that voluntary job shifts from SOEs were rare during this transitional time (Davis, 1992; Lai, 2001; Liu, 2003; Zhou *et al.*, 1997), it is possible that a small proportion of voluntary job losses were inadvertently included in our study. Individuals who voluntarily change jobs may possess greater ambition and healthier lifestyles, which could introduce a conservative bias into our estimates. Second, the data do not capture more covert forms of layoffs, such as cases where individuals remain affiliated with an employer without receiving regular pay. This limitation may have led to an underestimation of the deleterious effects of job loss on health behaviors. Third, although our fixed-effects approach controls for inter-individual differences in job loss selection and leverages policy-driven layoffs as a quasi-experimental setting, our estimates may not be considered causal due to unobserved time-varying factors that could affect both displaced workers and those who retained their jobs.

Fourth, our ability to observe long-term effects is limited by the timing of layoffs within the study window, particularly for those laid off between 2000 and 2004. This limitation may have caused the long-term results to be influenced by period effects. The period from 1997 to 2004 was characterized by intense layoffs, which likely exposed displaced workers to a harsher economic environment compared to those laid off earlier. This context suggests that our estimate of the long-term effect may understate its true magnitude. Finally, the self-reported nature of the dietary intake data may introduce biases. Displaced workers who restricted their dietary diversity could be reluctant to accurately report or may misreport their food intake, potentially leading to an underestimation of the true effects.

## 5. Conclusions

The current study advances our understanding of the impact of layoffs on health behaviors, specifically dietary diversity and alcohol consumption, within a developing and transitional context. It underscores the importance of contextual factors in shaping the life-course impact of layoffs on health behaviors. One key finding is that displaced workers often prioritize alcohol consumption over maintaining dietary diversity, highlighting the complex interplay between financial constraints, psychological stress, and lifestyle choices. This insight contributes to a broader scientific understanding of how economic and emotional stressors influence health behaviors. Moreover, our observation that layoffs adversely affect workers across all career stages – early, mid, and late – yet have

distinct impacts on different health behaviors, provides valuable evidence for the development of targeted policies and interventions. For instance, food vouchers may be particularly beneficial for displaced workers in mid-career, while interventions to address excessive drinking could be more effective for those in early-career. Educational efforts aimed at improving dietary diversity could also improve individuals' nutritional status. Such measures would address the unique health behavior challenges faced by different groups, ultimately mitigating the negative health consequences of involuntary job loss.

## Acknowledgments

None.

## Funding

This research was supported by the National Institutes of Health under grant number [1R03AG064265].

## Conflict of interest

The authors declare that they have no competing interests.

## Author contributions

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*Formal analysis:* Qian Song, Emily Lim

*Investigation:* All authors

*Methodology:* Qian Song

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## Ethics approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Availability of data

The data used in this study can be accessed at <https://www.cpc.unc.edu/projects/china>.

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<https://doi.org/10.1016/j.socscimed.2010.03.048>

## RESEARCH ARTICLE

## Transitivity and couple relationship satisfaction: Sharing and visiting friends and family make the difference

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### Abstract

This study examined the relationship between couple relationship satisfaction and the transitivity of ties with family and friends within couples, i.e., the tendency of partners to share friends and family. In this case, transitivity was measured by using three indicators: (1) the proportion of shared friends (friendship network overlap); (2) the frequency of contact that each partner has with their own friends and family as well as those of their partner; and (3) whether social visits to friends and family are made with/without the partner (togetherness). The data were obtained from the Measurement and Observation of Social Attitudes in Switzerland survey, which included 1320 partnered individuals residing in Switzerland. The association between the transitivity of ties with family and friends within couples and couple relationship satisfaction was estimated by using structural equation modeling. According to the results, transitivity was consistently informed by the three selected indicators (i.e., friendship network overlap, frequency, and togetherness), while transitivity positively contributed to couple relationship satisfaction. Moreover, transitivity explains a couple's relationship satisfaction more than the partner's education level and nationality, or the duration of the couple's relationship. By emphasizing the role and importance of joint visits by each member of the couple, this study provides unique insights into the ways in which marital satisfaction can vary.

**Keywords:** Personal network; Couple relationship satisfaction; Social visits; Transitivity; Structural equation modeling

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**Citation:** Drevon, G., Gauthier, J., Viry, G., Kaufmann, V., Masse, F. & Gumy, A. (2026). Transitivity and couple relationship satisfaction: Sharing and visiting friends and family make the difference. *International Journal of Population Studies*. 12(1):117-127.  
<https://doi.org/10.36922/ijps.2418>

**Submitted:** December 12, 2023

**1st revised:** April 30, 2024

**2nd revised:** May 30, 2024

**Accepted:** June 11, 2024

**Published online:** January 8, 2025

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**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

### 1. Introduction

Couple relationship satisfaction (traditionally called *marital satisfaction*) is a concept that covers several intra- and interpersonal dimensions (Spanier & Lewis, 1980) and comprises four domains: (1) a consensus regarding organizational and relational aspects; (2) the sharing of common interests and activities; (3) the degree of trust and tension between spouses; and (4) the expression of affection. Specifically, this study focuses on the first two domains, corresponding to the dimensions of conjugal system

cohesion and adaptability proposed by Olson *et al.* (1988). According to the authors, the notion of cohesion describes how the conjugal system is maintained. In this case, one of its dimensions, i.e., fusion, describes the extent to which spouses have friends and family in common. From a network perspective, fusion is considered as the degree of overlap in the spouses' personal networks and is positively associated with romantic commitment. The second domain, i.e., the sharing of common interests and activities, involves the regulation of daily practices (including social visits) and is a dimension of adaptability.

The combination of these two domains can be applied to examine the transitivity of ties with family and friends within couples, hereafter referred to as *transitivity*. In general, sharing friends and family is one of the key characteristics of couple relationship satisfaction. While many personal relationships are not shared by both partners and may have different impacts on couple relationship satisfaction, developing networks of mutual friends and family can help the couple maintain their identity as a unit and provide partners with support and opportunities for social comparison. Conversely, non-shared relationships reinforce personal identity and support each member of the couple, rather than the couple as a unit. In addition, non-shared relationships may compete with the conjugal bond, e.g., in terms of time investment. According to balance theory (Heider, 1958), individuals tend to avoid inconsistencies between personal relationships by favoring transitive relationships, since they are more likely to develop their own relationships with those who are in a close relationship with their partners. Thus, as individuals become acquainted and interact with their partner's friends and family, they gradually become mutual friends of their partners. In contrast, when individuals dislike or have a negative opinion of a friend of their partners, dissolution of the friendship is more likely to avoid relational inconsistency. Increased transitivity as the couple's relationship develops has been mainly examined during the early years of the relationship (Kalmijn, 2003). However, recent research has shown that transitivity continues to positively influence the couple later in conjugal life (Fiori *et al.*, 2017).

The originality of this study lies in its use of an innovative conceptual framework that examines the relationship between transitivity (Turner & West, 2014; Widmer, 2016) and couple relationship satisfaction. In this case, we measure transitivity through a combination of three factors: (1) the frequency of contact that each partner has with their own friends and family as well as those of their partner; (2) whether social visits are made alone or with one's partner; and (3) the proportion of

shared friends. Although the frequency of contact or the proportion of shared friends are factors of transitivity that are well-known in the literature, the importance of shared visits remains underexplored, especially regarding the association between shared visits and couple relationship satisfaction. Therefore, the purpose of this study is two-fold: To confirm the latent congruence between the three aforementioned factors of transitivity; and to examine the relationship between the estimated transitivity and couple relationship satisfaction.

This study comprises four parts. The first part discusses the current state of knowledge on the interpersonal aspects of couple relationship satisfaction. The second part describes the data and the methodology structural equation modeling (SEM), while the third section presents the results of the analysis. The final section discusses the results and their contributions to the current state of knowledge as well as proposes directions for future research.

## 1.1. Relational dimensions of couple relationship satisfaction

From a sociological perspective, conjugal functioning incorporates two dimensions: regulation and cohesion (Olson, 2000). The former describes (among other aspects) the division of tasks, while the latter describes marital togetherness. Meanwhile, fusion, as one of the indicators of cohesion (Spanier, 1976), evaluates the extent to which the activities of spouses are shared. An example of a shared activity is visiting friends together. Previous research has found that high degrees of fusion within the relationship are associated with a better quality of conjugal life, less conflict, and more effective coping strategies (Widmer *et al.*, 2004). Overall, shared activities positively contribute to the stability of the union (Rhoden, 2003). In addition, among well-functioning families, maintaining relationships with friends and family members by visiting or hosting them is a factor of satisfaction for both partners, regardless of which partner's friends or family members they may be (Greeff, 2000).

## 1.2. Factors associated with couple relationship satisfaction

A literature review highlights the multidimensionality of the factors associated with couple relationship satisfaction, which interact with the norms, values, projects, and sociability of the couple. Specifically, these factors include sociodemographic characteristics, personality traits, and the quality of sexual relations (Sorokowski *et al.*, 2017; Tavakol *et al.*, 2017; Zaheri *et al.*, 2016). This may be traced back to the level of partner homophily regarding various practices, habits, behaviors, beliefs, feelings, or

tastes. These practices also define a common ground that is likely to facilitate conjugal functioning, both in terms of its regulation (by establishing common rules) and its cohesion (by developing common projects) (Widmer *et al.*, 2004). Common ground is often a prerequisite for first conceiving and then realizing shared projects such as starting a family, purchasing a house, or consuming together. Moreover, these projects constitute focus points (Feld, 1981) around which the convergence of aspirations is likely to form mutual relationships and strengthen couple relationship satisfaction (Li & Fung, 2011) by regulating conjugal functioning, especially in relation to communication and the ability to resolve problems and overcome conflicts (Chi *et al.*, 2013).

Several other markers of differentiation are relevant to marital satisfaction, with gender being one of them, since women tend to be less satisfied with their conjugal lives than men (Jackson *et al.*, 2014). Meanwhile, unequal distribution of domestic tasks and/or childcare at the woman's expense can lead to ambivalent feelings, conflicts, and dissatisfaction (Ruppanner *et al.*, 2019). Such inequalities are frequently triggered by life course events such as workforce integration and the transition to parenthood (Widmer *et al.*, 2012). Paradoxically, limited studies have empirically focused on the relational dimensions of couple relationship satisfaction, particularly regarding the role and importance of the couple's activities.

### 1.3. Personal networks and couple relationship satisfaction

As for the people constituting a couple's entourage, they include the relatives and friends of each partner, representing an important source of emotional and instrumental support (Aeby *et al.*, 2021). However, these individuals can also generate (through their interactions with their spouses) various factors, such as jealousy or disapproval that interfere with the quality of the conjugal relationship (Stein, 2020).

The notion of transitivity applied to couple relationships describes the process by which the friends and family of one partner also become the friends and family of the other. However, merging two separate sets of family and friends can be challenging for couples, especially those who must learn to share time with family and friends and when connecting with their respective in-laws (Fiori *et al.*, 2017). Depending on their degree of transitivity, the personal networks of both partners may exhibit a high degree of overlap, i.e., the members of one partner's network also belong to the other partner's network (Bidart *et al.*, 2018). In this case, this configuration is beneficial to the available

support to partners and to conjugal quality (Cohn-Schwartz *et al.*, 2021). According to Kalmijn (2003), this reflects the process by which partners tend to withdraw from their personal networks during pairing and cohabitation. From this transition point, the personal networks of each partner are gradually reconfigured according to two principles: the principle of competition between the members of the partners' entourage, which tends to limit their number; and the principle of balance, which aims to limit the number of problematic/conflicting relationships in the network (as mentioned earlier). These two mechanisms explain the tendency of the partners' personal networks to overlap (Kalmijn, 2003). Since a greater proportion of shared friendships and family can help maintain a couple's identity and provide them with approval and support, it has a positive effect on couple relationship satisfaction (Cornwell, 2012). In the United States, Stein (2020) found that the couples who have the most members of their respective families in common are those with the highest levels of couple relationship satisfaction. Transitivity may also be associated with marital stability since sharing many friends and family can increase the barriers to separation since both partners must sever more relationships upon separation. However, evidence supporting this hypothesis is limited (Fiori *et al.*, 2017; Kalmijn, 2003).

Among partners considering marriage, those who value their personal network the most and promote shared interactions with its members are more likely to maintain their commitment and recognize the importance of the shared network to the success of this process (Ogolsky *et al.*, 2016). In addition, social relationships characterized by mutual commitment are more frequently associated with different forms of social support (Ashida *et al.*, 2019), which, in turn, is strongly correlated with couple relationship satisfaction (Collins & Feeney, 2000). This trend appears to be sustained over the life course (especially among older adults) since life satisfaction is positively correlated with the frequency of contact with friends and social visits (Litwin, 2005).

### 1.4. Joint activities as factors of couple relationship satisfaction

In general, a positive relationship has been observed between joint activities and couple relationship satisfaction (Johnson *et al.*, 2006; Orthner, 1975; Reissman *et al.*, 1993). Previous research has also indicated that various activities, such as playing games together, chatting, sharing hobbies, walking or biking, and cooking or dining together, are significant contributors to couple relationship satisfaction (Ward *et al.*, 2014), in addition to cultural activities such as attending concerts or shows (Harmon, 2016). Even passive leisure activities, such as watching television

together, are conducive to physical intimacy (Finucane & Horvath, 2000). Moreover, shared leisure activities can help strengthen the couple's identity by creating a sense of belonging and offering opportunities associated with efficient communication and conflict management skills (Hickman-Evans *et al.*, 2018).

As for the practice of visiting friends and family, which combines elements of mobility and sociability, it is an essential aspect of regulating social contacts (Janta *et al.*, 2015). However, there has been limited research on these practices, particularly at the conjugal level (Janta *et al.*, 2015). In this regard, some studies have focused on the emotional support offered by the members of spouses' personal networks to explain couple relationship satisfaction (Rajput, 2017). Overall, recreational visits, along with friends or family, have been found to be an important factor in couple relationship satisfaction (Cai *et al.*, 2020). Furthermore, spouses who visit friends and family together are less likely to separate than those who do not, especially if the number of mutual friends is high (Hogerbrugge *et al.*, 2013). Thus, the present study also elucidates, how social visits to the family and friends of both partners are a dimension of transitivity and are positively associated with couple relationship satisfaction.

**1.5. Conceptual model and hypotheses**

The conceptual model in this study (Figure 1) is based on a literature review and the proposed hypotheses, with the objective of examining both transitivity and

couple relationship satisfaction. We also measure the relationship between these factors, while considering various control variables. To meet these objectives, this model is based on several relationships (pathways) designed to test the hypotheses, i.e., to confirm the latent dimension of transitivity on the one hand and couple relationship satisfaction on the other. First, transitivity is estimated from the convergence between shared visits, the frequency of the respondent's contact with the partner's family and friends, and the number of mutual friends of each member of the couple (H1). Second, as for couple relationship satisfaction, it is based on the declared general satisfaction, the frequency of arguments, and thoughts about separation (H2). Third, the relationship between conjugal satisfaction and transitivity is established to show that transitivity is more likely to predict couple relationship satisfaction (H3). Finally, this model integrates other factors that could potentially explain couple relationship satisfaction, such as gender, education level, the distance between places of origin, and nationality, to determine whether these factors challenge the impact of transitivity.

**2. Methods**

**2.1. Study population**

The data in this study are derived from the Measurement and Observation of Social Attitudes in Switzerland

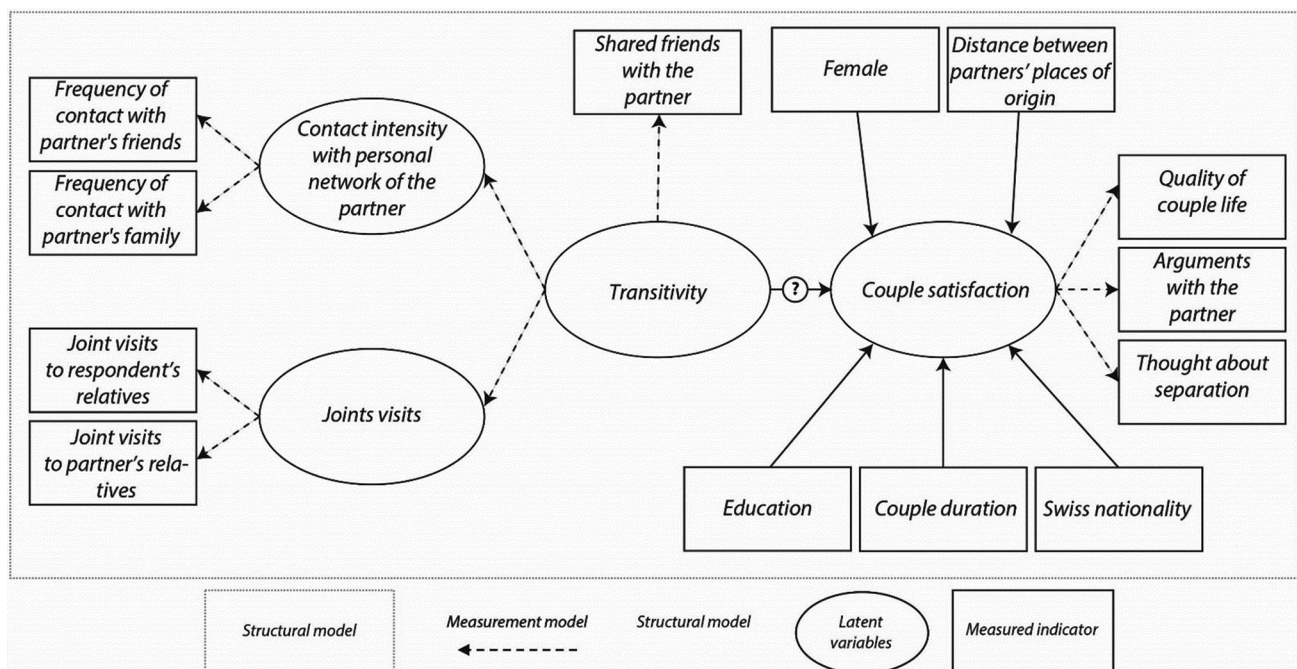


Figure 1. Conceptual model

(MOSAiCH) 2019<sup>1</sup> cross-sectional survey (2020), which focused on the attitudes and values of the Swiss population on a wide range of social issues. The international component is complemented by a local module composed of Swiss-specific questions, examining the inequalities related to spatial mobility, personal network characteristics, and couple relationship satisfaction. Specifically, the MOSAiCH 2019 survey is based on a probability sample representing the population of adults (over 18 years of age) residing in Switzerland ( $n = 3.098$ ) (Table 1). The data were collected by means of a self-administered questionnaire that was completed by 2043 individuals. For the following analyses, we selected the respondents living together as couples ( $n = 1.320$ ).

## 2.2. Analytical strategies

### 2.2.1. Method and modeling

To test the conceptual framework and measure the relationships pre-figured in the hypotheses, we select confirmatory factor analysis (CFA), followed by SEM. This allows us to confirm the latent character of transitivity and couple relationship satisfaction while assessing their relationship. An additional advantage of using SEM is its simultaneous approach, which enables us to verify the conceptual model (fit indicators) as well as measure the relationships between the different observed and estimated variables of the model.

In this case, the SEM consists of two parts: a measurement model and a structural model. First, the measurement model links a set of measured and observable variables to an unobservable (latent) variable. As for the choice of indicators, it is guided by the empirical literature, while the latent variables are set up by using CFA and Cronbach's alpha for indicator congruence (Hoyle, 2014). Second, the structural model estimates the explicit links between the different latent variables, testing our hypotheses. This combination of methods is frequently used to determine whether a set of indicators reflects a theoretical construct (Anderson & Gerbing, 1988). In the present study, it is used to estimate the theoretical constructs regarding both the transitivity of the couple's personal network and their couple's relationship satisfaction (H1, H2). The SEM also allows us to examine the relationship between these two latent variables (H3) and the other observed variables (H4). Moreover, we use the maximum likelihood (ML) estimator (lavaan package R version 0.6 – 8; Rosseel, 2012) with robust standard errors, and Satorra & Bentler's (1994) scaled test statistic to account for the non-normality of the observed variables (Hoyle, 2014).

<sup>1</sup> Measurement and Observation of Social Attitudes in Switzerland.

**Table 1. Description of the sociodemographic variables**

	Overall ( $n=962$ ) (%)
Gender	
No answer	3 (30.3)
Male	480 (49.9)
Female	479 (49.8)
Age	
Mean (SD)	48.3 (11.3)
Median (Min, Max)	49.0 (23.0, 85.0)
Missing	5 (0.5)
Nationality	
Without nationality	3 (0.3)
No answer	6 (0.6)
Switzerland	840 (87.3)
Italy	25 (2.6)
France	11 (1.1)
Germany	28 (2.9)
Austria	4 (0.4)
Rest of Europe	34 (3.5)
Africa	3 (30.3)
America	4 (0.4)
Asia	4 (0.4)
Education	
No answer	7 (0.7)
Primary school, not completed or completed (ISCED 0 and 1)	17 (1.8)
Lower secondary education (including 10 <sup>th</sup> year) (ISCED 2)	74 (7.7)
Upper secondary education, elementary vocational (ISCED 3 short)	19 (2.0)
Upper secondary education, full vocational (ISCED 3)	208 (21.6)
Upper secondary education, general, access to tertiary (ISCED 3)	69 (7.2)
Post-secondary education, higher vocational (ISCED 4 and 5B)	194 (20.2)
Tertiary, vocational (ISCED 5A)	173 (18.0)
Tertiary, university (ISCED 5)	159 (16.5)
Tertiary, PhD (ISCED 6)	42 (4.4)

### 2.2.2. Definition of the latent variables and observed indicators

In this study, the measurement model is based on the CFA of a series of observed variables that contribute to the construction of three first-order latent variables and one second-order latent variable. The structure of this model is described in Figure 1, while the descriptive statistics

of all the observed data in the model are presented in Table 2.

From the perspective of the conceptual framework proposed earlier, this model estimates the transitivity of the couple's network and its impact on couple relationship satisfaction. Specifically, it is based on the following three first-order latent variables and one second-order latent variable:

- [1] The contact intensity variable between the respondents and their partner's family is estimated from the frequency of contact between the respondents and their partner's friends and between the respondents and their partner's family.
- [2] The latent variable of shared visits is based on the latent congruence between joint visits by the partners at both the respondent-entourage and partner levels.
- [3] The latent variable of transitivity (second-order) is estimated from the latent congruence of the contact intensity between the respondents and their partner's family, the shared visits, and the number of common friends.
- [4] Finally, the couple relationship satisfaction variable is estimated from the latent congruence between the perception of the quality of the couple in general, the frequency of arguments between them, and the frequency of the respondents' thoughts of separation.

### 3. Results

The first sub-section covers the measurement model, which includes the different types of visiting practices of couples and couple relationship satisfaction. The second sub-section discusses the SEM results (Figure 2).

#### 3.1. Latent variables of joint visits and couple relationship satisfaction

The CFA results indicate that the model estimation is good, based on the standardized root mean square residual (SRMR = 0.041), the root mean square error of approximation (RMSEA = 0.044), the comparative fit index (CFI = 0.910), and the Tucker-Lewis index (TLI = 0.882). These findings also confirm the latent congruence between the observed variables used to estimate the latent variables (H1, H2). First, the observed variables concerning the frequency of contact between the respondents and their partner's family and friends were used to construct the first-order latent variable representing such frequency. Second, the latent congruence between the variables regarding joint visits to the respondents and their partner's family allowed us to estimate the joint visits in the first-order latent variable representing such visits. Combined with the number of common friends, these first-order latent variables enabled us to construct the second-order variable representing transitivity. Finally, the estimation of couple relationship satisfaction, as a latent variable from

Table 2. Definitions of the variables and the descriptive statistics

Variable	Definition	Type	Min	Max	Mean	SD
Quality of couple's life	The respondent's perceptions of the quality of the couple's life	Likert scale ranging from 1 to 5 (1=Very bad→5 = Very good)	1	5	1.7	0.7
Arguments with the partner	Reported frequency of arguments with the partner by the respondent	Likert scale ranging from 1 to 7 (1=Almost every day→7 = Almost never)	1	7	5.2	1.6
Thoughts about separation	Reported frequency of thoughts about separating from the partner by the respondent	Likert scale ranging from 1 to 5 (1=Yes, and it happened (to reconciliation) → 5=No, never)	1	5	1.8	1.0
Frequency of visits to the partner's friends	Frequency: Visiting/meeting the partner's friends face-to-face	Likert scale ranging from 1 to 6 (1=Never→6 = Several times a week)	1	6	3.8	1.2
Frequency of visits to the partner's family	Frequency: Visiting/meeting the partner's family face-to-face	Likert scale ranging from 1 to 6 (1=Never→6 = Several times a week)	1	6	3.7	1.3
Frequency of visits to one's friends	Frequency: Visiting/meeting one's friends face-to-face	Likert scale ranging from 1 to 6 (1=Never→6 = Several times a week)	1	6	2.8	1.3
Frequency of visits to the family	Frequency: Visiting/meeting one's family face-to-face	Likert scale ranging from 1 to 6 (1=Never→6 = Several times a week)	1	6	1.9	1.2
Joint visits to friends	Together with the partner: Visiting/meeting the respondent's friends	Likert scale ranging from 1 to 6 (1=My partner never visits his/her family→6 = Always together)	1	6	2.7	1.0
Joint visits to the family	Together with the partner: Visiting/meeting the respondent's family	Likert scale ranging from 1 to 6 (1=My partner never visits his/her family→6 = Always together)	1	6	2.3	0.9
Joint visits to the partner's family	Together with the partner: Visiting/meeting the partner's family	Likert scale ranging from 1 to 6 (1=My partner never visits his/her relatives→6 = Always together)	1	6	2.1	1.0

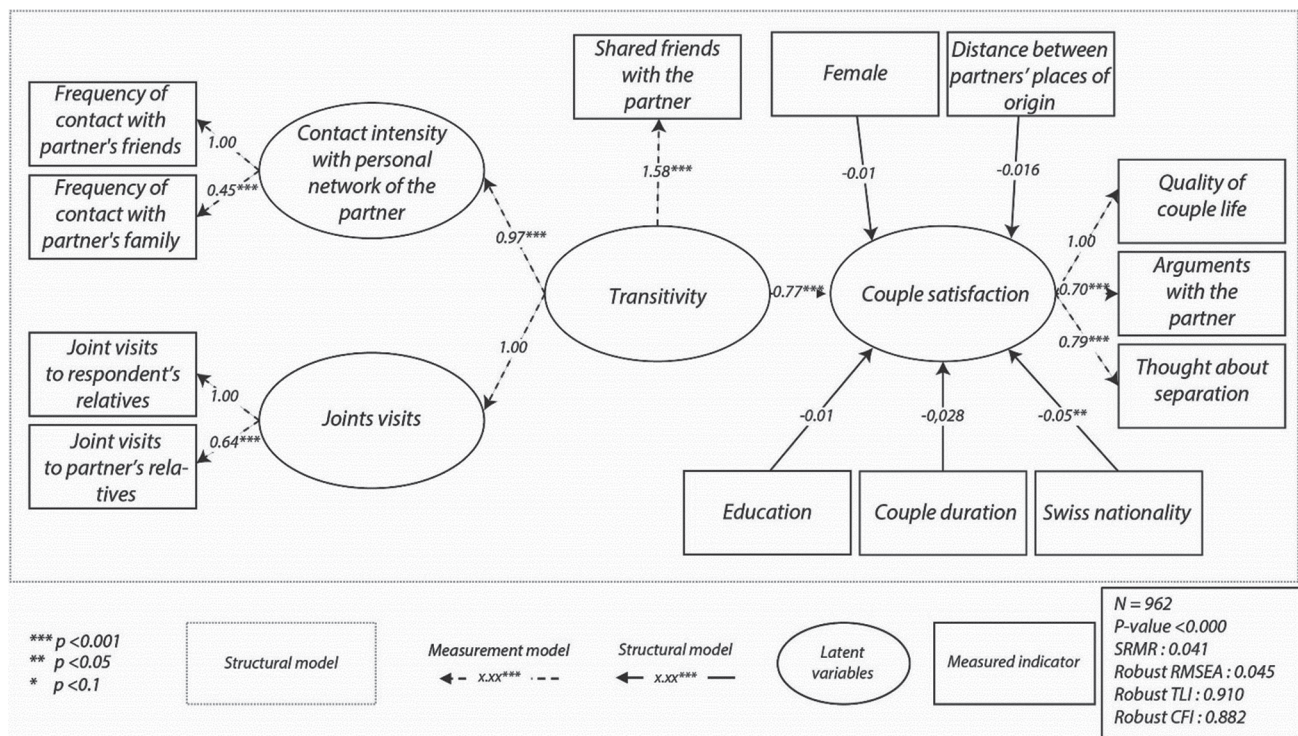


Figure 2. Structural equation modeling results

the observed variables related to the quality of life of the couple, the frequency of arguments between them, and thoughts of separation, was also supported by the CFA. Overall, the CFA results confirm the robustness of the latent variables from the different observed variables as well as the robustness of the measurement model.

### 3.2. Results of the SEM model

As shown by the SRMR, RMSEA, TLI, and CFI, the fit indicators of the SEM are robust, which allowed us to establish the relationships between the different latent variables. In terms of testing the relationships, their significance and intensity between network transitivity and couple relationship satisfaction were measured. The measurement model also considered several control variables for each member of the couple, including gender, education level, nationality, the distance between the place of origin, and the duration of the relationship.

The results also showed significant effects between the network transitivity of both members of the couple and couple relationship satisfaction, with such transitivity favoring the latter (standard estimate = 0.77). These findings suggest that joint visits to family and friends, the frequency of contact between the respondents and the partner's family and friends, and the friendship network overlap correlate with high couple relationship satisfaction. This is consistent with previous research indicating that the

network transitivity between both members of the couple is positively linked to couple relationship satisfaction (H3).

Furthermore, after controlling for couple relationship satisfaction with the variables (i.e., gender, education level, duration of the relationship, nationality, and distance between the place of origin), the findings show that they are not significant. This supports the idea that the transitivity of a couple's network and its components, which include contact intensity, shared visits, and friendship network overlap, is a powerful vector of couple relationship satisfaction.

### 4. Discussion

Based on the data from couples living in Switzerland, the transitivity of ties with family and friends among couples was positively associated with couple relationship satisfaction. These results contribute to the literature on couple relationship satisfaction by revealing several underlying structural determinants.

First, our findings indicate that the proportion of shared friends among couples, the frequency of contact, and joint visits to the partner's friends and family are the main dimensions of the transitivity of family and friendship ties among couples. Meanwhile, mutual friendships and family members imply a greater interaction between members of the couple's entourage, which may be associated with

different forms of support and approval (Ashida *et al.*, 2019). Notably, the couple's social network plays a facilitating (or negotiating) role that contributes to the consolidation of the conjugal bond (Cornwell, 2012; Stein, 2020; Widmer, 2016).

Second, our results suggest that social visits involving both partners are a key factor in couple relationship satisfaction. This is in line with previous studies suggesting that joint activities significantly increase couple relationship satisfaction (Flood & Genadek, 2016; Reissman *et al.*, 1993). Joint activities also define and reinforce the couple's identity within a shared universe as well as provide opportunities to improve communication and conflict management skills (Hickman-Evans *et al.*, 2018). These activities not only depend on the interactions between partners but also the interactions with members of each partner's personal network.

The identified association between couple relationship satisfaction and joint activities (e.g., social visits) may also be relevant to other fields of study that examine couple relationship satisfaction (Urry, 2012). For example, joint mobility practices performed as a couple are likely to improve couple relationship satisfaction (Kaufmann & Widmer, 2006). Spatial mobility also has an indirect impact on couple relationship satisfaction, while social visits are a time investment, especially when they frequently occur and involve considerable distances. In this regard, the couple's spatial mobility is an important element of couple relationship satisfaction. This finding also confirms that mobility is an important resource for the quality of life and social integration (Kaufmann & Widmer, 2006; Kesselring, 2005). Moreover, joint activities and social visits refer to sharing both time and energy. Hence, time studies (as a field of research) should be conducted to determine how spending quality time with one another can enhance couple relationship satisfaction (Bó, 2020).

However, several limitations of this study should be noted when interpreting our results. First, only one member of each couple was interviewed. Second, the data did not allow us to distinguish whether the absence of social visits could be attributed to the geographical distance from family and friends or whether it was a deliberate choice. Finally, the specific motivation for the visits and the perceived quality of the visits, friendships, and family relationships were unknown.

## 5. Conclusion

The existing literature mainly focuses on the association between the multiple facets of couple relationship satisfaction and the norms, values, and projects of the couple. However, there is limited empirical research on the relational dimensions of couple relationship satisfaction by

using activities that member of a couple have in common. Thus, this study clarified the association between transitivity and couple relationship satisfaction, highlighting the importance of sharing friends and family as well as making joint visits to the members of this shared network.

This is particularly important because transitivity is a central concept in relational sociology (Emirbayer, 1997) since it elucidates the interconnectedness and dynamics within social networks (Granovetter, 1973). It also highlights how relationships between individuals influence one another, creating patterns of interaction and social cohesion. Moreover, transitivity is associated with bonding social capital, which is characterized by strong ties between individuals (Widmer, 2016). In this regard, it helps us understand the significance of social connections and resources embedded within these networks as well as the way they shape individuals' opportunities and outcomes. Altogether, transitivity and social capital provide a nuanced understanding of how relationships foster trust, reciprocity, and collective action, impacting both individuals and communities (Torche & Valenzuela, 2011). However, further research is necessary to better empirically assess how transitivity, social networks, and social visits interact with life course dynamics, which is still an understudied topic (Vacchiano *et al.*, 2024).

Overall, by emphasizing the role and importance of joint visits by both members of the couple, this study shares a conceptually and methodologically original insight as well as provides a better understanding of the ways in which couple relationship satisfaction can vary. Therefore, it fills a gap in the existing literature on conjugal interactions.

## Acknowledgments

The authors are grateful to the Swiss National Science Foundation for its financial assistance.

## Funding

This publication benefited from the support of the Swiss National Centre of Competence in Research LIVES – Overcoming vulnerability: Life course perspective (NCCR LIVES), which is financed by the Swiss National Science Foundation (grant number: 51NF40-185901).

## Conflict of interest

The authors declare they have no competing interests.

## Author contributions

*Conceptualization:* All authors

*Formal analysis:* Guillaume Drevon, Jacques-Antoine Gauthier

*Investigation:* All authors

*Methodology:* Guillaume Drevon, Florian Masse, Alexis Gummy  
*Writing–original draft:* Guillaume Drevon, Jacques-Antoine Gauthier, Gil Viry  
*Writing–review & editing:* All authors

## Ethics approval and consent to participate

Not applicable.

## Consent for publication

Not applicable.

## Availability of data

The data used in the study can be obtained for research purpose at: <https://www.swissubase.ch/de/catalogue/studies/13362/16860/overview>.

## Further disclosure

Part of or the entire set of findings has been presented in a conference, academic meeting, congress, etc.

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<https://doi.org/10.19082/3369>

## REPORT

# I slept with a man from the shopping center to get sugar and money in return: Survival strategies of left-behind children in rural Zimbabwe

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## Abstract

Employing an in-depth phenomenological approach, this study explores the experiences of left-behind children residing with extended families in the Chivi district, Zimbabwe. Twelve participants, aged 13–19 years, were selected for this qualitative investigation. Through individual in-depth interviews, the children shared their insights on familial dynamics, revealing the nuanced nature of extended care arrangements. The key findings illuminate the participants' profound reflections on the challenges of having been left behind and elucidate the psycho-emotional ramifications of parental separation. In addition, the study underscores risk survival strategies that left-behind children employ to navigate socioeconomic challenges within extended family settings, including engagement in transactional sex and risky mining activities. Participants expressed feelings of abandonment in comparison to their peers living with biological parents. Notably, the study reveals the significant resilience exhibited by left-behind children, who described various coping mechanisms such as journaling and reliance on religious practices. The study recommendations advocate for the enhancement of legal and policy frameworks to better safeguard the well-being of children in Zimbabwe's strained extended family support system.

**Keywords:** Left-behind children; Extended family; Survival strategies; Rural Zimbabwe

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**Citation:** Jimu, C., Tarisayi, K.S., & Mutambisi F.J. (2026). I slept with a man from the shopping center to get sugar and money in return: Survival strategies of left behind children in rural Zimbabwe. *International Journal of Population Studies*. 12(1):128-138.  
<https://doi.org/10.36922/ijps.4486>

**Received:** August 9, 2024

**Revised:** September 17, 2024

**Accepted:** October 17, 2024

**Published online:** November 14, 2024

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**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## 1. Introduction

Across sub-Saharan Africa, it is common for children to be raised within extended family networks rather than solely by their biological parents. In Eastern Africa alone, it is estimated that more than 19 million children live in such kinship care arrangements (Martin & Zulaika, 2016). Zimbabwe is no exception, with data indicating that more than a third of children aged 1–14 years reside solely with extended family, with their biological parents being absent (Black *et al.*, 2017). The practice of entrusting children

to the care of relatives, often aunts, uncles, or grandparents, serves important socioeconomic functions in resource-constrained contexts, enabling access to resources, education, and support that might not be available within the nuclear family. However, the specific circumstances leading to kinship care placements vary, with some children being purposely sent to live with relatives and others being left behind when one or both parents emigrate for work.

Migration often serves as a catalyst for the separation of children from their parents, leading to their placement with extended family members. In Zimbabwe, challenging economic conditions frequently drive one or both parents to emigrate to neighboring countries such as South Africa in search of better employment opportunities (Matsa, 2020; Ndlovu, 2022; Tarisayi & Manik, 2020). However, the receiving countries have been tightening immigration laws and border controls, making it increasingly difficult for labor migrants to bring their families with them (Benería *et al.*, 2012). As a result, many parents are forced to emigrate without their children, leaving them in the care of extended family networks back home (Parreñas, 2009). Notably, research indicates that women have been emigrating out of their home countries at higher rates, further intensifying the challenges faced by left-behind children (Bachan, 2018). Although in some cases, one parent might remain with the children while the other emigrates, the focus of this study is on children who have been entrusted to the exclusive care of extended family members because of the absence of one parent or both.

However, despite the pervasiveness and implicit protective motivations underlying this practice in rural Zimbabwe, evidence suggests that children in extended family care experience substantial adversities, including sexual abuse, discrimination, child labor exploitation, and lack of access to schooling. Moreover, sexual abuse can lead to increased risk of HIV transmission among these children as the encounters are often forced and do not involve protection (Ayerdi Aguirrebengoa *et al.*, 2020; Makuyana *et al.* 2020; Mushunje, 2014).

Although the challenges that confront children placed in the care of non-parental relatives have been increasingly recognized, the perspectives of the children themselves on their lived experiences remain scarce, especially in the context of rural Zimbabwe. Existing studies have tended to focus on the efficacy of extended families in providing care for orphans and vulnerable children (OVC) and the coping strategies of caregivers in addressing the needs of OVCs at the household level (Ringson & Chereni, 2020; Matsa, 2020). This represents a significant gap in the literature, given the status of children as social actors with unique insights that warrant deeper investigation (James & Prout, 2015).

To address this gap, this qualitative study explores the everyday experiences of children aged 13–19 years who have been left in the care of extended family members in Chivi, a poor rural district of Zimbabwe. By centering the subjective perspectives of these children, the study aims to contribute nuanced empirical insights into the realities of life in extended family caregiving arrangements in this context. These findings can inform a more contextualized understanding of the needs and challenges faced by this often overlooked population of children.

The phenomenon of left-behind children is relatively unexplored in Zimbabwe (Ringson & Chereni, 2020; Tawodzera & Themane, 2019), yet crucial aspects such as the survival strategies of these children have been overlooked (Mathambo & Gibbs, 2009), although they are important for addressing health risks such as HIV/AIDS vulnerability. As further testament to academic neglect of this vulnerable group, little has been done for this group in rural Zimbabwe, especially in terms of documenting interventions. In this research, we argue that Zimbabwe, like any other developing country that faces economic challenges, is experiencing increased emigration, leading to parents leaving behind their children in extended care settings. Our findings may be generalized to other geographic locations with similar populations. Furthermore, our findings may be applicable to other sub-Saharan countries with settings comparable to those in Chivi. Without adequate support and guidance, left-behind children experience numerous challenges that include assuming adult responsibilities, caring for their siblings, and providing for the family (Mao *et al.*, 2020). However, research on the experiences and coping mechanisms of left-behind children has been limited. Therefore, this study aims to address the following research questions:

- I. What are the survival strategies employed by left-behind children living with extended families in rural Zimbabwe?
- II. What are the experiences of left-behind children living with extended families in rural Zimbabwe, particularly in the Chivi district?

## 1.1. Theoretical framework

We used Bronfenbrenner's (1979) ecological systems theory as a conceptual lens for analyzing the multifaceted experiences of children in this study. Bronfenbrenner's model posits that human development is shaped by the complex interplay of influences across various systemic levels, from the immediate interpersonal interactions within the household (microsystem) to the broader community and institutional contexts (mesosystem and exosystem) and ultimately to the overarching societal and policy environments (macrosystem).

At the microsystem level, children in kinship care can face challenges such as abuse, discrimination, and lack of affection compared with children living with their biological parents (Kiraly & Humphreys, 2017; Terre Des Homes, 2018). In addition, the financial precarity and age-related vulnerabilities of grandparents and other older relatives who increasingly serve as primary caregivers can undermine the quality of care provided (Cheng & Siankam, 2009). These interpersonal dynamics within the household can take a psychological toll, contributing to higher rates of behavioral and attachment issues among children in out-of-home placements (Kiraly & Roff, 2023).

Moving outward to the mesosystem, children living with extended family might also confront community-level challenges such as poverty, stigma, and exploitation, which can lead to neglect or force children to engage in unsafe activities to meet their basic needs (Kuyini *et al.*, 2009; Stark *et al.*, 2018). The exosystem encompasses institutional factors, such as the failure of schools in providing adequate emotional support to separated children, leading to poorer educational outcomes (Dolbin-MacNab & Yancura, 2018).

Finally, at the macrosystem level, the assumption that kinship care inherently promotes child well-being has underpinned government efforts in some countries to encourage such family-based alternatives to institutionalization, without commensurate allocation of support resources (Hallett *et al.*, 2021; Kiraly & Humphreys, 2017). This ecological framework thus provides a valuable lens for conceptualizing the complex, multilayered challenges that confront children who are raised by extended families.

Crucially, however, children are not merely passive victims in these challenging ecologies. Using a resilience perspective (Rutter, 2015; 2000), this study also explores children's agency and adaptive coping strategies amid kinship care adversity, encompassing self-reliance behaviors, drawing on peer and religious support, and intentionally reshaping their sociocultural environments (Thwala, 2018; Skovdal *et al.*, 2009; Ungar, 2008). This balanced approach acknowledges the limitations of the kinship care system while also recognizing children's demonstrated capacities for resilience.

## 2. Data and methods

This qualitative study used an in-depth phenomenological approach to explore the lived experiences of children left in the care of extended family members in rural Zimbabwe. As described by Boyd (2015), phenomenology aims to understand participants' subjective realities and determine the essence of phenomena through their experiences. This approach was suitable for capturing the complex and nuanced narratives of left-behind children.

An interpretivist paradigm underpinned this research, which emphasizes that individuals construct subjective meanings from their experiences (Denzin, & Lincoln 2011; Maree, 2007; Zondi & Tarisayi, 2020). This paradigm facilitated the exploration of the socially constructed realities and perceptions of children in kinship care arrangements in the context of rural Zimbabwe. This paradigm allowed the study to capture the unique experiences and survival strategies of left-behind children, thus contributing new insights into the lived experiences of this vulnerable population (Nieuwenhuis, 2016).

A purposive criterion sampling method was employed to select 12 participants aged 13–19 years who lived with non-parental guardians in the Chivi, a rural district with high levels of poverty and kinship care. To address concerns regarding consent for participants aged 13–15 years, assent was obtained from the children and formal consent was secured from their legal guardians or caretakers, following ethical guidelines that protect minors' participation in research. The first two participants were recruited through local leaders who were well-acquainted with children in extended family care (Gallagher, 2020). Thereafter, snowball sampling was used, with the initial participants referring peers who met the inclusion criteria. The inclusion criteria were residence with extended family for at least 6 months, regardless of whether one parent or both were absent; signed assent and consent forms; and voluntary agreement to be interviewed. This method ensured a broader diversity of participants while mitigating selection bias.

Data were collected through in-depth semistructured interviews, each lasting approximately 45 minutes. Participants were asked about their familial relationships, living conditions, psychosocial challenges, survival strategies, and experiences of extended family care. Four participants were re-interviewed to obtain further clarification about issues raised in the initial interviews. The flexible nature of the interview guide allowed for the exploration of unanticipated themes (Bryman, 2016; Zondi & Tarisayi, 2020). To foster trust and minimize distress, the interviews were conducted in private, comfortable spaces, such as local community centers. In addition, interviews were conducted during school hours per children's preference; moreover, our data collection methods were age appropriate, and all researchers were experienced in child protection and ethical research practices.

The data were analyzed thematically, using an inductive coding process (Braun & Clarke, 2006). Initial coding was followed by clustering themes and the refinement of categories to identify key patterns in the participants' narratives. This iterative process helped to surface critical themes related to children's survival strategies and the

socioemotional impact of parental separation. To ensure trustworthiness and credibility, the study used member-checking, triangulated findings with the existing literature, and provided detailed contextual descriptions (Amankwaa, 2016). Ethical approval was obtained from the Reformed Church University and social welfare bodies of the Government of Zimbabwe. All participants were assured of confidentiality, and pseudonyms were used throughout the reporting of the findings to protect their identities. Signed consent and assent forms were obtained, and data were securely stored following standard data protection protocols.

### 3. Key findings

#### 3.1. Description of study participants

The data set captured in Table 1 presents a diverse group of 12 participants ranging in age from 13 to 19 years, with an equal distribution of males and females. Their educational backgrounds vary from Grade 7 to different forms of secondary education, reflecting a progression in academic levels with age. Half of the participants had paid their monthly tuition, and the other half had not, indicating potential financial disparities within the group. Notably, four participants, all aged 15 and above, had dropped out of school, suggesting that older students might face increased challenges in continuing their education. The data also revealed engagement in high-risk activities: four female participants aged 15 and older reported involvement in transactional sex, and three male participants aged 17 and older were reported to have been involved in illegal mining. Interestingly, not all school dropouts were engaged in those risky behaviors, and some participants involved in transactional sex or illegal mining were still

attending school. This complex picture highlights the multifaceted challenges that face these young individuals, including educational retention, financial pressures, and exposure to potentially exploitative or dangerous activities. This information underscores the need for targeted interventions to address educational support and prevention of risky behaviors among adolescents and young adults in this community.

#### 3.2. Navigating fluid family dynamics

The complex relational dynamics within extended family caregiving arrangements profoundly impacted the participants' sense of belonging. Children expressed feelings of subordinate status because of the discriminatory actions of caregivers who favored their biological offspring. As 16-year-old Tatenda recounted, *"My aunt shouts at me differently than her own children.our lunchboxes are packed differently."* Such favoritism appeared to be tied to the economically strained context, resulting in the children being considered "extra mouths to feed," as described by 13-year-old Nicole: *"Sometimes I feel like an added burden when my uncle complains about buying food for all of us."*

However, one girl, Alicia, aged 15, had moved in with her grandmother after parental emigration and felt wholly embraced into the new family ecology, stating, *"I love living with grandma. she shares everything equally."* These variable family-belonging experiences align with previous research demonstrating that the quality of kinship care depends substantially on caregivers' attitudes and commitment toward fostered children (Kiraly & Humphreys, 2017; Delap, & Saksena, 2016). The financial resources in households also clearly mediated care dynamics, underscoring the relevance of Bronfenbrenner's ecosystem

**Table 1. Profile of participants by Education Level, tuition payment, and engagement in risk behaviors**

Participant pseudonym	Age	Gender	Level of education	Monthly tuition paid on time	School dropout	Engagement in transactional sex	Engagement in illegal mining
Nicole	13	Female	Grade 7 (primary)	No	No	No	No
Alicia	15	Female	Form 1 (secondary)	Yes	No	Yes	No
Tanaka	18	Male	Form 4 (secondary)	No	Yes	No	Yes
Nyasha	16	Female	Form 2 (secondary)	No	No	Yes	No
Tino	17	Female	Form 2 (secondary)	Yes	No	Yes	No
Takura	18	Male	Form 3 (secondary)	Yes	Yes	No	Yes
Tatenda	16	Male	Form 4 (secondary)	Yes	No	No	No
Tapiwa	18	Male	Form 5 (advanced)	Yes	No	No	No
Chawapiwa	19	Male	Form 6 (advanced)	Yes	Yes	No	No
Patrick	17	Male	Form 3 (secondary)	Yes	No	No	Yes
Anotidaishe	16	Female	Form 1 (secondary)	No	Yes	Yes	No
Kudzai	13	Female	Grade 7 (primary)	Yes	No	No	No

that emphasizes reciprocal impacts among multilayered systems that surround children.

### 3.3. Contesting gendered caregiving roles

Several children described consciously resisting socially prescribed gender conventions to tackle caregiving duties, which simultaneously fostered self-reliance. One 18-year-old boy, Tanaka, proudly stated, *“I wake up doing all chores, dishes, laundry, cleaning, despite the notion that boys shouldn't do ‘women's work’. I have no choice if I want to survive.”* Similarly, 13-year-old Nicole challenged gender norms by earning to provide for her siblings: *“I sell firewood, fetch water, herd cattle. [these are] traditionally men's jobs, but I'm proud to provide as the head of the household.”*

These acts of youthful defiance in fostering environments signify children's agentic negotiation of adverse circumstances, hinting at emerging transformational notions of gender. However, 16-year-old Nyasha's testimony poignantly highlights the emotional toll imposed by such pre-mature adultification: *“I desperately miss just being a child, you know. but responsibility of my siblings means I must grow up quickly.”* This demonstrates the complex tension between displays of resilience and subtle grief at lost childhoods because of caregiving duties. Such accounts crucially highlight children in Zimbabwean foster households as social actors dynamically interacting with their sociocultural ecologies, congruent with Bronfenbrenner's model.

### 3.4. Survival strategies amidst scarcity

The most frequently referenced challenge was the scarcity of basic provisions within characteristically low-resourced rural homesteads. Children adopted a range of pragmatic coping responses to mitigate hunger, invoking solidarity with peers and self-directed efforts to meet needs and signaling strength and ingenuity applied to difficult conditions. As 13-year-old Kudzai explained: *“When starving, my friends share their extra food. I also make brooms for sale using bush reeds.”* Similarly, Anotidaishe, aged 16, stated, *“I sell aunt's tomatoes at the market after school to earn money for clothes and sanitary pads.”*

However, two male participants, Patrick and Takura, aged 17 and 18, respectively, openly divulged their engagement in risky and illegal informal mining for sustenance, captured by Tanaka's statement: *“I know digging pits to mine gold without permits is dangerous, but spare cash from gold panning keeps my siblings fed when the crops fail.”* These strategies for coping with economic constraints reveal children's concerted attempts at welfare provision within a challenging caregiving landscape, again reinforcing youth agency. However, the forced adoption of hazardous subsistence strategies also denotes a worrisome

direction of last resort induced by adversity and systemic inequities in the family care system.

### 3.5. Transactional sex: A desperate survival mechanism

The research findings highlighted that poverty and economic hardship drove some adolescent girls in extended families to engage in transactional sex. Tatenda, a 16-year-old participant, recounted the following:

*“There was a time when my grandmother was away; I slept with a man from the shopping center to get sugar and money in return, which I used to buy street-style clothes like my friends. I'm afraid I may have contracted HIV because I got an STI from the same man. I also bought a cell phone and lied to my grandmother that it was from my mother who is in South Africa.”*

Transactional sex has been associated with increased risk of intimate partner violence and HIV transmission, particularly when women have limited leeway to negotiate condom use (Deane & Wamoyi, 2018; Jewkes *et al.*, 2012; Jimu *et al.*, 2021). In addition, transactional sex often results from coercive economic circumstances, including poverty and peer pressure to adopt modern lifestyles (Kyegombe *et al.*, 2020). These findings underscore the desperate measures that some left-behind children resort to in the face of intersecting vulnerabilities.

### 3.6. Abandonment, stigma, and discrimination

Some children considered their entry into extended family care a normal part of their upbringing; however, for others, this entry represented a traumatic rupture. Nyasha poignantly described feeling abandoned, first by her mother who had emigrated to South Africa and then by her father who started a new family:

*“I miss my mom, especially on Civic Day at school when other children are sitting with their parents. I last saw her when I was 7 years old; now I'm 16 and she hasn't come back. I sometimes sit in a quiet place processing my thoughts and feelings. I am mad at my father for abandoning us; it breaks my heart and makes me very sad that my own father rejected me.”*

Research suggests high rates of depression, emotional and behavioral problems, and post-traumatic stress among adolescents with separated parents (Bohman *et al.*, 2017; Kiraly & Humphreys, 2017). The distress expressed by Nyasha and other participants underscores the profound impact of parental absence and perceived rejection on children's well-being.

### 3.7. Finding hope and meaning amid adversity

A prominent cross-cutting theme was children's resilient maintenance of hope and future orientation despite

manifold foster-care challenges. Many participants expressed heartfelt aspirations that appeared to posit a symbolic light at the end of the tunnel. For Tatenda, this encompassed romanticized visions of reunification: *"I dream every day about both my parents coming back so we can be a real family again."* Other participants articulated ambitious career goals as motivational coping anchors, with 18-year-old Tapiwa sharing, *"I want to be a doctor to help my community... remembering this goal keeps me working hard in school."*

The most powerful narrative emerged from Nyasha, whose escape strategy involved writing messages of self-encouragement in her journal: *"I write hopeful words addressed 'to the future me' about overcoming this hardship and succeeding."* Such endured optimism in the face of structured adversity is a stirring example of individual and collective resilience, showing belief in self-efficacy and a better future. This speaks to the irrepressible human capacity to construct healing, affirmative counter narratives even in difficult circumstances.

### 3.8. Role of remittances in left-behind children's experiences

Remittances from parents working abroad constitute an important factor influencing the well-being of left-behind children. Remittances, defined as financial or material support sent by emigrant individuals to their families back home, are a critical component of household income for many families in rural Zimbabwe. However, this study revealed that remittances were inconsistent and, in many cases, insufficient to meet the basic needs of the left-behind children.

Several participants indicated that although their parents were working in neighboring countries, the remittances received were sporadic and often delayed. For example, 17-year-old Tino, who is also involved in transactional sex, mentioned: *"My mother sends money, but it comes every few months, and sometimes it's not enough for school fees and food."* Similarly, Patrick explained that his family rarely received remittances, forcing him to engage in illegal mining to provide for himself and his siblings.

In other cases, remittances were used primarily to cover essential household expenses such as food, leaving little to no funds for education-related costs. As a result, several participants reported that they struggled with paying tuition fees on time, which, as reflected in Table 1, contributed to school dropouts. The economic instability caused by irregular remittances also increased the likelihood of participants engaging in risky survival strategies, such as transactional sex or illegal mining, in order to supplement the household income.

This study highlights that although remittances can provide much-needed financial relief, their irregularity exacerbates the vulnerability of left-behind children, who are often forced to assume adult roles to support their families. Future policies aimed at supporting left-behind children should consider the variability of remittance flows and the need for additional social safety nets to mitigate financial uncertainties.

## 4. Discussion

This section highlights the resilience and agency of left-behind children in rural Zimbabwe, providing insights into their lived experiences with extended family networks. This exploration aligns with the existing literature on the psycho-emotional impacts of parental separation on children in the Global South. Economic deprivation often compounds children's distress, further influencing their sense of belonging and family dynamics (Bray & Dawes, 2016). However, this study moves beyond a simplistic view of vulnerability to reveal the agency of these children, particularly in their efforts to negotiate gender roles and economic responsibilities.

At the microsystem level, Bronfenbrenner's ecological systems theory (1979) serves as a useful framework for determining how these children's immediate environments, including their relationships with their caregivers, shape their experiences. The findings highlight that the care provided by extended family members varies significantly and is often influenced by the economic strain experienced by caregivers themselves. Instances of differential treatment, such as favoritism toward biological children, are common; such treatment leads to feelings of alienation among left-behind children. This mirrors existing research on kinship care, which emphasizes the importance of caregiver attitudes in determining the outcomes for children (Kiraly & Humphreys, 2017). However, the study also shows that not all extended family arrangements are inherently problematic, with some children reporting positive, nurturing relationships with their caregivers.

The children's agency is evident in their ability to adapt to challenging circumstances. The study illustrates that children often assume non-traditional roles, particularly in terms of caregiving and economic provision. Boys, for example, challenge gender expectations by performing household chores typically associated with women. This defiance of social norms indicates an emerging shift in gender roles within the caregiving framework. These findings resonate with Gitterman & Germain's (2008) life model perspectives, which emphasize individuals' motivation to adapt to their environments. The children made conscious efforts to fit into shifting family dynamics

and provide for their households despite the challenges they face.

At the mesosystem level, the study explores how broader community interactions affect the children's well-being. Economic scarcity within these rural homesteads often forces children into precarious situations, including transactional sex and illegal mining, as strategies for survival. These actions, although harmful, are considered last-resort measures taken because of extreme deprivation. Children's engagement in such dangerous activities is a distressing manifestation of how systemic poverty and insufficient institutional support heighten vulnerability. The findings align with the broader literature that addresses how poverty exacerbates the exploitation of children in caregiving systems (Madhavan & Gross, 2013). These risky behaviors also highlight the structural drivers—such as inadequate remittance flows—that push children to adopt survival strategies that compromise their well-being.

The children in this study are not passive victims. Instead, they actively respond to the challenges of abandonment, displaying significant resilience. For instance, the use of journaling and reliance on religious faith emerged as coping mechanisms, showcasing the children's ability to create meaning and hope amid adversity. Rutter's (2015) resilience framework provides a lens to understand how children use protective strategies, individually and collectively, to navigate their complex realities. This active construction of affirmative narratives despite harsh circumstances further destabilizes the idea that left-behind children are merely victims of circumstance.

Furthermore, the study uncovers the socioemotional costs of pre-mature adultification, wherein children are thrust into adult roles, often at the expense of their childhood. This phenomenon reinforces the agency of children; however, it also places a psychological burden on them, as reflected in their expressions of grief over lost innocence. The tension between their resilience and the emotional toll of their responsibilities indicates the necessity for sensitive interventions that recognize both their strengths and vulnerabilities (Nagl-Cupal *et al.*, 2014). The emotional distress linked to pre-mature caregiving roles is also supported by research on the psychological effects of caregiving on children in similar contexts (Cheng & Siankam, 2009).

The study also touches on the role of remittances, or the lack thereof, in shaping the experiences of left-behind children. Although remittances from parents who work abroad can provide financial support, findings reveal that these transfers are often inconsistent and insufficient. Such unpredictability exacerbates children's economic hardships, forcing them to assume adult roles to support their families.

This finding resonates with the existing literature that emphasizes the precarious nature of remittance flows and their impact on left-behind children (UNICEF, 2007). The variability of remittances underscores the need for more stable social safety nets to protect children from falling into dangerous survival strategies.

This study offers a nuanced view of left-behind children in Zimbabwe, transcending the victim narrative to emphasize these children's resilience, adaptability, and agency. However, the findings also underscore the systemic challenges these children experience, particularly the lack of institutional support and the pervasive effects of poverty. To address these issues, policies and interventions aimed at supporting left-behind children should be reconsidered, with a focus on strengthening family care systems and ensuring more consistent financial support from emigrant parents. Longitudinal studies can be conducted to obtain deeper insights into the evolving dynamics of gender roles, caregiving, and resilience in these contexts, thus offering valuable pathways for bottom-up social change.

#### 4.1. Policy implication

This research calls for a holistic, strengths-based policy framework that addresses the material needs of left-behind children and also recognizes their resilience and capacities. By centering children's lived experiences in the design and implementation of policies, more effective and sustainable support systems can be created to uplift and protect this vulnerable population in the Chivi district and beyond. First, by recognizing children's agency in negotiating their familial and social environments, policies should prioritize their voices in decision-making processes. Children in kinship care settings must be regarded as social actors with the capacity to contribute to discussions about their own welfare. This requires the inclusion of child perspectives in local and national policy dialogues to ensure that programs are designed with, rather than solely for, children (Ruiz-Casares *et al.*, 2017).

Addressing the economic challenges faced by extended families that care for left-behind children is critical. Our findings underscore the need for targeted social protection policies to address the economic vulnerabilities that shape caregiving dynamics in extended families. Policies should focus on poverty alleviation strategies such as cash transfers, educational support, and access to health care for left-behind children and their caregivers (Mao *et al.*, 2020). The cash-transfer method has proved to be a success, for instance, the Harmonized Social Cash Transfer Program in Zimbabwe. It started with a few households in Gutu and Highfields in Masvingo and Harare provinces, respectively, reaching out to at least 113,500 people, 53,000 girls and boys included, and was used for nutrition and,

more broadly, child protection services (UNICEF, 2023). Therefore, this approach would mitigate some of the economic stressors that contribute to differential treatment and precarious survival mechanisms such as transactional sex and illegal mining.

Moreover, community-based interventions need to be strengthened to reduce stigma and foster collective self-help mechanisms among left-behind children. Policy initiatives could focus on enhancing community resilience through establishing support groups for both children and caregivers, facilitating access to psychological services, and promoting the role of local leaders in child protection efforts (Mwoma & Pillay, 2015). In addition, interventions should be implemented to ensure that children and caregivers have access to psychological and material assistance through local networks (Castillo *et al.*, 2019).

Finally, mental-health interventions must be a central component of policy responses, given the emotional toll experienced by children who face pre-mature adultification. Support services, including counseling and peer-support networks, should be made readily accessible to children who are left behind to mitigate the psychological impacts of their circumstances. Mental-health support is a key component of policies that address left-behind children (Castillo *et al.*, 2019). Given the psychological toll of pre-mature adultification, policies should provide access to counseling and peer support while also promoting positive coping strategies such as journaling and spiritual practices.

## 4.2. Strengths and limitations

This study addresses a critical and sensitive issue by exploring the survival strategies of left-behind children in rural Zimbabwe. The findings highlight the often overlooked struggles of this vulnerable group, elucidating their coping mechanisms in difficult circumstances. The strength of this study lies in its use of qualitative interpretive methodologies with in-depth semistructured interviews, which allow for detailed and nuanced data collection. This approach can capture the complex personal experiences of the children and thereby provide a deeper understanding of their survival strategies.

By focusing on a specific region (Chivi district) in Zimbabwe, the research remains contextually grounded and well-positioned to obtain insights that are culturally and geographically relevant. This specificity can contribute to the development of targeted interventions. However, with only 12 children recruited, the sample size is limited. Although qualitative research often involves smaller samples, the small sample size may limit the generalizability of the findings as it may not capture the full diversity of experiences among left-behind children in the district or

across Zimbabwe. The study is focused on a single district, which might also limit the broader applicability of the findings. The experiences of left-behind children in other regions of Zimbabwe, including in urban areas, might differ significantly.

## 5. Conclusions

This study examined the lived experiences of left-behind children in rural Zimbabwe, focusing on the survival strategies they employ while living in extended family care. Using a phenomenological qualitative approach, in-depth interviews with 12 participants aged 13–19 years provided insights into the challenges and resilience of these children. Key findings highlight significant disparities in caregiving, with many children experiencing discrimination and feelings of abandonment. However, some participants reported positive, nurturing relationships within their extended families. The study revealed that left-behind children often assume adult responsibilities and defy traditional gender roles in their efforts to support themselves and their families. Despite these adaptations, the psychological toll of pre-mature adultification was evident, with children expressing grief over their lost childhood.

Participants also faced economic challenges, resorting to risky behaviors such as transactional sex and illegal mining to meet basic needs. Nonetheless, coping strategies such as journaling and religious faith provided emotional support and a sense of hope amid adversity. Although the study's small sample limits generalizability, the findings underscore the urgent need for targeted policy interventions. These measures should address inconsistent remittances from emigrant parents, enhance child protection systems, and offer psychological support to mitigate the emotional burdens experienced by left-behind children. Left-behind children in rural Zimbabwe demonstrate remarkable resilience; however, their well-being remains at risk considering the lack of adequate social and economic support. Future research should explore the long-term impacts of extended family care and potential interventions to better support this vulnerable population.

## Acknowledgments

The authors thank the participants who joined this study.

## Funding

None.

## Conflict of interest

The authors declare no conflicts of interest.

## Author contributions

*Conceptualization:* All authors

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## Ethics approval and consent to participate

Ethical approval of this study was obtained from Reformed Church University and the Department of Social Development. The participants provided informed consent for participating in this study.

## Consent for publication

The participants gave consent to publish their data in this study.

## Availability of data

Data are available from the corresponding author upon reasonable request.

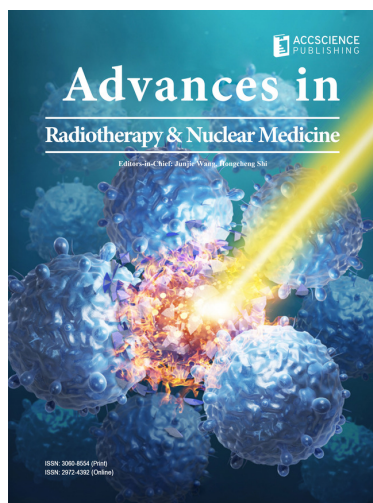
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