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RESEARCH ARTICLE

Lifelong learning, well-being, and climate justice activism: Exploring social movement learning among Australia's Knitting Nannas

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(This article belongs to *Special Issue: Active Ageing and Educational Gerontology*)

Abstract

The participation of older people in social movement learning presents a unique perspective on lifelong learning opportunities and well-aging in later life. Australia's Knitting Nannas Against Gas and Greed exemplifies how older women have challenged the "double jeopardy of old age" embodied in ageist sexism and become well-regarded anti-coal seam gas environmental activists. This article explores how engagement in environmental activism has fostered a learning ecology, which promotes transformative and emancipatory learning dispositions that benefit well-aging. A significant gap exists in transformative environmental adult educational research in relation to the motivation for and engagement of older women in environmentalism. Drawing on my Ph.D. research, I identify how women acquire environmental and ecological literacy, develop activist skills, and cultivate emancipatory learning dispositions. They benefit from being part of a supportive community of older women, enhancing their quality of life. This phenomenon is referred to as "Nannagogy."

Keywords: Ageist sexism; Critical feminist geragogy; Older learners; Social movement learning; Nannagogy

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1. Introduction

The participation of older people in social movement learning (SML) represents a unique perspective on lifelong learning opportunities and well-aging in later life. Knowledge of older women's environmental activist learning is a lacuna in environmental education, adult learning, and SML. In environmental education, feminists refer to the exclusion of female experience as gender-blind. They argue that gender inclusivity is integral to recognizing the complexity of human and more-than-human relationships, multiple subjectivities, knowledge, and interactions (Gough, 2013; Gough & Whitehouse, 2020). Gender-blindness has contributed to a knowledge gap in older women's SML (Larri, 2021). In addition, Formosa (2021, p. 179) identified a "lack of feminist debate on later-life learning and older women learning," which results in adult educators and educational gerontologists using outdated or "malestream" approaches.

This article fills this gap by presenting a case study of Australia's Knitting Nannas Against Gas and Greed (aka KNAG or the Nannas) as a community of practice (CoP).

It discusses both motivation for learning and the impact of participation on the lives of these older women in KNAG. Drawing on my Ph.D. research, I outline how engagement in environmental activism stimulates a learning ecology that promotes transformative and emancipatory learning dispositions and benefits for well-aging. I refer to this as "Nannagogy." The Nannas have demonstrated how older women challenge the "double jeopardy of old age" embodied in ageist sexism (Formosa, 2005, as cited in Findsen & Formosa, 2011, p. 95) to become well-regarded anti-coal seam gas (CSG) environmental activists.

The research posed the following question: "What educational processes enable older women to experience personal transformation that leads them to become environmental champions actively contributing to the transition to a low-carbon economy?" Two specific subquestions framed the research.

The first subquestion was, "What have the older women learned about starting and growing their movement to become 40 or so groups in just 4 years, from 2012 to 2016?" This question was designed to understand the motivations and learning processes that led to the development of the older women's environmental activist identity. The initial inspiration behind the movement laid the foundation for subsequent learning. Understanding why older women were attracted to KNAG and identifying their pre-existing capabilities that predisposed their involvement, referred to as their learner entry behaviors, was central to addressing this question.

The second subquestion was, "What learning processes have enabled older women to sustain motivation and ongoing engagement in activism supporting the transition to a low-carbon future?" This inquiry investigated the learning processes that facilitate the maintenance and sustainability of engagement and commitment to the KNAG causes, transitioning from fossil fuels and protecting the environment for future generations.

This article primarily focuses on findings from the first subquestion to provide the reader with an indication of the nature of the findings and analysis undertaken.

In a manner similar to how theories of education segment learner needs and styles based on age and stage, I initially coined the portmanteau of "Nannagogy" to differentiate KNAG learning processes from other established and formalized learning systems such as pedagogy (childhood teaching and learning in schooling), andragogy (adult teaching and learning, such as vocational or higher education), and later-life learning (post-retirement learning, for example, University of the Third Age). Through the research, I developed this conceptual segmentation of KNAG learning processes to focus on gender and identity by combining "Nanna" (older woman) with "*agogy*" (derived from the Greek "I lead" meaning "learning"). Nannagogy is, thus, a concept of older women's learning, which is explored as a hypothetical construct.

This article continues with theory and a literature review of ageist sexism in relation to older women's learning, with reference to critical feminist geragogy and provides a brief overview of older women's environmental and climate justice SML. Subsequent sections cover research methods, results, and discussion.

1.1. Theory and literature review

Older adulthood is a phase within the continuum of aging through adulthood. The terms "elder" or "the eldest" refer specifically to individuals, while "older" or "the oldest" refers to both individuals and objects. Throughout this article, these terms are used interchangeably (Merriam-Webster, 2021).

An increasing demographic in Australia and worldwide, older women are categorized into three age groups: young-old (65 – 74), old-old (75 – 84), and oldest-old (85 and beyond) (APA Dictionary of Psychology, n.d.). Older women live within two interweaving culturally based systems of oppression: ageism and sexism (Wilińska, 2016). Breaking the nexus of these oppressions enables agency, activism, and active aging for those who choose it.

The human rights implications of climate change on aging populations intertwine ageism with multiple intersectionalities and vulnerabilities associated with fundamental well-being (United Nations Human Rights Council [UNHRC], 2021). Despite this, older people are often overlooked in climate-related protections in national and international law. However, it is recognized that "older persons possess enormous knowledge, experience, skills, and resilience," and enabling their "participation in climate action is not only a human rights imperative but also a means of ensuring effective solutions for all people and for the planet" (UNHRC, 2021, p. 16). The UNHRC (2021) recommended strategies to include older persons in policy-making and planning, such as membership of national delegations to the United Nations Framework Convention on Climate Change. In addition, it proposed opportunities for later-life learning to maximize the voice of older persons concerned about the sustainability of their communities in the face of climate change, as well as facilitating intergenerational dialogue around climate change and the environment.

1.2. Critical feminist geragogy overcoming ageist sexism

Older people are negatively affected by ageism, limited by perceptions of the older learner as frail and possessing a reduced capacity for learning. Ageism is defined as "the negative social and cultural construction of old age and a process of systematic stereotyping and discrimination against people just because they are old" (Doron, 2018, p. 33).

Ageist sexism exacerbates the issue, leading to older women being marginalized and disregarded. Anecdotally, women often describe experiencing a sudden onset of invisibility and condescension as they age, particularly as their hair turns grey. Australian writer Helen Garner (2016) attributes this phenomenon to the withdrawal of the erotic gaze, as older women "are no longer, in the eyes of the world, a sexual being." Feminist scholars have taken up this theme. Cecil *et al.* (2021, p. 11) consider the "pervasive and insidious nature" that goes with the "social shaming of older women," depicting them as "little old ladies, as old bags, as useless nobodies."

In relation to later-life learning and older women's SML, the literature does not provide definitive answers. Apart from physiological and psychological barriers, learning continues throughout old age. Certain factors "may even give older learners an edge over younger peers" (Findsen & Formosa, 2011, p. 75), such as the integrity and accumulation of knowledge and abilities acquired throughout one's life (or crystallized intelligence), and an ongoing ability for curiosity and making meaning from new information. Successful later-life learning depends on "a wide repertoire of cognitive resources and brain structures that work on their own as well as interacting with one other" (Findsen & Formosa, 2011, p. 63).

Recent researchers challenge the inherent ageism of the elderly as frail and therefore inconsequential, preferring to replace it with opportunities for agency and dignity (Kydd *et al.*, 2018). Shifting power to older learners through emancipatory education contributes to the sociopolitical transformation of ageist structures.

Older learners are "citizens capable of being reflexive and knowledgeable [who]… critique societal norms and practices" (Beck, 1992 cited in Findsen, 2018, p. 844). Critical geragogy (or educational gerontology) recognizes that ageism is a barrier to the participation of the elderly in work, post-work, and civil society. Conversely, society benefits from the inclusion of all citizens. Being able to draw on and draw out the capabilities of elders as a cohort of active citizenry adds depth to society (Findsen, 2018, p. 844). Society benefits from their life experiences, and "social movements … may provide further opportunities for elders to actively engage in authentic learning to improve their life chances" (Sutherland & Crowther, 2006, cited in Findsen, 2018, p. 844).

Critical feminist geragogy informs older women's learning in a woman-centered social movement where ageist sexism is less likely. It can be distilled into the following three criteria: (i) Cultivating respectful relations that seek empowerment and appreciate women's experiences of oppressions, including ageism, sexism, and their multiple intersectionalities; (ii) valuing each woman's individuality by recognizing her capabilities; (iii) providing enjoyable, engaging, and sufficiently challenging learning opportunities in a milieu that supports and celebrates success.

Learning is a lifelong process. Motivational conditions conducive to older women's learning value individuality and inclusivity in an enjoyable atmosphere of respectful relations, with opportunities for emancipatory personal growth. Older learners are able to integrate significant life experience and analytical, reflective, future-oriented cognitive skills to bear on situations. Older learner activists are generally intrinsically motivated, seeking a legacy of social and intergenerational justice.

1.3. Older women's environmental and climate justice SML

Social movements are educational. Formed from groups of like-minded people, they create cognitive and physical spaces for social learning (Eyerman & Jamison, 1991). Educational anthropologist Niesz (2019, p. 227) agrees that "adult education researchers have argued for years that social movements are educators; not only are they sites of popular education and other forms of non-formal education, they are also important sites of learning through the practice of movement activity." Social learning requires conversation, which is a social process and a "deeper, transformative and reflexive learning whereby people challenge the values and norms of present business-as-usual trajectories" (Kent, 2016, p. 150).

SML draws from adult learning and social movement theories and is inherently situated in transformative and emancipatory experiences (Larri & Whitehouse, 2019). Different forms of SML involve communities of practice where individuals and groups learn in a range of ways, including: instrumental skill-based cognitive learning (peaceful protest strategies, social media use); meta-cognitive development of critical consciousness through conscientization, critical reflection, questioning insight, and productive problem-solving; and epistemic or axiological shifts in worldviews through reconceptualizing hegemonic power structures (Branagan & Boughton, 2003;

Curnow, 2013; Ollis, 2011; Scandrett *et al.*, 2010). Similarly, drawing on Habermas's three kinds of knowledge (Cranton, 2002), Moyer & Sinclair (2020) identify instrumental, communicative, and personal transformation as domains of transformative learning theory. Ideally, personal transformation leads to action, which can be categorized as individual, interpersonal, or collective, as seen in social movements. Transformative environmental adult education combines ecological and environmental literacy with activist skills and transformative or emancipatory learning dispositions (Hall *et al.*, 2006; Riedy *et al.*, 2018).

SML is learning by persons who are part of a social movement and learning by persons outside of a social movement affected by becoming aware of the existence of a movement (Hall & Clover, 2005; Hall *et al.*, 2006). Learning within social movements can be informal, incidental, or planned. Social movements develop as people interact and dynamically co-construct meaning from being drawn together to make sense of a common conflict, a process referred to as frame alignment (Della Porta & Diani, 2006). As shared understandings grow, identity formation toward "shared collective identity" also strengthens (Della Porta & Diani, 2006, pp. 20-25). Ollis & Hamel-Green (2015) described adult education in the context of CSG protests (in Gippsland, Victoria, Australia), describing it as informal, incidental, often emotionally charged, holistic, purposeful, transformative, and involving individual and collective social learning.

When individuals join together in a specific context, building rapport, sharing experiences, and learning from one another's insights over time, a CoP is likely to emerge. Curnow (2013, p. 837) succinctly captures this concept, stating that "the group, not the individual, is the source of knowledge, and meaning derives from participation in the community. It is through participation in the collective activity that meaning is negotiated, identities are formed, and the CoP coalesces." Lave & Wenger (1991) developed the concept based on two premises: (i) that learning is a social process situated within a cultural and historical context; and (ii) that a CoP can occur in any area of human endeavor (Farnsworth *et al.*, 2016).

When interviewed by Farnsworth *et al.* (2016), Wenger considered that CoPs are learning partnerships related to a domain of practice in which they have the legitimacy to define competence. Identity in CoPs is formed on two levels: (i) Through the individual's negotiation of their identity within the CoP, determined by their participation and recognized competence, and (ii) through how the individual's identity within the CoP reflects in other social contexts.

The process of building one's identity within the CoP is encapsulated in the concept of "legitimate peripheral participation." This refers to the process of knowledge and skill acquisition necessary for "full participation in the sociocultural practices of a community" (Lave & Wenger, 1991, p. 16). While Lave and Wenger mention that learning within CoPs can be affected by power dynamics, they do not expound (Salminen-Karlsson, 2006). Hodges (1998) provides a critique of CoP that exposes legitimate peripheral participation as loaded with hegemonic historical powerlessness and marginalization. Building on critiques from Hodges (1998) and others (Paechter, 2006; Salminen-Karlsson, 2006; Barron, 2007; Hughes *et al.*, 2007), Curnow (2013) further explores the unchallenged reproduction of dominant ideologies and the impact of power and social difference (gender, class, and race) on learners within CoPs.

In her research, Curnow (2013, p. 837) investigated the status of women activists in a student movement advocating for ethical purchasing. She found that the women's transition from the periphery to centrality within the movement was hindered by sexist attitudes among male colleagues. Despite gaining the requisite skills, the women were relegated to performing menial tasks, repetitive and reproductive work that enabled other tasks. When the women compared their experiences with one another, they were able to identify patterns and interpret systemic problems of sexism. Being marginalized, the women developed a sub-CoP and eventually challenged the male privilege that relied on exclusionary leadership styles. Thus, "social movements are sites of situated learning where power dynamics related to socio-historical inequity are reproduced and contested, and their critical consciousness led to political analysis and collective action." (Curnow, 2013, p. 847)

Thus, CoPs are applicable to SML. In both, learning is recognized as a situated, unstructured, informal, and social process where knowledge is collaboratively co-created and shared among members of the community or movement. Through this process, a collective culture, patterns of interaction, and identity emerge (Curnow, 2013; Kluttz &Walter, 2018; Ollis & Hamel-Green, 2015; Scandrett *et al.*, 2010). CoPs were originally conceptualized by Lave & Wenger (1991) as work-based participatory learning through apprenticeship-style enculturation, where people move from novice to full practitioner, contrasting with formal teaching and learning.

CoP theory assumes an existing work culture into which novices progressively integrate from the periphery to the center. Social movements, on the other hand, are emergent forms of grassroots collective action for social change. Social movements are characterized by a "shared collective identity" linked through "dense informal

networks," engaged in "conflictual relations with clearly identified opponents" over significant time periods, thus becoming a collective force (Della Porta & Diani, 2006, p. 20-25).

The process of social movement germination is itself a CoP in identity generation rather than merely a place of integration and adaptation. Eventually, as a movement grows, it is likely to take on the need for enculturation processes or identity reproduction (Della Porta & Diani, 2006, p. 105-113; Lave & Wenger, 1991;). The consciousness-raising groups of the 1970s women's liberation movement are considered a form of CoP in which women shared personal experiences, leading to a transformative collective understanding of patriarchal power structures in society (Curnow, 2013, p. 839).

There is limited research into older women's environmental activism and learning, with Canada's Raging Grannies being an exception. Much literature exists on the Raging Grannies in relation to their role as social change agents, educating others, and countering ageist sexism (Caissie, 2006; McHugh, 2012; Pedersen, 2010; Roy, 2003; 2007; Sawchuk, 2009, 2013; Schmitz, 2009). Only one scholar, Narushima (2004), has researched the implications for later-life learning of older women's social activism within this movement. Narushima (2004) concludes that the "social and collective learning environment" enabled significant personal benefits, such as "self-help, self-acceptance, liberation, and the realization of their capacity to become an agent for change." The women experienced ongoing self-actualization in later life, along with "creativity, critical thinking, a sense of self-liberation, and well-being in late adulthood" (Narushima [2004], pp. 38-41).

A common thread of women's environmental activism is strategic essentialism. Essentialism refers to the practice of assuming that the nature of things is fixed rather than culturally defined. Women are often essentialized as being close to nature, depicted as earth mothers and nurturers, and therefore more likely to be concerned with environmental issues and planetary well-being (Bartlett, 2013; Murray, 2010). However, this portrayal is "descriptively false in that it denies the real diversity of women's lives and social situations" (Stone, 2004, p. 142). Sexism and ageism are examples of the negative effects of essentializing (McHugh, 2012).

While numerous feminist scholars look at the intersection of motherhood and activism, fewer have extended this analysis to include grandmotherhood and activism (Chazan & Baldwin, 2016; Chazan & Kittmer, 2016). Sawchuk (2009) critiques the ageist and sexist narratives of grandmotherhood; finding the Raging Grannies' "strategic deployment" (Sawchuk, 2009, p. 173) of the grandmother identity is disarming and efficacious. Police were reluctant to move them on or arrest them, as they found it easier to get their message across using humor and parodying the image of essentialized older women (Sawchuk, 2009, p. 180-181). The Grannies have used strategic essentialism and humorous performative activism as their identity brand to engage and educate audiences in understanding a myriad of issues, including the toxic impacts of CSG. In Ecuador, antimining women drew on their Pachamama (Mother Earth Inca goddess) mythology to "present a more cohesive identity and narrative around their activism." (Jenkins, 2015, p. 453).

2. Methods

2.1. Researcher positionality

This inquiry was framed within the context of post-structuralist feminist research. Inspired by Haug's "feminist social constructionist method" (Onyx & Small, 2001 p. 775), my research cast the researcher and subjects as equal "coresearchers," drawing on everyday experience as a valid process of knowledge creation. Davies & Gannon (2005, p. 315) describe this approach as demonstrating respect for the other through "post-structural ethics" and "mutual embeddedness in discourse and relations of power." The researcher is thus obliged to understand both the subjects and herself as they grow and change. Therefore, the methodology involved planning for both proposed and emergent aspects. Learnings from field observation, ongoing review of new research, and data analyses were incorporated into other phases.

Social movement research has often failed to sufficiently address gender and activism (Maddison & Shaw, 2014). The inexplicable interstices, glaring silences, and omissions in SML research are explained by a feminist theory, which challenges the rationalist presumption that knowledge production is "value neutral," instead recognizing that "knowledge and the production of knowledge are inherently gendered" (Maddison & Shaw, 2014, p. 417). This perspective enables feminist researchers to represent human diversity by developing research methods "designed to reveal the gender problematic through prioritizing women's lived experience of the social telling in their own voice" (Byrne & Lentin, 2000, in Maddison & Shaw, 2014, p. 416).

A transdisciplinary approach was deemed necessary to integrate the complexity, interdependence, and intersections of multiple disciplines (Nicolescu, 2014). This approach encompassed various fields, including social movement theory, adult learning theory, environmental education, gender, critical feminist geragogy, media studies, environmental climate activism, and craftivism.

2.2. Case study methodology

Constituted by a number of groups in approximately 40 locations, KNAG is a "multisite bounded system" (Merriam, 2014, p. 49). A mixed-method descriptive case study of their network was conducted to understand the women's informal learning processes. This approach has proven effective in educational research involving complex social elements, multiple variables, and a need for rich description (Merriam, 2014). Learning within social movements is characterized by complex, dynamic, and "messy" processes that constantly shift between the individual and the collective (Kluttz & Walter, 2018, p. 96-97). It is "multi-site" because the network is comprised of a membership of older women within a range of geographically located subgroups known as loops. All research participants were active members of the KNAG at the time of the research.

Both qualitative and quantitative data were collected through primary sources, including written (online) survey data, interviews, and document analysis of social media in the public domain (Facebook posts, digital videos, emails, and e-news bulletins). The research was approved by the Human Research Ethics Committee at James Cook University.

To obtain ethics approval from the university, I ensured that all participants surveyed or interviewed were deidentified. Each woman signed a consent form, which included agreement of the following terms:

> "The information collected will be specially coded so that you cannot be personally identified. Your responses and contact details will be strictly confidential. The data and any visual or audio recordings from the study will be used for data analysis only. The results of the study will be used for academic purposes such as research publications and conference presentations. You will not be identified in any way in these publications unless you specifically agree."

Survey respondents are referred to as "S," followed by their unique respondent number. Each interviewee chose a pseudonym based on women they admired, which I have consistently used throughout my writings.

The content analysis of social media in the public domain from 2012 to 2020 included Facebook posts, digital videos, emails, and e-news bulletins. The collection and analysis focused on confirming, challenging, and triangulating findings from all sources. The Association of Internet Researchers (Markham & Buchanan, 2012) provided the ethical guidelines for conducting social media research, and quotes from Facebook and other social media were anonymized.

2.3. Research strategies: A sequential mixed methods case study with a developmental design

The research strategy used a sequential mixed methods study with a developmental design, where "analysis of preliminary data informs and/or initiates the development of a subsequent data collection" (Bazeley, 2018, p. 73; Onghena *et al.*, 2019).). The study started with a quantitative and qualitative survey, which was then expanded on through purposive sampling of interviewees and social media data.

An initial draft questionnaire was developed based on analysis of the documentary *Knitting Nannas* (Larri & Newlands, 2017; O'Keefe & Brown, 2014), the KNAG website, and researcher observation of KNAG members at the 2016 KNAG Annual Conference (Chinchilla, August 26–28, 2016). Getting to know KNAG culture contributed to the construction of interview and survey questions in ways meaningful to the Nannas themselves.

2.3.1. Mixed methods

There has been substantive literature addressing the incompatibility of mixing quantitative and qualitative research methods. This contention stems from the different ontological and epistemological traditions inherent in each method, which led to the "paradigm wars" of the late 1980s and early 1990s (Bazeley, 2018, p. 5). Mixed methods have since gained acceptance as "a third major approach to social science research" (Bazeley, 2018, p. 5). Aligning with the objective of a descriptive case study, Onghena *et al.* (2019, p. 463) promote mixed methods for researchers aiming for a rich narrative case study that integrates qualitative case study with statistical analysis, thus adding "narrative flesh." Bazeley (2018) contends that there is no universally agreed-upon definition of mixed methods research. Methodological and temporal triangulation was employed through the use of multiple data methods from 2017 to 2020. Validity and reliability were ensured within each data collection strategy to the extent possible. Validity or legitimation in mixed methods research (Check & Schutt, 2011; Cohe*n et al.*, 2011) was enhanced by: (i) Sample integration using the same sample to enable high quality inferences from data, such as selecting interviewees from the original survey sample; (ii) multiple strategies to ensure validity within each type of quantitative and qualitative data gathered; and (iii) cross-referencing details from survey findings with interviewees, referring between interviewees, and asking interviewees to reflect on the practices of others, drawing from their experiences.

The research approach drew on a post-positivist framework, using objective data triangulated with descriptive phenomenology gained from the subjective

reality of survey respondents and interviewees. These were further combined with an interpretive phenomenology drawn from a feminist poststructuralist researcher positionality to derive a model for conceptualizing the Knitting Nannas SML CoP, referred to as "Nannagogy."

2.3.2. Data collection and analysis strategies

Before designing the data collection instruments, a data matrix was devised, linking the research questions to the data collection instruments. Data were collected through primary sources, including a written online survey (n = 67 in 2017), interviews (n = 10, 2018 – 2020), and document analysis of social media in the public domain (a purposive sample of Facebook posts, digital videos, e-mails, and e-news bulletins, spanning from 2012 – 2020). Analysis using NVivo 11 involved thematic coding and triangulation of multiple data sources. Critical feminist geragogy was one of the analytical lenses applied to the data to ascertain whether Nannagogy could achieve transformative and emancipatory learning in older women.

The survey was designed to elicit both qualitative and quantitative data in response to Research Questions 1 and 2. The purpose of the survey was to gain an overview of the movement after 4 years of its inception and growth. Semistructured interviews were conducted to contribute more detailed data by confirming and complementing findings from the online survey. Thematic content analysis of media supported knowledge about how KNAG learned their activism and online connectivism through the use of Web 2.0 (social media) tools in combination with traditional media, with posts on Facebook being the most used KNAG social media platform.

An interpretive model was developed to conceptualize the elements of Nannagogy, enabling the synthesis of all data sources. Nannagogy was framed as an Australian CoP in older women's environmental activism. The collected research data revealed similarities with elements of the SML theory frameworks proposed by Branagan & Boughton (2003), based on Newman's taxonomy, Scandrett *et al.* (2010), and Kluttz & Walter (2018). Using existing frameworks assisted in summarizing the key findings of this research and indicating their application to the KNAG CoP.

The model includes an additional element to the previous frameworks to recognize the influence of learners' entry behaviors and prior capabilities on their motivation in relation to activist skill acquisition. The three levels (micro, meso, and macro) drawn from Scandrett *et al.* (2010) and Kluttz & Walter (2018) are reinterpreted as distinct elements. Instead of being viewed as levels, they are couched in terms of learning cognition. In the presented model, these are: (i) *Cognitive – Instrumental learning*; (2) *Metacognitive – Interpretive learning*; and (3) *Epistemic and axiological – Emancipatory critical learning* (Larri, 2021).

My interpretive model is presented in Figure 1. In this model, drawing from Kluttz & Walter (2018), learning can occur across a continuum of two distinct vectors. The first vector, from left to right, recognizes the different ways learning can be structured, ranging from unstructured, informal, and unplanned to structured, formal, and planned. The second vector, from top to bottom, acknowledges that learning can comprise inquiry directed by the self (individual), the loop (group), and the collective (whole movement). Numbered boxes are placed within the model to demonstrate the evidence of an element, the structure of learning, and whether it involves individuals or different-sized groups. The placement of each number within each box aims to locate the nature of learning. For example, in Figure 2**,** regarding the formation phase, Box 2 is located within both cognitive and metacognitive learning domains. It is semistructured in format and occurs within the group setting of the Gasfield Free Northern Rivers (GFNR) CoP.

3. Results

The findings presented here pertain to answering the first subquestion regarding what older women learned in starting and growing their movement, which is referred to as the "Formation Phase." In terms of the initial motivation to create the movement, the majority of the Nannas were identified as circumstantial activists (described by Ollis, 2012; Ollis & Hamel-Green, 2015; Ollis, 2020) and novice campaigners who were intrinsically motivated to establish and join KNAG due to their pre-existing mobilization and commitment to fighting CSG in the Northern Rivers region of New South Wales. These findings are encapsulated in Figure 2.

Age, gender, and purposeful retirement were significant contributing factors to both intrinsic motivation and frame alignment. A pre-existing interest in knitting or crafting was found to be peripheral. Qualitative analysis of responses to the survey question, "What motivated you to join the Nannas?" identified three key themes (n = 63): (i) wanting to be part of anti-CSG campaigning (37 mentions); (ii) already being concerned for the environment (35 mentions); and (iii) being attracted to an older woman-centered movement (34 mentions). Comments related to active aging were mentioned 19 times. Knitting or other forms of crafting were not mentioned as motivators but rather as useful skills that a number of women did not have.

The desire to be an effective activist against CSG and its impacts on climate was a strong motivator for Nannas, as expressed by S.13, "I believe it is one of the most effective non-violent protests ever. I am strongly against CSG and concerned about climate change".

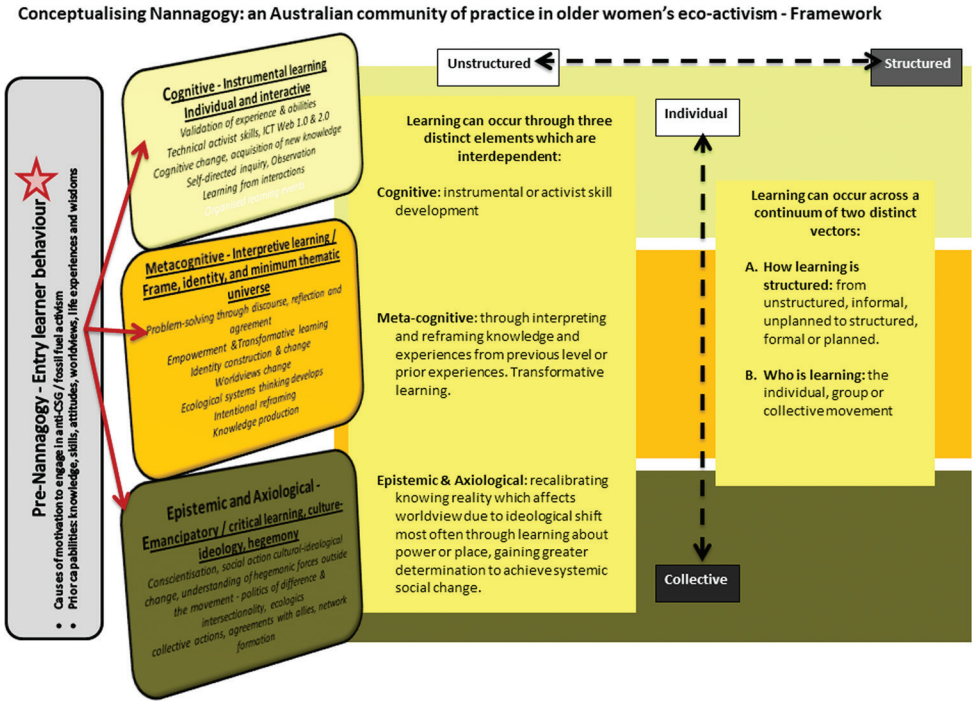

Figure 1. Conceptualizing Nannagogy: An Australian community of practice in older women's eco-activism – Framework.

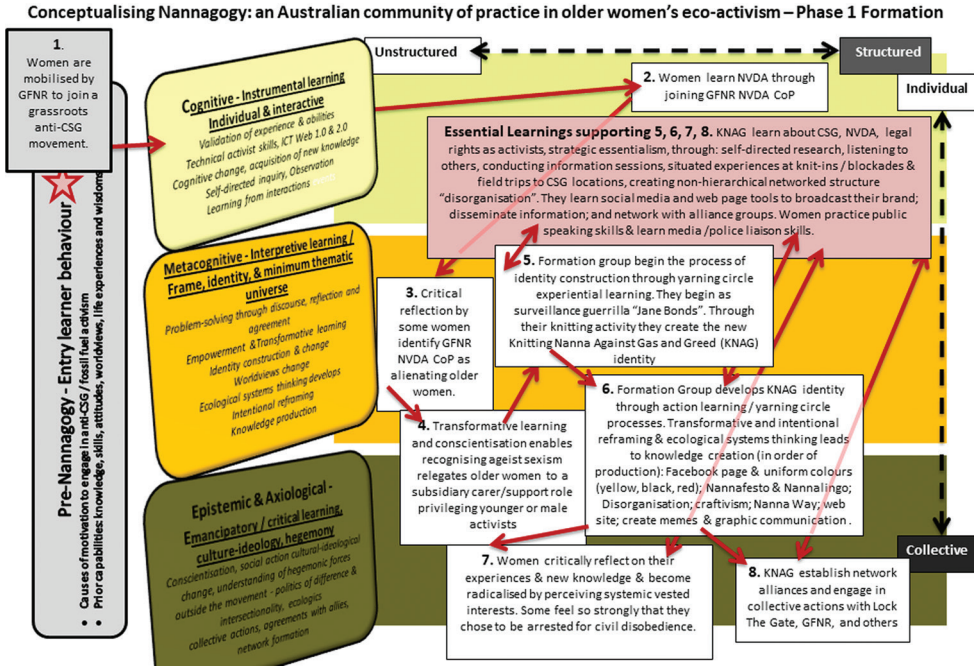

Figure 2. Conceptualizing Nannagogy: An Australian community of practice in older women's eco-activism – Phase 1 Formation.

3.1. Frame alignment

Drawing from social movement theory (Della Porta & Diani, 2006; Snow *et al.*, 2014), the Nannas' pre-existing frame alignment and key motivation were a strong emotional commitment to protecting environmental values for future generations and seeking a legacy of social and intergenerational justice.

Nanna Evelyn (pseudonym), a member of the first loop, joined KNAG after initially encountering them when she was part of local anti-CSG protests at Shannon Brook ponds

in 2012 and hearing how well-respected they were even at that early stage. She remembered feeling comfortable with their effective, non-confrontational approach that aligned with her values. She said:

> "I just felt like I didn't want to be a part of a very loud and angry group of people. I've got no problem with people protesting, but when they get aggressive and abusive, I just didn't want to take part in that. So Nannas were an option that I felt much more aligned with and comfortable with and I thought I could get my voice heard in a much more calm way."

While few Nannas had a background as feminist activists, they possessed an awareness of sexism in their lives as "everyday feminists" (Schuster, 2017, p. 651), which explains their attraction to KNAG. Survey data demonstrate that motivation to join KNAG was not influenced by the views of their significant others, such as family members. The need these older women felt for an activist culture that appreciated their experiences of oppression, engendering respectful, empowering relations in place of denigration, illuminates the claims of critical feminist geragogy (Garner, 1999; Findsen & Formosa, 2011; Schuster, 2017). This finding contributes to the under-researched and recurring theme of sexism in social movements (McHugh, 2012; Jenkins, 2015; Roy, 2003; Tosh & Gislason, 2016; Velásquez, 2017) and begins to address gender blindness by adding the intersectional dimensions of gender and age into frame alignment.

This extract from Respondent S.61 encapsulates these values of frame alignment, emphasizing the importance of meeting "amazing" women with whom she hoped to build longstanding friendships. Other respondents also referred to the value of this aspect of "sisterhood":

> "I think people see that KNAG is a way to 'protest' that is not confronting to you. Obviously, some people want to be a Nanna because they see the popularity of the Nannahood. My kids thought I was crazy at first, but now they love it. My partner is very supportive. My dear old mum still thinks I'm going to get arrested. Some of my friends say they could never do it. KNAG is great. It has given me the opportunity to meet some amazing women who I'm sure I'll be friends with for a very long time."

Interpreted in terms of adult learning motivation, the Nannas' identity aligned with older women's worldviews by offering respectful inclusion, fostering involvement, and colearning (Wlodkowski & Ginsberg, 2017). An older women's form of non-confrontational social action, which values each woman's individuality and capabilities, was appealing. This blend of cognitive and metacognitive elements was identified when the women initially sought empowerment as anti-CSG activists.

Interpretive learning (Branagan & Boughton, 2003), involving collaborative critical reflection and creative group problem-solving, occurred as the women began to construct their identities. The pivotal "activating event" (Cranton, 2002, p. 66) of recognizing unanticipated ageist sexism in the GFNR non-violent direct action (NVDA) group was interpreted as stimulating transformative learning by drawing on Freirean conscientization (Mayo, 1994). Nanna Joy described how the older women critically reflected, for the first time as a group, about the dynamics of oppression they were encountering. It set the tone for the core values of the KNAG movement – a determination to be activists, not relegated to insubstantial support roles, with confidence in their own judgment not to ask permission (from men or others) before acting. It was also the first step toward social learning in a women's CoP. Nanna Joy said:

> "… some of the men involved and the NVDA were not treating the women, especially the older women, as if we had any agency. Pretty much putting us in our little pigeonhole … [with] suggestions that we provide catering, tea, and bickies and that we could do paperworkey bits and pieces. Which is certainly not why we joined the NVDA … we were pretty much stereotyped, and there were quite a few sweet little old ladies there; I suppose, they did not expect us to be on the cutting edge. It's a particular type of sexism that suddenly, once you reach menopause, you've never had sex, you've never used your brain, you haven't heard half the words in the English language, and you're deaf. Yeah – and they speak slowly and loudly to you!
>
> … there was a meeting where some of the men from the Greens and the [forest activists group] kind of picked on us, you know. We were doing things on our own initiative; I think that was one of the biggest things. And so it was particularly targeted, especially targeted toward the women who had shown the most initiative. So after the meeting, we went downstairs, had a coffee, and it was just like, 'What the fuck just happened there?' I guess that happened within the couple of months leading up to the start of the Nannas. We kept going to the NVDA after that and tended to sit in a group and support each other."

This was the moment when the women recognized the patriarchal power differential within the GFNR NVDA CoP. The Nannas made a self-defining emancipatory move as older women who refused to accept this gender and age-based stereotyping from others and preferred to determine

their own form of antifracking activism. Mezirow's concept of a "disorienting dilemma" (Cranton, 2002, p. 66; Merriam & Baumgartner, 2020, pp. 130-131) is applicable here, as is Scandrett *et al.*'s (2010, p. 137) transformative paradigm shifts resulting from "making sense of unexplained experiences …stimulated by discursive encounters." Kluttz & Walter (2018, p. 97) recognized that considering "intersectional and interlocking oppressions" illuminates the transformative effect of adult learning, but their work did not take ageism into account.

Within 20 days of distancing themselves from the broader anti-CSG alliance, the members of the original loop used their "knit-in" alternative to the traditional sit-in to construct their own identity. They learned that the knit-in, as an activity, was conducive to group learning processes toward defining their older women's way of protesting. Thus, it was possible to determine that the formation phase involved the development of a CoP as understood by Lave & Wenger (1991).

The participatory, collaborative creation of the KNAG as an identity was fun, socially engaging, and therefore motivating as the women realized they were getting to know one another through participating in purposeful environmental activism. On Facebook, the Nannas celebrated the early recognition; they gained from the media and other anti-CSG activists as a nascent movement. Being recognized for credibility and visibility as older women activists was another significant emancipatory step that demonstrates McHugh's (2012, p. 288) analysis that older women engaged in activism are both socially active and challenge "cultural constructions of older women" as being digitally inept.

Initially, this group of women cast themselves as fearless "elder Jane Bonds." However, they later realized the subversive and humorous potential of playfully using the stereotype they had originally railed against. The persona of little old ladies stealthily knitting appealed to their collective sense of humor. At this stage, they did not know that the Canadian Raging Grannies (Roy, 2003) had made the same choice some 25 years before. Nanna Joy explained the experience:

> "At the same time that was happening, a few of us went and toured all the gas wells. That's what kind of initiated us, watching Shannon Brook. We had lots of fun playing with the word Nanna. And also we were pushing ourselves to the other activists as being kind of like fearless old ladies. Because we first started this as a surveillance group, we were pushing the thing that we were little old Jane Bonds … we had spoken about the Knitting Nannas before as a stealth kind of group. I guess it was a bit of a joke among us. So we decided to take our knitting and our cups of tea."

These older women discovered collective creativity that engendered positivity in overcoming the challenges of activism and aging within a supportive and inclusive learning environment, consistent with adult learning motivational conditions (Wlodkowski & Ginsberg, 2017) and critical feminist geragogy (Findsen & Formosa, 2011). It was a liberating, collective, negotiated learning enterprise that recognized the extensive life experience of older women. Similar to Curnow's (2013) case study, women shared personal experiences that led to a transformative collective understanding of patriarchal power structures in society.

3.2. Enablers of learning

Data about the capabilities these older women brought with them, in terms of knowledge, skills, attitudes, and world views, were important in understanding what enabled their activist learning. By applying learner entry behavior analysis (Ireri & Omwenga, 2014), it was found that older women entered the anti-CSG movement with an extensive range of skills easily transferrable to their activism. These skills were drawn mostly from stereotypically female occupations such as educators, nurses, and business administrators, as well as from creative fields. The combined capabilities of the older women encompassed organizing, planning, coordinating, managing, creating, performing publicly, and crafting. Many Nannas had previous involvement in environmental activism, supporting the view that women of all ages have contributed to many eco-movements (Gaard, 2011). It was found that many women entered the movement with computer email (Web 1.0) competence and varying degrees of digital literacy, including social media (Web 2.0) competence, aligning with previous research (Australian Bureau of Statistics, 2018; Haukka & Hegarty, 2011; Larri, 2023; Wiesslitz, 2019; Yellow Social Media Report, 2020).

However, what women lacked were NVDA strategies, specific knowledge of CSG extraction, and an understanding of hegemonic power relations within extractive industries and government. Martin & Coy (2017) identified the lack of a formal definition of activist skills and postulated that social activism involves diverse skills found in many occupations. They did not consider a gender dimension to occupations, nor did they account for the skills developed by women as homemakers and carers. In addition, they did not gather data on which occupational skills contribute to activist skills and which learning and skills gaps may need to be addressed.

Analysis of the initial stages of the KNAG movement's formation phase indicated the ways in which the women used their pre-existing skills to generate their activist

identity. Data about the process indicated a series of informal, situated, experiential, and transformative learning steps, beginning with semistructured instrumental learning (Branagan & Boughton, 2003) of the mock blockade and then transitioning to an actual blockade in the GFNR NVDA CoP.

3.3. Resisting ageist sexism for a meaningful retirement

The culture on which KNAG was founded recognized that age should not be a barrier to activism. Resistance against ageist sexism served as a motivational factor for participation. The specific form of NVDA employed by KNAG pragmatically and gracefully aligns with the capacities of aging women. Respondent S.27 indicated that many women perceive this approach as empowering and effective:

> "I liked that it is a woman's way of protesting: non-confrontational, talking patiently to people, being visible and determined, understanding that change takes as long as it takes, cementing friendships, knitting useful stuff, and being creative, learning more about the issues, talking and sharing. There is strength in being part of a group."

Being retired and older offers individuals an opportunity to choose how to spend their time, liberated from the responsibilities of employment and family commitments. Nannas in this study ranged in age from 45 to 84, with the majority falling between 50 and 74 (88%, n = 61, Survey data Q4: Age category) and typically over half were retired (54%, n = 30, out of 56 responses).

Respondent S.2 viewed this participation as being able to be actively involved and contribute meaningfully. Of importance to her was the enjoyment of being supported by "like-minded women" while she had an intrinsic motivation of wanting to contribute meaningfully to society:

> "[The KNAG movement has grown quickly because of …] the interest and concern, particularly with older KNAG. They have retired and now have the time and support from other like-minded women. The KNAG come along, and whammo! That's how we can do our bit."

Older women protesting with other older women send a strong visual image of concern for future generations. The Nannas connect with intergenerational climate justice through their actions. This accords with the intrinsic motivation more prevalent in older learners and the empowerment sought by critical feminist geragogy. Respondent S.21 said that her concern for future generations was her motivation. The way in which "KNAG-ing" (as the Nannas refer to their activism) aligns with her worldview is further evidence of frame alignment:

> "We have more time than most people today, and we have seen the effects of poorly planned decisions regarding the environment etc. We can clearly see what is happening to our planet and have a very strong sense and need to protect our grandchildren. We try and keep the planet in some sort of healthy state for all future generations."

3.4. Using strategic essentialism is empowering and builds connection

Being a KNAG is power-shifting. Nannas claim that the act of being in a group of old women, sitting and knitting defuses situations where tensions and aggression emerge. Respondent S.7 provides an example of this use of strategic essentialism to de-escalate tensions. This practice is consistent with the literature (Della Porta & Diani, 2006; Ricketts, 2012) on NVDA as a powerful tactic that engenders loyalty shifts. "Sitting with knitting gear is incredibly calming when the police are aggressive. Older women are together, seemingly 'harmless' but insistent." As previously mentioned, Canada's Raging Grannies had comparable experiences and used similar tactics, unbeknown to KNAG (interviewee Nanna Angie, involved in KNAG since 2014).

Women mentioned feeling dignified, braver, and surprised at their emerging fearlessness. Respondent S.53 commented that she noticed "just how brave I can be," while Respondent S.17 described this feeling as "the creative spirit and bravery." Respondent S.21 considered the KNAG identity as "a way of protesting with dignity, standing with other strong, fearless women in a non-violent, yet very effective manner."

A sense of achievement and popularity by using non-threatening humor and light-heartedness adds to the existing intrinsic motivational condition (Wlodkowski & Ginsberg, 2017). A strong sense of camaraderie was developed through "sisterhood," deploying the SML logic of numbers (Della Porta & Diani, 2006), and the added effect of developing friendships. KNAGing, according to Respondent S.56:

> "… gives opportunity to continue campaigns through a lighthearted platform. It gives friendship and support to women working for the same outcomes. It encourages others to be brave, strength in numbers. It is a popular movement that has caught people's eye. It is effective."

KNAG's recognition of their growing bravery indicates that the learning experiences of on-the-job activism

are challenging and that the KNAG CoP provides a supportive and inclusive learning environment. This recognition combines the motivational conditions for the engagement of older learners with the characteristics of critical feminist geragogy. Respondent S.17 described a positive camaraderie as dedication and determination to work together to overcome problems, saying she valued "how friendly and dedicated they are … the ongoing positiveness, no matter how large the problem."

Nannas have an ethos of inclusivity by identifying and then drawing on women's different abilities. This practice builds connection and motivation in the women as they feel validated for their contributions, no matter how small. Respondent S.61 valued "being able to contribute my creativity to a good cause." Nanna Joy emphasized the importance to Nannas of finding and utilizing people's strengths. She compared this approach with wasting women's abilities by falling into ageist stereotyping, where older women are viewed as "wrinkly invisible, useless drudges, drains on the public purse." Nanna Joy explained her rationale for the KNAG approach to empowering members:

> "… you'd sit with six women knitting in, and so you've got 300 years of experience, and you've got graphic designers and nurses and managers and academics and people who have brought up a million children. Yeah, all of these incredible talents are wasted making cups of tea and pushing petitions under people's faces. This is, I guess, one of the strong points of the Nannas: to find people's strengths and to utilize those strengths within each loop and then within the larger movement. So some people are very good at organizing. There are some people who are good at public speaking. We make a point of acknowledging each other as valuable members of society, not as kind of wrinkly invisible, useless drudges, drains on the public purse."

This KNAG approach is a conscious and intentional strategy that challenges ageist sexism and empowers older women, which is consistent with critical feminist geragogy.

Craftivism and the essentialized persona of older women have become key elements of the Nannas' identity. Identity formation can be understood through both CoP and social movement theories (Della Porta & Diani, 2006; Holst, 2018; Snow *et al.*, 2014).

Nanna Evelyn described how craftivism is used by KNAG as a form of CoP induction, gently drawing out women's individuality and capabilities, which directly link with the criteria of critical feminist geragogy:

> "A lot of Nannas that come in and they're new [say] 'Oh, I can't knit, I can't do this, I can't do that.' And you'll ask them, 'Well, what do you do when you're sitting at home watching television, or what do you do when you're out in the garden?' They start thinking, and inevitably, they'll come up with something they can make."

The existence of a KNAG enculturation process of induction, where people move from novice to full practitioner, supports Lave & Wenger's (1991, p. 16) concept of "legitimate peripheral participation."

The KNAG CoP utilized the tools of "knitting" and being a "Nanna," along with attention-seeking uniforms and the KNAG persona, to stimulate the engagement of passers-by and opportunistically educate them. These tools fostered the KNAG's skill in activating social change, thereby establishing the KNAG CoP ethos of educating both insiders and outsiders within the movement. It provides a valuable case study in adhering to Hall and Clover's (2005) definition of SML.

A key feature in the learning culture of the KNAG CoP was the emphasis on creativity and humor. Having fun as older learners and enjoying meaningful, purposeful social interactions was an unanticipated and much-valued by-product that can be considered to promote well-aging.

A strong sense of meaningful, active aging was important for many. Respondent S.26 described the knit-in tactic as "great fun and an effective way" of expressing concerns. Respondent S.55 was relieved to find a way of drawing on her extensive life experience post-retirement by engaging in a liberating, collective, and enjoyable negotiated learning enterprise within KNAG. For her, the determination to overcome limitations to participate in a purposeful retirement was important, as also was being able to use her professional skills:

> "I've always been involved in social justice issues as a result of being a teacher of adults. It's helped me come to terms with retirement. I have worthwhile causes and feel passionate about making a difference. Didn't think I'd be able to make much of a difference when I stopped working. Nannas have the time, the passion and the staying power because their families have grown, and they no longer have work pressures to deal with."

The social aspect of feeling welcomed and connected to other women through being visible and vocal added a further positive dimension. This sentiment was expressed by Respondent S.54, who stated that what she valued most in joining the KNAG was "the spirit of the groups I've met, openness, creativity, fun, determination, stamina, and caring for one another." This sentiment harks back to the instrumental importance of inclusivity. The data

strongly suggest that Nannas have discovered collective creativity that engenders positivity in overcoming both the challenges of activism and aging.

4. Conclusion

This research illuminates older women as capable and adept at managing their own experiential situated learning to achieve transformational change in becoming environmental activists and effective contributors to social change for transitioning to a low-carbon economy. For the majority of the participants in this case study, the identity shift from caregivers, homemakers, and breadwinners, as wives and partners, mothers, and grandmothers, to environmental activists was a transformation they had never envisaged previously. Older female environmental activists encountered unexpected ageist sexism that sought to silence them. Instead, they created spaces in which they would be seen and heard.

The research identified Nannagogy as a hybrid operating through a dynamic of instrumental, communicative, transformative, and emancipatory learning embedded within the Nannas' CoP. The principles of self-directed, needs-based, critical feminist geragogy were demonstrated through primary data. It is defined as a learning system for a specific form of SML praxis that honors the wisdom and experience of older women and enhances their well-being.

First and foremost was the ethos of older women's empowerment that underpinned the KNAG CoP. The initial and most critical shift was to segregate themselves and place boundaries around the external control of their activist identity. Such a move represented a refusal to be complicit in their oppression. The next shift was valuing and drawing on the combined life experiences and knowledge of the older women to articulate their environmental activism. KNAG intuitively and explicitly embraced a hybrid of learning strategies to achieve outcomes in ecological and environmental literacy and activist skills that led to epistemic and axiological shifts in personal worldviews. Both these shifts were foreshadowed by Darlene Clover in her seminal work, *Gender Transformative Learning and Environmental Action* (Clover, 1995), and subsequently documented in a number of studies (Roy, 2003; Jenkins, 2015; Tosh & Gislason, 2016; Velásquez, 2017).

Sadly, this research confirms the ongoing challenge of overcoming oppressive gender and age-based stereotypes in environmental social movements. Happily, the Nannas have shown us a model where older women's wisdom has successfully achieved older women-centered power shifting, which does not exclude men but equally does not privilege them.

Incorporating critical feminist geragogy with transformative environmental adult education in this interpretive model demonstrates the usefulness of SML as a transdisciplinary analytical tool. The integration of these approaches further raises the profile of transformative learning in informal settings such as social movements and later-life learning. It challenges tertiary education institutions to integrate SML into their programs. Contexts that rely on situated collaborative, experiential learning, and peer-to-peer learning require educators skilled in facilitating experiential learning. This presumes that expertise and qualifications have been gained and recognized, which further presumes that educational institutions incorporate social movement and transformative learning into undergraduate and postgraduate fields of study. I do not advocate the institutionalization of SML; rather, I seek to support the democratic rights of citizens to work for social justice and ecological and environmental sustainability. To achieve this, capacity building is required.

To benefit from the Knitting Nannas learnings, I propose four recommendations:

(i) Social movements are advised to value their participant's voices and capabilities. Specifically, when aiming to attract older women, organizers are advised to promote peaceful activism and to overcome ageist and sexist stereotyping. This is best achieved by providing positive, creative, purposeful, inclusive, and collaborative learning environments that affirm and draw on life experiences, meaningful social interaction, and supportive networks.

(ii) Later-life learning organizations are advised to review their curricula to ensure instructional methods reflect critical feminist geragogy.

(iii) Tertiary education institutions are encouraged to advance transdisciplinary critical dialogue toward further development of a theoretical base that addresses gender and other intersectionalities within ageism.

(iv) Governments are encouraged to implement strategies that support the policy directions of the United Nations Decades on Ecosystem Restoration and Healthy Ageing (2021 – 2030) by embracing older citizens' right to quality later-life learning and their capacity for leadership, expertise, elder wisdom, and resilience in the challenge to address the impacts of transitioning to a low-carbon economy.

Ultimately, this is a movement of older women activists who have proven their claim that "you're never too old to be an activist." In doing so, they have crafted their special niche in a galaxy of environmental activist organizations, where they are admired for their bravery and courage – a far cry from their beginnings.

Women and older women have always been activists. What has been lacking is the acknowledgment and recognition of women's capabilities. Intuitively, the Nannas implemented critical feminist geragogy and realized that well-being flowed from their developing community. These are women of consequence because they have come to believe in their agentic selves and challenge others to never underestimate the wisdom and power of older women.

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Conflict of interest

The author declares that she has no competing interests.

Author contributions

This is a single-authored article.

Ethics approval and consent to participate

This research was approved by the James Cook University Human Research Ethics Committee (approval number: H6886). Participants provided written consent on the proviso that they would be deidentified.

Consent for publication

Written consent permission was obtained from each of the subjects that confirmed their understanding regarding publication.

Availability of data

A copy of the complete thesis from which this paper is drawn is available in James Cook Univerity's institutional repository, ResearchOnline@JCU, accessible here: https://doi.org/10.25903/h15s-t502.

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PERSPECTIVE ARTICLE

Age-friendly cities and lifelong learning

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Abstract

This article investigates the modern phenomenon of age friendliness, more particularly the notion of an "age-friendly city," from both a macro perspective as well as at the level of a localized application of age friendliness in a single city. Much of the rhetoric of age-friendly conceptualization has strong affinity to the themes of lifelong learning, and proponents of each sector can benefit from mutually understanding the respective principles and implementation strategies of the other. Allied concepts of aging ("growing older") and active aging are discussed before discussion of the main discourses of lifelong learning. A case study of an age-friendly city in New Zealand is presented wherein achievements and challenges are discussed; an argument is presented that as "close cousins," actors within these two domains can enhance the application of their humanistic principles by closer alignment of policy and practices. Further, challenges ahead for implementation of age friendliness are discussed, some of which are shared by the lifelong learning movement.

Keywords: Lifelong learning; Age friendly cities; Aging in place; Later life learning; Active aging

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1. Introduction

The main objective of this paper is to investigate the modern phenomenon of age friendliness from both a macro perspective as well as at the level of a localized application of the age-friendly city approach in which the author is engaged. Much of the rhetoric of age-friendly conceptualization is profoundly linked to the themes of lifelong learning, and proponents of each sector can benefit from mutually understanding the respective principles and implementation strategies of the other. A case study of an age-friendly city in New Zealand is presented wherein achievements and challenges are discussed. An argument is presented that as "close cousins," actors within these two domains can enhance the application of their humanistic principles through closer alignment of policy and practices. Further, this paper also discusses the challenges that lay ahead for the implementation of age friendliness, some of which are shared by the lifelong learning movement.

1.1. Origins of the age-friendly movement

The exact origins of the movement for age-friendly cities, universities, and communities are imprecise but ostensibly the leadership of the World Health Organization (WHO), and its support for then emergent initiatives to enhance older persons' well-being was a prominent factor. According to Buffel *et al.* (2022), in response to dominant forces of increasing urbanization, the First World Assembly on Aging held in Vienna in 1982 and subsequent major global milestones such as the 1986 WHO Ottawa Charter for Health

Promotion triggered age-friendly initiatives in both the Global North and South. The establishment of the Global Network of Age-friendly Cities and Communities (AFCC) in 2018 was a trigger event to capture global initiatives of communities around the world.

The upsurge of interest and commitment to the concept and implementation of age friendliness is hardly accidental. Global and societal changes such as rapidly changing age population structures, divergent family living patterns, increasing life expectancies, and greater technological advances (Findsen & Formosa, 2011) have exerted more pressure on national and local level governments, NGOs, and some elements of industry to better consider the needs and aspirations of older adults. In addition, Phillipson & Buffel (2020) argued for the strong inclusion of urbanization into big cities as a dominant factor affecting the potential for elders to live a pleasant life. These authors indicated that "the continuing spread of urbanization, with 55 per cent of the world's population now living in urban environments" (p.139) pressurises cities to respond to everyone's needs, regardless of age. As van Hoof & Marston (2021) pointed out, the vast majority of older adults want to age in place. Accordingly, the built and social environments for seniors need to be aligned to their real needs.

The lifelong learning movement, with a longer tradition than the age-friendly equivalent (Wain, 2009), has tried to grapple with similar issues wherein learning, whether as formal (adult) education, non-formal education or at an informal, day-to-day basis, has been the conduit for sustaining the well-being of older people (Withnall, 2010). While the purposes of lifelong learning are diverse and occasionally antagonistic (see below), this movement has also been motivated by maximizing the prospects of people of all ages to enjoy a good life. Hence, what is meant by an age-friendly environment? According to the WHO, "age-friendly environments (such as in the home, community) foster healthy and active aging by building and maintaining intrinsic capacity across the life course and enabling greater functional ability in someone with a given level of capacity" (WHO, n.d. [a]). Further, an age-friendly city "encourages active aging by optimizing for health, participation, and security to enhance quality of life as people age" (WHO, 2007, p.1). These definitions of age friendliness (environment, cities) can be applied to all people regardless of age. In respect to seniors in cities, an age-friendly environment can have considerable benefits including ready access to public facilities such as medical services, cultural and leisure centers, shopping, and other aspects of living where reasonable access to general necessities is paramount (Phillipson, 2011). Nor is the increased density of population from migration into urban settings necessarily detrimental to liveability, as demonstrated in cities such as Hong Kong where aging-in-place is not often problematic despite high population density.

The question of what makes a community age-friendly is not easy to answer. While the above definitions from the WHO provide guidance, they are insufficiently directive when it comes to planning, implementing, and evaluating strategies that can be adopted by cities. The notion of an age-friendly city needs to move beyond a tokenistic stance by local and national governments. Lui *et al.* (2009) have reviewed the international literature from 32 articles and reports from different city contexts and suggest that an ideal age-friendly community would give equal weighting to physical and social environments on a continuum and encourage governance on a continuum between top-down and bottom-up approaches. They asserted that enhancing a social environment is just as important as giving attention to material conditions in determining well-being in later life.

1.2. Literature review

Allied concepts to age friendliness are important to incorporate into a discourse where the health, security, and participation of older people come to the fore. Since age friendliness is linked to people regardless of the stage of life course they are in, setting the needs of seniors as priorities, as a common refrain, would benefit the rest of the public (Hamilton City Council, 2021). Certainly, kindred concepts of age, such as active aging, aging process, and old(er) age, are all relevant as underpinning ideas related to what age friendliness might mean. This paper does not offer a comprehensive treatment of every conceivably related concept, but a brief analysis of key linked concepts – age, "growing old(er)," and active aging – are presented next. In addition, the precepts of lifelong learning and major thematic concerns from learning in later life have considerable resonance in a rapidly changing world that is supposedly becoming more conscious of the implications of larger numbers of older persons in its midst.

1.2.1. Age and "growing old(er)"

Analysis of age is often treated at a macro level (as in reviewing particular countries changing population structures), meso level (reviewing trends in local communities), and individual level (investigating how a person progresses from childhood to early and mid-adulthood to later adulthood in physical, psychological, emotional, and spiritual domains). In addition, many theories of the social construction of aging (*e.g.*, Phillipson, 2013) as well as critical approaches to aging and later life (*e.g.*, Jamieson *et al.*, 1997) emphasize the importance of

understanding how cultural and social aspects underpin much human behavior. Historically and culturally, older age is conceptualized quite differently in varied locations often associated with labor market conditions, government social policies (particularly on retirement), and life expectancy (Chui, 2012). In my experience, many East Asian societies, while having higher regard for elders due to the Confucian tradition, have accentuated that "retirement" is expected by seniors in their 50s and 60s (*e.g.*, the Golden Age Foundation in Hong Kong; the Seoul 50+ Foundation in South Korea). In such contexts, expressive forms of learning are given prominence; instrumental education/training has a lesser priority (Hiemstra, 1976). This reflects a more passive form of aging – leisure rather than work. Regions such as Taiwan are taking significant steps to incorporate active aging in a lifelong learning framework to better balance expressive/instrumental activities (Findsen *et al.*, 2022).

Across the world, the reality of age discrimination takes hold, even when more age-friendly policies promulgated by governments and in regions have been enforced. Of course, the official retirement age is often a marker for employees to leave or reduce work (Phillipson, 1998), while retirement may be legally unenforceable in some countries (*e.g.*, New Zealand), often social pressure means that people beyond pension age of 65 may feel the need to conform to an early departure from paid work. Fortunately, retirement patterns are becoming more variable, at least in many Western countries, so that both workers and employers can enjoy the benefits of continuity of work (Findsen, 2016). A more "age-friendly" workforce is one where organizations as employers can help older workers to thrive, with supports such as appropriate training and development (Beatty & Visser, 2005). Accompanying age discrimination is the phenomenon of the relative invisibility of older people as participants in society. Tuckett (2022) pointed out how this invisibility is related to younger people's diminished expectations of engagement from the older generation and from seniors' self-monitoring.

1.2.2. Active aging

Another central concept related to both age friendliness and lifelong learning is that of active aging. As a new element of public discourse, active aging replaces older notions of an aging process where elders have been protected by paternalism and dependence, living more passive lives. As explained by Boulton-Lewis (2012), "it is critical that demeaning stereotypes of aging are challenged and that we accept a new perspective on aging and learning in modern society" (p. 3). The traditional conceptualization of older age as a time of expanded leisure and segregation protected from the everyday trials of society is increasingly redundant and replaced in part by the advent of the third age of creativity (Laslett, 1989). Yet even this view of aging is subject to critique, given that postmodern life is full of contradictions, tensions, and nuances of living where greater resilience is called for among seniors.

Among many authors on this topic, Braun (2022) has been prominent, especially in the Asia Pacific, in building on the WHO's (2002) framework for active aging. This framework has emphasized the three pillars of security, health, and participation. While acknowledging similarities to allied concepts such as *healthy aging*, *successful aging*, *productive aging*, and *creative aging*, Braun argued for the distinctiveness of active aging linked to social policies that support "the inclusion of older people in education, employment, volunteering, civic, and cultural activities" (2022, p. 15). Braun also explicitly stated that lifelong learning is an essential component to older adults to achieve their full potential and to foster age-friendly environments.

1.3. Links with lifelong learning

Within the literature of adult education and lifelong learning, there are four main thematic strands to explain the purposes for learning throughout life (Findsen & Formosa, 2011). These strands provide an underpinning rationale for possible engagement for older adults in an age-friendly context.

1.3.1. The economic dimension

At a societal level, it is essential that a nation uses the full talents of its citizens to be financially productive. Individuals, especially older people, as workers need to adjust to the uncertainties of the workforce and to the expectations of government, commercial organizations, and community agencies to maintain economic security and lead a productive life. However, government policy tends to favor the recruitment of younger workers (Lundberg & Marshallsay, 2007), and age discrimination functions to render the older workforce less visible even when COVID-19 has helped to trigger an employment crisis that older people could help to alleviate. As argued by Phillipson (1998), the position of workers in the political economy allocates rewards in accord with age, social class, race, and ethnicity. Amid these interdependent variables, age tends to function as a deterrent for seniors seeking to maintain relevance in the financial realm.

1.3.2. The personal development dimension

Personal development is associated with the liberal adult education tradition of individuals achieving what they are fully capable of. For older adults, this opportunity is heightened in retirement wherein there is purportedly

greater scope for creativity and deferred human potential aligned to Laslett's (1989) third age. This age, amid four from birth to death, focuses on active aging where older adults can flourish, exemplified in the educational area by the work of the U3A movement (Formosa, 2019). In the informal learning sphere, seniors can exercise self-directed and experiential learning to achieve new goals in a learning society (Brookfield, 1986). This dimension is predicated on an ideology of individualism and is humanistically oriented (Knowles, 1980).

1.3.3. The active citizenship dimension

An active citizen is crucial in a democratic and civil society. Older people can engage in communities as active participants in such a society. Welton (2005, pp.101–2) has defined civil society as "a social space with emancipatory potential, influenced by but not completely absorbed into the state and economy." In a less work-oriented space, seniors have arguably greater opportunity to undertake volunteering in community organizations and actively contribute to society as part of their active aging. Potentially, in later life, citizens can influence the direction of local initiatives through selective choices about where to invest their energies. For instance, in exercising their political rights, older people can seriously influence, through strategic voting, outcomes in local and national elections.

1.3.4. The social inclusion/exclusion dimension

Many nations are grappling with the challenge of how to create unity out of diversity. This diversity may emerge through identity formation related to networks linked to ethnicity, gender, social class, disabilities, and other forms of exclusion away from dominant groups' ideologies and practices. Seniors can readily be marginalized and rendered invisible (Tuckett, 2022). The workplace is a classic example of where the government, through uninspiring public policy implementation, or employers, through enacting ageist practices (*e.g.*, in recruitment), can fail to capitalize on the latent talents of older people (Short & Harris, 2014). In the educational context, the practices of universities do not match the application of inspirational principles espoused by some leading higher education institutions in the age-friendly university network (Talmage *et al.*, 2016). While much exclusion of older people from everyday life may be inadvertent or subtle, it nevertheless often renders individuals as unable to exercise equal opportunity (Wain, 2009).

The above dimensions are not mutually exclusive but can coexist and/or have a partially causal relationship. For instance, the state of a country's economy can have a more detrimental effect on many seniors who may be dependent on a government pension (if such exists). Static funding for elders in a rapidly rising cost of living crisis renders many in precarious financial situations. It will be demonstrated that each of the above lifelong learning themes is revealed and enacted to some degree in age-friendly practices.

1.4. Contexts of age friendliness

While the focus of this article is concentrated on the age-friendly city phenomenon, there are many other locales which may share many of the same principles and practices as a city environment. According to the WHO (n.d. [b]), as at November 2023, there are currently 1542 cities and communities in 51 countries, covering 320 million people worldwide. Giving special attention to older people's needs and aspirations is hardly new but this relatively fresh initiative of age friendliness globally and locally provides enhanced possibilities for citizen involvement in their daily lives.

In a broader context of case studies concerning AFCC, Remillard-Boilard *et al.* (2021) comment that "little is known about the progress made by cities developing this work around the world" (p. 4). Their purposeful sampling strategy captured 11 cities (all of which had been in the age-friendly program; already members of the WHO's (n.d.) Global Network for Age-friendly Cities and Communities; varied in size; located in different countries). Their findings emphasized the aspects of changing the perception of older age, involving key actors in age-friendly efforts, responding to the diverse needs of older people and the need to improve planning and delivery of programs.

Thus, many of the issues faced by older adults in an immediate locality are included in the projected plans of varied organizations (private sector; non-governmental organizations; and community education agencies), including local councils. This is evident in the case study below which illustrates how conceptualization, implementation, and evaluation (common program development mechanisms employed in adult education and lifelong learning) are presented in one New Zealand city. Further, this case will help to illuminate the achievements and challenges of cementing age friendliness into the consciousness of city dwellers.

2. Methods

In this article, the focus is on age-friendly cities while acknowledging the expanding literature on age-friendly universities (Talmage *et al.*, 2016) and other communities (van Hoof & Marston, 2021). The author is using a selected literature review of salient concepts and learnings from other locations (see Remillard-Boilard *et al.*, 2021) together with his active engagement at an experiential level

in a specific age-friendly city in New Zealand to explicate the promise and challenges of enacting an age-friendly plan. The intent is not to present an exhaustive analysis of potentially relevant studies and reports but to consider sufficiently portray a convincing theoretical background for the more in-depth case study of Hamilton, New Zealand, as an age-friendly city. The author of this paper is the current Chair of the Age-Friendly Hamilton Steering Group operating as a semi-autonomous entity under the auspices of the Hamilton City Council.

3. Case study: Age-friendly Hamilton (New Zealand)

Historically, the people in Hamilton city, situated inland in the upper portion of the North Island of New Zealand with a population of near 180,000, has maintained a solid relationship with the older generation (defined here arbitrarily as age 65+). The current Age-Friendly Hamilton Group (AFHG) grew out of a previous Council of Elders (since 1993) and an Advisory Panel on Older People (2014+). The group has 12 volunteer members who represent varying segments of the older population in Hamilton, which has more than one in 10 Hamiltonians being over the age of 65. In the 2018 Census, the proportion of the total population aged 65+ for New Zealand as a whole was 15.4% and 11.9% for Hamilton. Among the larger cities of the country, Tauranga (a favored retirement spot), has the highest proportion of 19.8%. In the same Census, when the New Zealand 65+ age populations are disaggregated into 65 – 79 and 80+ categories, Hamilton has 75% in the former category and 25% in the latter (*Age-Friendly Hamilton Plan 2021 – 2024*). Hence, the age structure of Hamilton, the fourth largest city in New Zealand, closely mirrors the country as a whole, except for being slightly titled toward the younger side. Yet, this is not a reason to be complacent.

The author, after volunteering for membership of a reconstituted Steering Group under the auspices of the Hamilton City Council, was appointed the chairperson, and the Group inherited a fairly comprehensive *Age-Friendly Hamilton Plan 2021 – 2024* (Hamilton City Council, 2021). Among the 12 members, four were returnees and eight new. As a consequence, it could not be assumed that there was consistency of agreement among members about what the plan is about and there was a need to examine projections for future priorities. The Group is semi-autonomous as it is informally supported by the Hamilton City Council (principally by a small secretariat) but the Steering Group can determine its own goals and actions. The group members reflect different components of the older population: university emeritus professor in adult education; a retired Indian academic in management; health practitioners; Māori representation from the Rauawaawa Kaumātua Trust (a major Māori older persons organization to promote well-being); a community house; a business member of the Hamilton Central Business District; Age Concern Waikato; and Pasifika. Meetings are generally held bi-monthly.

Figure 1 shows the overview of the *Age-Friendly Hamilton Plan 2021 – 2024* (Hamilton City Council, 2021) taken from the public document.

4. Discussion of the *Age-Friendly Hamilton Plan 2021 – 2024*

There are two stipulated goals in the *Age-Friendly Hamilton Plan 2021 – 2024* (Hamilton City Council, 2021), namely, raising awareness within the community of the increasing number of older people in Hamilton, and empowering the community to take action to improve the lives of older people in Hamilton. The newly formed Group decided to not take for granted what the Plan entailed. Although yet to be ratified as a formal change, the first goal was seen to be too innocuous because raising the *awareness of increasing numbers* is hardly aspirational nor sufficiently encapsulating of what seniors might need. According, we sought to replace this first goal, retaining the second, with the following: Raise awareness within the community of *the needs and contributions* of older people in Hamilton. This revamped goal goes beyond a knowledge of numbers to ponder on the (learning) needs of older people (*e.g.*, physical, social, emotional, *etc.*) and what seniors can offer the wider community. In effect, this change acknowledges that aging has an impact on older citizens' changing needs (where aging is commonly interpreted from a deficit perspective) but it also points to the positive features of an informed citizenry, a manifestation of active aging.

The five principles in the plan are based on community development notions and are currently viewed as appropriate. The themes identified in the plan are derived from those of the WHO (2018), complemented by the addition of "safety" from the previous group. There are obvious overlaps amid the themes (*e.g.*, social inclusion in housing; and safety in transport and mobility) and there is no explicit mention of learning in later life which could be incorporated under "social participation."

The following section of this article looks into some of the early achievements and the conspicuous challenges for the future as this new Group assumes firmer direction and support for its work. It is followed by more general discussion, linking aspects of literature to the realities of practice.

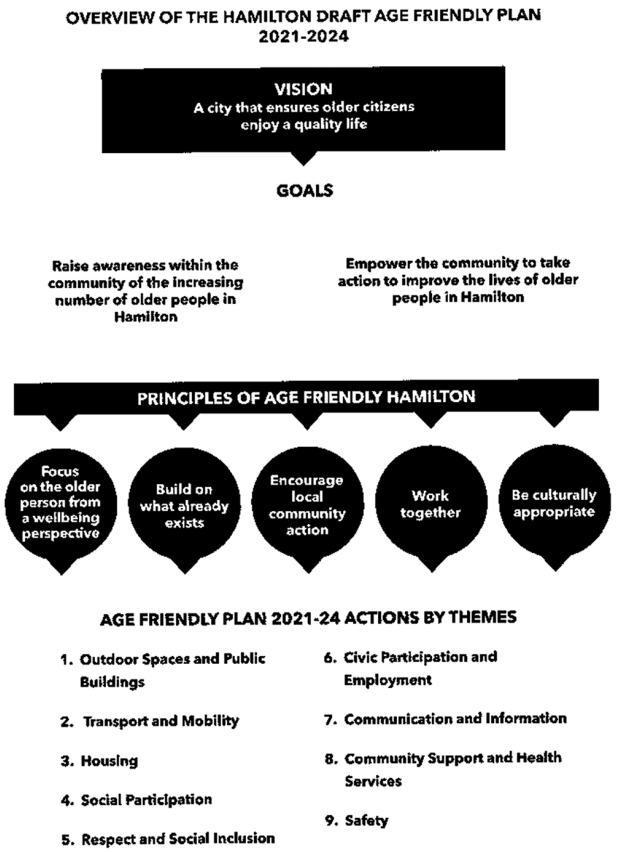

Figure 1. The overview of the *Age-Friendly Hamilton Plan 2021 – 2024*
Source. Hamilton City Council, (2021, p. 9).

4.1. Achievements

Hamilton was the first city in New Zealand to join the World Health Organization's Global City network in 2018, based primarily on a submission from the previous Group of the 2018 – 2021 Plan. It has been a flagship initiative. Recently, visitors from the American Association for Retired Persons (AARP) visited Hamilton in August 2022 to view progress and discuss relevant issues. Hence, the Group is facing some understandable pressure for acting as a leading agency of this type in this country.

The original plan was developed after considerable consultation from varied community organizations throughout Hamilton. During 2020 (despite COVID-19), there were open forums held and ongoing discussions with agencies such as Age Concern, Rotary, churches, the Waikato Indian Senior Citizen's Association, the University of the Third Age, and neighborhood houses. This needs assessment exercise became the basis for changes to the current Plan. However, needs analysis requires constant revisiting and subsequent action (Wacker *et al.*, 1998). A strength of the Plan is that for each of the nine themes, there are clearly defined goals followed by three columns: action, status, and responsible agency. For example, under the theme of *Outdoor Spaces and Public Buildings*, the main goal is stated as follows:

> *The community has places to enjoy and be part of outdoor activities that are accessible and where people feel safe.*
> *Action 1.4: Completion of Phase 2 of the Age-friendly and Dementia Friendly Kaumātua Centre*
> *Status: Enhance*
> *Responsible Agency: Rauawaawa Kaumātua Charitable Trust.*

While the usage of key performance indicators (KPIs) might be criticized for excessive monitoring and surveillance, they do provide an indication of what has been achieved and what is yet to be enacted.

One of the themes for the Age-Friendly Hamilton Group, derivative of the WHO's priorities, is that of housing. From a broader perspective, as noted by Buffel *et al.* (2022), the theme of housing is a more hardened area for age-friendly entities to investigate. They remark that "the argument is that doing 'age-friendly' work also means recognizing and challenging the wider inequalities and injustices which affect city life" (p. 157). Given current economic stringency and continuing immigration into New Zealand, the demand for housing has far exceeded supply. For seniors in particular, especially those from relatively deprived neighborhoods, the costs for either home ownership or renting are very high with increasing homelessness. In Hamilton city, there are a range of providers (some national governmental, private agencies, non-governmental organizations, *etc.*) but there is little overt co-operation across providers and the gaps in provision are serious. Accordingly, the AFHG has secured the services of senior tertiary education students to develop a plan for ascertaining exactly who is providing what for whom in the social/senior housing market. We intend to seek further research assistance on a voluntary basis to gather more evidence in this thematic area of housing and in other domains, but we lack the financial resources to do so.

4.2. Challenges

4.2.1. Challenges in task-relationship dichotomy

For a newly formed AFHG, paying attention to both relationship building and task completion is critical, as indicated by group dynamics specialists (*e.g.*, Johnson & Johnson, 1982). Unless individual members see a place for their participation, their commitment may waver. At present, we are revisiting the plan for updating and allocating responsibility for subgroups to concentrate on elected themes and actions.

4.2.2. Funding and influence

The group receives support in kind from the Hamilton City Council (through a Community Development secretariat). However, there is no direct funding from the local government. It is prudent to establish a firm financial base – for instance, from research sources – to provide a sharper edge to our activities. In effect, the Group relies on influencing "significant others" (individuals and agencies aligned to the mission of the AFHG) to carry out its agenda. However, the Group's indirect influence may be "too soft" to effect significant changes.

4.3. Cultural/Ethnic inclusion

The Group requires Māori (indigenous), Pasifika, and Asian representation to ensure its ethnic diversity. In Hamilton, Māori constitute 8.8% of the population aged 65+ and 6.5% across New Zealand; Pasifika 2.4% in Hamilton and 2.8% in New Zealand; and Asian 8.6% in Hamilton and 6.7% in New Zealand, according to the 2018 Census (Hamilton City Council, 2021). The Rauawaawa Kaumātua Trust, a holistic agency, whose function is to sustain the well-being of Māori elders, has its director as a member of this Group and is well-known nationally and internationally for its considerable work. Yet, the Group needs to commit further to cultural inclusion such as employing more *te reo* (Māori language, an official language in New Zealand) in its communications as well as in recruiting an Asian representative. At present, older Pasifika adults are poorly served in social and health services, and this issue needs remedying.

4.4. Marketing

Despite the Hamilton City Council underpinning the work of this volunteer group, the work itself is not well known amid the public. Communication across agencies and among individuals working for and with seniors needs greater enhancement. Discussions are currently being held about inclusion of the work of the group in a regular page of a well-known public magazine focusing on the well-being of older adults and to bring to Hamilton seniors' attention the opportunities for access to health services, public events, and the like. It cannot be assumed that older people have confidence and/or competence in digital literacy (Boulton-Lewis, 2012) so some "old-fashioned" methods in publicity still need to be maintained while simultaneously upgrading technological literacy of seniors.

4.5. Action more than words

The plan provides a very good basis for identifying and prioritizing activities to improve the well-being of seniors in Hamilton. However, there is a distinct danger that the group becomes a continuing "talkfest" and actions are relegated for others to undertake. While ongoing dialog is essential, the goals and actions for the themes need mechanisms for evaluation and accountability. It is incumbent of the group to maximize the aspiration of improving the lives of local seniors and this goal is actually met by actions and accountability. Hence, prioritization of actions linked explicitly to the key issues for local citizens is important so that achievements can be monitored.

The literature review has emphasized the alignment of conceptual components of age-friendly communities, especially in urban environments, and lifelong learning themes. In both the theoretical strands of age-friendly cities and lifelong learning, the fundamentals of active aging and learning in place, the autonomy of individuals to exercise choice in work and leisure, the contribution of seniors to civil society, and the need to include the marginalized in society are to the fore. The nine themes of the *Age-Friendly Hamilton Plan 2021 – 2024 Hamilton Age-Friendly Plan 2021 – 2024* are fully aligned with the four themes of lifelong learning to present a powerful strategy for influencing the well-being of seniors not just in the city of Hamilton but elsewhere too. Socially inspired themes from the WHO framework such as social participation, respect and social inclusion, communication and information echo the lifelong learning impetus for personal development, active citizenship and social inclusion. From the perspective of the built environment (van Hoof *et al.*, 2021), the WHO theme of Transport and Mobility requires an economic base to go forward; its implementation affects seniors, especially those with significant disabilities, in terms of building social capital; active engagement of elders requires ease of mobility; and without effective transport, (older) people can be excluded from participation in societal affairs. The interconnectedness of the physical and the social environments is undeniable.

5. Concluding remarks

The challenges facing the AFHG are intrinsically inward- and outward-looking, but the need to address these challenges is important to achieve the goals of AFHG. While it is inappropriate to extrapolate from this one case study to the hundreds of other kindred groups concerned with establishing age-friendly environments across the globe, this case does provide some insights into what it really means to implement goals that are inspired by both global and local priorities.

The themes from the Plan and the WHO paradigm readily align to the four lifelong learning themes: economic imperatives, personal development, active citizenship, and social inclusion/exclusion, which are very much interlinked and can be colloquially known as "close cousins" in this

realm. While these conceptual paradigms do provide firm bases for strategy, the challenges remain in practical terms to materialize these humanistic aspirations. As observed by Buffel *et al.* (2022), one of several interventions to improve the effectiveness of an age-friendly agenda is to link more closely with other disciplines. In this case, a lifelong learning lens provides further scope for strategy and implementation.

As pointed out by van Hoof & Marston (2021), the risks of tokenism are pervasive. At the time of writing, the local Council to whom the AFHG reports is announcing fresh economic stringencies to constrain spending and to look for possible asset sales. The AFHG has a volunteer base where commitment and aspiration can readily be curtailed by political indecision, research incapacity and financial stringency, which are challenges awaiting to be addressed.

Acknowledgments

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Conflict of interest

The author is the Chair of the Age-friendly Hamilton Steering Group. The case study directly relates to this voluntary work. It is not possible to exercise impartiality in discussing the theoretical and practical aspects of this article.

Author contributions

This is a single-authored paper.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

Data are available from the corresponding author on reasonable request.

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ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Light, activity, and sleep: Design and usability evaluations of a web-based course supporting changes to routines and the home

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Abstract

While research indicates that indoor lighting, exposure to daylight, physical activity, and sleep interact to influence functioning, mood, and daily rhythm, strategies are needed to support behavioral changes among older adults who often spend more time at home after retirement. The objective was to design a web-based course to encourage behavior change related to light, activity, and sleep. Grounded in the information-motivation-behavioral skills model, the course aims to promote well-being and improve lighting and darkness conditions at home. The technology acceptance model was used as a framework for evaluating usability aspects of the course. Data were collected through video observations, interviews, and questionnaires. Three experts on pedagogy, design for older adults, and/or interaction design were invited to independently assess usability of the course content in a full-scale model of an apartment. Six adults (age 70 – 79) participated in a similar usability evaluation in a second round in the apartment. A two-step usability evaluation by experts in the first round and target users in the second proved valuable. Findings enabled refinement of the course content and significantly reduced the number of identified usability issues in the second round. All six participants in the second round rated the overall user-friendliness as 6 out of 7. Changes to the content after the second round included, e.g., clarifying the different types of text links and considering issues with online enrolment in the course. The web-based course, supplemented with physical meetings, can benefit late-life learners because of the relevant easy-to-use content.

Keywords: Older adults; Web-based course; Behavioral changes; Usability; Home environment

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1. Introduction

1.1. Background

Older adults spend more time at home after retirement, and the home becomes a central place for activity. Studies have shown that people spend an average of about 90% of their time indoors (Brasche & Bischof, 2005; Hiller, 2015; Leech *et al.*, 2002). However, there are variations between age groups. While people spend an average of 15.7 h/day (65%)

indoors at home, the figure for adults aged 65 or older is 19.5 h/day (81%) (Brasche & Bischof, 2005). These figures are derived from studies conducted before the COVID-19 pandemic, so differences between age groups might have changed since. However, likely, time spent indoors has not decreased.

People spend one-third of their lives in bed sleeping, and older adults often sleep poorly at night (Lockley & Foster, 2012). Research points to inadequate daytime light levels in homes of older adults for visual tasks (Charness & Dijkstra, 1999) and for maintaining a healthy daily rhythm (Connolly *et al.*, 2021). Furthermore, older adults spend less time being physically active than younger ones (<65 years) (Public Health Agency of Sweden/ Folkhälsomyndigheten, 2018).

Indoor lighting, exposure to daylight, physical activity, and sleep interact with each other to influence functioning, mood, and daily rhythm (Harvard Medical School, 2019; Lockley & Foster, 2012). Being physically active during the day, for example, improves sleep at night. A person who slept well is more likely to feel energized and be physically active the following day. Another example is the importance of environmental time cues for setting the internal body clock, which in humans is slightly longer than 24 h on average.

Recent studies have established convincing links between light-dark cycles and health, for example, between disturbed daily rhythm and diabetes in shift workers (Lowden & Favero, 2017; Foster & Kreitzman, 2017). Typically, aging is associated with circadian rhythm sleep disorders and insomnia (Foster & Kreitzman, 2017). One reason could be reduced light exposure among older adults due to gradual yellowing of the lens and decreased pupil area (Turner & Mainster, 2008). Cataracts and age-related diseases will also reduce the light signal to the body clock (Boyce, 2014).

Although well established in research, awareness of light as the most crucial environmental time cue for the body clock and knowledge of how to achieve appropriate lighting conditions in the home seem to be limited among community-living residents in Sweden (Gerhardsson *et al.,* 2020). Furthermore, residents may know what lighting they want, but this does not necessarily mean that they have such lighting in their home for various reasons (Gerhardsson *et al.,* 2019). The most important factor influencing lighting choices is the physical setting of the interior home environment, which can facilitate or limit residents' choices and actions.

What strategies can promote behavioral changes among community-living older adults to optimize indoor lighting and darkness conditions, outdoor exposure to daylight, physical activity, and sleep? One strategy is to provide a web-based course comprising factual information, guidance for self-managed and personalized home adjustments, and changes to routines. Similar strategies have been used to prevent falls in older adults living in the community and to treat those with mild to moderately severe late-life depression (Pabst *et al.,* 2020; Vieira *et al.,* 2016). One of the benefits of using a web-based course is that it can be offered to many older adults to supplement other municipal services, including those who live further away from senior centers. A web-based course allows course participants to complete learning activities online at their own pace. Although not yet determined, a web-based course could be more cost-efficient than a course delivered in a face-to-face mode (Maloney *et al.,* 2015).

Regarding internet use, however, older populations face barriers such as age-related changes in vision, hearing, perception, memory, and comprehension, and the digital realm is marked by a rapidly changing technical environment and web-based interfaces that require constant learning; therefore, a lack of access to computer and/or broadband availability and a lack of previous experience with computers during working life will prove challenging to the elderly populations (König *et al.,* 2018; Lee *et al.*, 2019; Notess & Lorenzen-Huber, 2007). Older adults' internet use varies across countries and age groups. Compared to many countries in the European Union, Sweden recorded a large share of people aged 65 – 74 who had used the internet in the past 3 months during the first quarter of 2020 (91%), while the average across the European Union was 61% (Eurostat, 2021). Among Swedish citizens born in the 1940s, 83% had used the internet in the past 12 months, and 71% had used e-services (Internetstiftelsen/Swedish Internet Foundation, 2021).

Taking health-promoting online courses (supplemented with physical meetings) in later life could contribute to active aging, which benefits both the individual and society. As defined by the World Health Organization (2002), active aging refers to optimizing opportunities for health, participation, and security to enhance quality of life. "Active" reflects people's continuing participation in their communities' social, economic, cultural, spiritual, and civic affairs. A web-based course is one example of enabling older adults to participate through education that supports their learning. Such learning provides an opportunity to maintain or develop new skills, such as using digital devices and digital learning platforms. In addition, health promotion in terms of a web-based course in later life could prevent the onset or worsening of disabilities and reduce the risk of loneliness and social isolation through

peer support. However, physical impairments or lack of good health can be strong barriers to participation in educational activities (Purdie & Boulton-Lewis, 2003).

While lifelong learning has received more attention in recent years (Schmidt-Hertha *et al.*, 2019), to the best of our knowledge, no research has addressed the design and development of a complex behavioral change intervention comprising a web-based course targeting light, activity, and sleep directed at older adults.

1.2. Objectives

This paper reports on the evaluation of usability aspects of an intervention delivered as a web-based course. The evaluation was conducted in a laboratory setting with invited experts and members of the target user group.

The principal objective of this study was to design a user-friendly web-based course that encourages behavior change related to outdoor physical activity, sleep patterns, and changes to the home environment, such as lighting and darkness. A second objective was to evaluate usability aspects of the course. The behavioral changes are intended to promote well-being and improve lighting and darkness conditions in ordinary homes of older adults. The long-term goals of the course are social inclusion and continued independent living.

The target group – adults aged 70+, living in ordinary housing – was chosen because they are likely to have retired from work and experienced changes in their daily routines. Furthermore, most older adults in Sweden live in ordinary housing (95% of those aged 60+) (Statistics Sweden/ Statistikmyndigheten, 2022). Ordinary housing refers to all dwellings on the open market, including different forms of housing tenure, while special housing denotes housing that requires an authority decision.

1.3. Theoretical approach to intervention strategy and usability evaluation

The intervention strategy departs from the information-motivation-behavioral skills model, which was developed in the nineties for promoting health-related behavior (preventive behavior to reduce HIV risks) while considering social and psychological factors that influence such behaviors (Fisher *et al.*, 2003). The model was designed to be easy to translate into health promotion interventions and claims that health-related information, motivation, and behavioral skills are fundamental for health-related behaviors. When people are well informed, motivated to act, and have the behavioral skills needed for effective action, they are likely to initiate and maintain health-promoting behaviors and experience positive health outcomes.

The elements of the model were considered in the design of the course content in the following ways. Factual information is provided, for example, light as the most potent external time cue for the internal body clock, characteristics of good indoor lighting, and the complex relationship between light, outdoor physical activity, and sleep. Motivation is considered through information about the individual benefits of maintaining routines, the possibility of peer support, weekly encouragement from the course leader/interventionist, and automatic feedback through text messages on the mobile phone when each module has been completed. Course content is adapted to the target users (aged 70 and above) and includes practical exercises and skills training to make learning experiences interesting and enjoyable. Behavioral skills involve how to change certain lighting design features. Course participants are encouraged to use a checklist and a test kit to identify individual lighting needs and preferences.

Behavioral changes entail physical activation (*e.g.*, increased engagement in outdoor activities such as walking), changes to sleep routines based on the principles of sleep restriction, and listing action plans to turn goals into habits. Participants list strategies to accomplish the goal by creating "if-then" plans. "If" refers to the critical situation or situational cue, and "then" refers to the goal-striving response (Gollwitzer & Sheeran, 2006).

The technology acceptance model was used as a framework to evaluate the course's usability aspects (Davis, 1989). According to the model, two factors predict and explain system use: "perceived usefulness" and "perceived ease of use." This means that people will use an application (*e.g.*, a software tool or a technical product) if they find that it helps them perform better. However, performance benefits might be outweighed by the effort to use the application.

2. Data and methods

2.1. Course design and development

The non-credit web-based course "*Light, activity and sleep in my daily life*" was developed for the online learning management system Canvas. Figure 1 shows examples of screenshots from Canvas. The course can be accessed on a computer, tablet, or mobile phone with an internet connection using either an internet browser or a mobile app. Course participants are asked to use a browser (either on a large tablet or a computer) to ensure that features work as intended and to facilitate typing when submitting online assignments.

The course includes various learning strategies, such as reading and listening to factual information, doing practical

exercises, recording diaries, and reflecting on goal setting and implementation intention by creating if-then plans. It is intended to run for 9 weeks and targets multiple types of behavior related to light, outdoor physical activity and sleep.

The course is divided into nine modules. An overview of the content is shown in Figure 2. Every completed module ends with a brief online evaluation. Besides online material, the course includes a test kit containing lamps, a sleep mask, a checklist for the inventory of a room, a cap, a notebook, and a sleep diary. The purpose of the test kit is to encourage experimentation and provide handouts and printed copies to facilitate the completion of assignments.

The course is mainly self-directed, and the estimated course time per week is between 2 and 4 h. Future course participants will take part in the course from home using their own digital devices and will be given the flexibility to complete the coursework at any time during the week, as long as they follow the course material in a pre-set order. A new course module is unlocked only after the preceding module is completed, so as to ensure that participants have completed all the modules.

The role of the course instructor is to facilitate rather than teach. To facilitate during the course, the instructor would: (i) monitor the progress of module completion so that participants stay on pace with the course completion date; (ii) respond to questions about homework assignments; and (iii) provide personal feedback on online assignments and encourage participants to continue to the next module upon module completion. Both personal and automated encouragement has been shown to increase intervention adherence in the context of internet cognitive behavioral therapy (Furukawa *et al.*, 2021). During the course period, future course participants will be able to offer peer support among one another, in the form of online messages through the integrated mailbox of the digital platform.

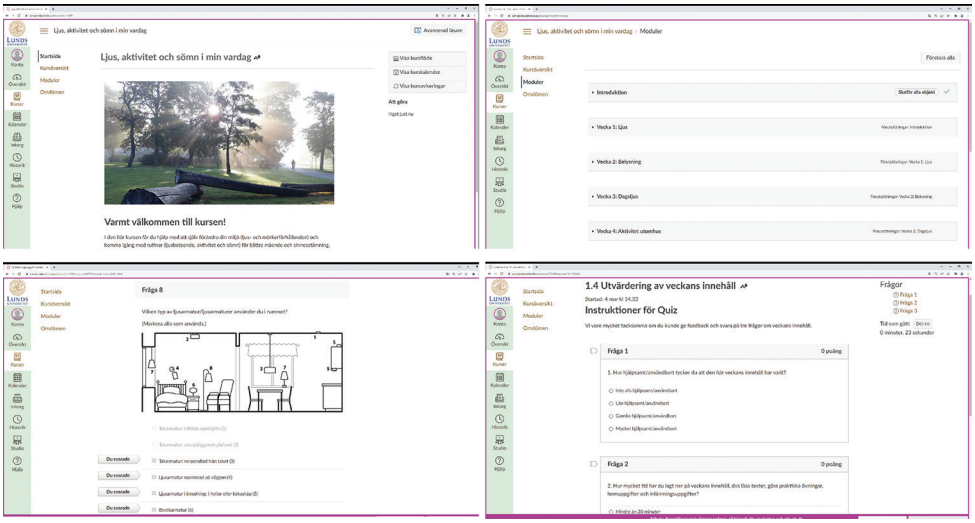

Figure 1. Screenshots of the web-based course "Light, activity and sleep in my daily life" showing the start page, the module structure, the assignment "Inventory of a room at home and time spent outdoors," and the evaluation ending each module.

Overview of the behavioural change intervention 'Light, activity and sleep in my daily life' delivered as a web-based course

Participants learn about …

Week 1: … light (reading, completion of an observer-based environmental assessment of light-related features in the home).
Week 2: … electric lighting (reading, practical exercises).
Week 3: … daylight (reading, practical exercises).
Week 4: … the benefits of daylight exposure and physical activity outdoors. They keep a one-week activity diary.
Week 5: … planning and implementing a walking programme. Preparatory work for the subsequent sleep modules: they keep a one-week sleep diary.
Week 6–9: … environmental cues for setting the body clock, the sleep drive, age-related changes in sleep, the importance of sleep routines, and using sleep restriction techniques.

Figure 2. Overview of the course content of each weekly module.

2.2. Usability testing

Identifying potential user difficulties is a critical step before evaluating immediate intervention outcomes in real-world homes. The study had a user-centered iterative design approach that is stepping through one design version after another (Nielsen, 1993). For every version, we conducted a usability evaluation of the course content accessed on the digital platform and made revisions based on the findings (Figure 3). The study used a mixed-methods approach (Mason, 2006), including questionnaires, interviews, direct observations, and interactions with the participants to uncover user problems and identify possibilities for improvement.

2.2.1. Participant characteristics

Round 1. Three experts on pedagogy, design for older adults, and/or interaction design were invited through professional networks to independently assess the usability of the course on their laptops. Two were employed by a university and one by a municipality.

Round 2. Six participants representing intended users (aged 70 and above) were invited for similar usability testing in a second round. The number of participants was considered sufficient for identifying usability problems, based on the findings by Nielsen (2012). The inclusion criteria of this study were as follows: age 70 or above, living in a one-person household in an apartment, speaking Swedish, having access to a computer and smartphone, and being an internet user. The reason for only enrolling residents living in apartments was because it can be more challenging for tenants to change fixed luminaires in the bathroom and kitchen, finishes, structural elements, or technical infrastructure. In rented apartments, the tenant must repair and cover the repair costs of any alterations. In tenant-owned apartments, the tenant has to seek approval from the board if they want to make any exterior changes, such as mounting solar screens. In addition, daylight availability may be limited in apartments on the lower floors in multi-dwelling buildings due to building density or balconies, reducing the amount of light entering a room.

Several recruitment methods were used, including participating at senior community events; posting flyers at the public library, a senior citizen meeting point, fitness center and in thrift shops; interacting with local branches of organizations (SeniorNet and the Swedish National Pensioners' Organization) who sent emails to their members; and interacting with personal networks. All participants but one had retired from work. Participants had work experience in health care, education, editorial work, and/or coaching domains. All participants considered themselves to be experienced Internet users. One of the participants informed us later in the process that she lived in a house, but she was not excluded from participation to ensure a sufficient number of participants. Participant characteristics are provided in Table 1.

2.2.2. Test environment

Usability testing sessions took place in a full-scale model of a one-bedroom apartment situated in a laboratory at the university. The reason for choosing a test apartment was to mimic course participation in one's own home. Figure 4 shows the test environment, which enabled manipulations of the lighting conditions and direct video observation to identify any problems when participants experimented with the test kit included in the course material.

2.2.3. Procedures

(A) Round 1

Before arrival on the first testing occasion, the experts received written instructions and information about the study's aim. They had also received standardized instructions for course enrolment provided by the university. The course was accessed through self-registration in a two-step process. First, the experts received a username (unless they already had one

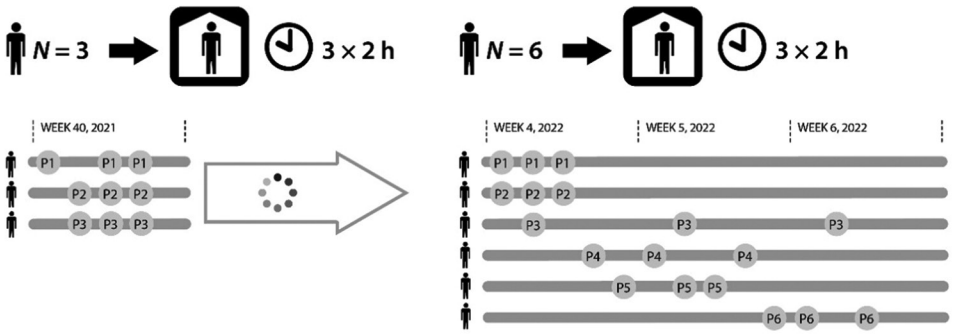

Figure 3. Procedure based on the principle of iterative design. Two usability rounds were conducted, including two different sets of samples – three experts in the first round and six older adults in the second. Every participant independently evaluated the course content on their laptops on three occasions (lasting 2 h) in the test apartment. The arrow symbol indicates the refinement of course content before the second round.

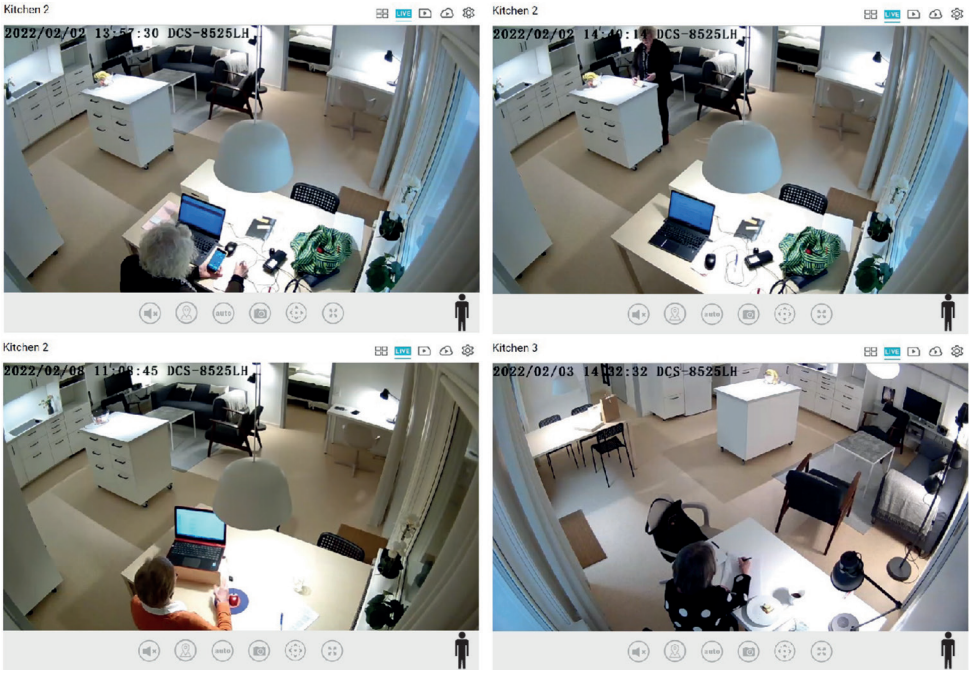

Figure 4. Test environment: A full-scale model of a one-bedroom apartment (63 m^2) equipped with video cameras to enable direct observation by the researcher.

Table 1. Characteristics of the participants in the second round

Characteristics	Round 2 (*n*=6)
Age (years in median)	74 (age range 70 – 79)
Gender (n)	6 women
Occupation (n)	
Retired	5
Retired+working as a consultant	1
Dwelling type	
Apartment	5
House	1

as a university employee), an email address, and a one-time password from the university. They also received instructions to change the password and activate their user account. Second, they received a course invitation by email and had to accept it by clicking a button to register. Participants were asked to bring their own laptop and smartphone.

In the laboratory, before entering the test apartment, the experts were verbally informed about the study and gave their written consent to participate. They were informed that they would be directly observed by the researcher with video cameras mounted in the test apartment but not recorded. The instruction for the task was to read the course content on the digital platform using their own laptop for 2 h and to pay attention to (i) graphical design, (ii) course instructions, (iii) interaction (*e.g.*, if the course was easy to use, if the course structure was consistent and the course modules were well integrated). They did not have to read anything from home. They were encouraged to open the test kit included in the course material to check the content.

To guide note-taking, they received a checklist based on ten heuristic design principles developed to identify user problems (Nielsen & Molich, 1990). The principles are available at https://www.nngroup.com/articles/ten-usability-heuristics/(the checklist is shown in Appendix 1. 1). The experts were informed that they could move furniture around and sit anywhere they wanted to. Self-service coffee or tea and snacks were available in the kitchen of the apartment.

On the final and third occasion, the experts were informed before the session that they had 1 h to read the remaining course material, after which they were asked to complete the one-page system usability scale (SUS) (Brooke, 1996) for the web-based course and participate in an interview. The purpose of obtaining the SUS scores was to supplement the participants' verbal feedback on how easy it was to use the web-based course and their overall experience of the course. The SUS quantifies the usability of products and services, including software and websites, consisting of 10 questions on a 5-point Likert scale. SUS scores of individual items were converted to range from 0 to 4 (the higher, the more positive). The sum of the converted values was then multiplied by 2.5, resulting in a total usability score ranging from 0 to 100

points. Higher SUS scores indicate greater usability. Based on empirical evaluations of the SUS, a score below 50 indicates usability difficulties, while scores in the 70 and 80 ranges are considered promising (Bangor *et al.*, 2008). The SUS items and one final question (Adjective Rating Scale) about the overall user-friendliness (rated on a scale from 1 "Worst imaginable" to 7 "Best imaginable") are included in Appendix 2.

The recorded interviews lasted between 38 and 67 min and included a series of open-ended questions related to general opinions about the course content, perceived ease of use, and usability concerns. The experts were asked about what type of device and internet browser they had used. The interview guide is shown in Appendix 3.

The learning management system recorded participants' online activity in terms of page views and time logged in. Approximately 4.5 h in total were available for reading through the course online during the three sessions in the test apartment. After the first round, changes were made to the course content based on the results.

(B) Round 2

The second round followed the same procedure as the first one. However, the task was slightly modified. No checklist was provided, and the instruction was to take notes and pay attention to: (i) readability (*e.g.*, difficult words or phrases or incomprehensible text), (ii) whether the course was easy to use (*e.g.*, instructions for the online assignments), and (iii) whether they would be able to do the home assignments. Furthermore, questions related to the perceived usefulness of the course were added to the interview.

The entrance door to the test apartment was left open to the laboratory space where the researcher monitored the activities. The participants could call on the researcher when they faced any navigation problems on the digital platform or had trouble understanding course instructions. During the test session, the researcher made regular checks on the participants in the test apartment to ask whether they had encountered anything particular working well or poorly and if there was something they wondered about. The reason for more active interaction was to continuously solicit participants' feedback and reduce the cognitive load of note-taking. The interviews lasted between 32 and 50 min. Participants received a gift card (550 SEK) as reimbursement a few weeks later by post. The course content was further refined after the second round.

2.2.4. Data and statistical analysis

(A) Round 1

A theory-driven approach based on ten heuristic design principles developed by Nielsen & Molich (1990) was used for the analysis of the qualitative data to identify potential user problems. One example of the principles is "#2 Match between system and the real world" (*i.e.*, use words familiar to the user).

Audio-recorded interviews were summarized, and answers to the questions in the interview guide were transcribed. Provisional coding was applied, that is, analysis begins with a start list of researcher-generated codes based on what might appear in the data before they are collected and analyzed (Miles, 2014). Based on the content of transcripts and field notes taken during the direct observations, the material was sorted as previously described.

SUS scores for each participant were transformed into a usability score from 0 to 100 points. A score of 68 was considered to be "OK," between 68 and 80.3 was "Good," and above 80.3 was "Excellent" (Usability.gov., n.d.).

(B) Round 2

A theory-driven approach based on the technology acceptance model was used for the analysis of the qualitative data to identify participants' general opinions, perceived ease of use, and concerns (Davis, 1989). Data from transcripts and field notes taken during the direct observations in round 2 were sorted into two pre-determined main categories: "perceived ease of use" and "perceived usefulness." A third pre-determined main category was "Potential future improvements." Emergent findings were compared with field notes taken in connection with course enrolment and during the direct observations and interactions with participants in the apartment.

Additional data collected in the second round were analyzed thematically. Written responses to the first online assignment of the course, "Your expectations," were assigned content-based codes to capture the participants' motivation for course participation. The purpose was to check whether the invitation for course participation should be modified to attract the intended users. The online assignment included the following questions:

(i) Why would you like to make changes to your home and routines related to light, physical activity, and sleep?
(ii) What are you aiming for? Please write a few positive effects that you hope for.

3. Findings

3.1. Round 1 with experts

3.1.1. Usability testing interviews

The three experts gave positive feedback regarding the course ("fun and interesting", "nice and inviting") and considered

that the instructions were easy to follow. They appreciated the combination of theory and practice but suggested some changes to the graphical design to increase readability. Changes included breaking up large text chunks into several paragraphs, using more subheadings in the introductory module, using bullet lists, and adjusting some of the headings (*e.g.*, "Sleep" was changed to "Sleep in later life").

The interviews revealed a number of usability issues (*e.g.*, difficult or inconsistent terms, unclear instructions). The most frequent conflict with the ten guiding principles for user interface design was "#2 Match between system and the real world" (*e.g.*, word choice and the use of technical terms), followed by "#10 Help and documentation" (*e.g.*, unclear instruction for one of the quizzes), "#8 Aesthetic and minimalist design" (*e.g.*, unnecessary repetition of information on quiz pages), "#4 Consistency and standards" (*e.g.*, inconsistent use of "buttons" and "text links"), and finally, "#5 Error prevention" (*e.g.*, error messages when taking multiple-choice quizzes).

One issue was not possible to solve because the clock display is a feature included in the learning management. A clock display ticks when taking a quiz, which can be annoying when there is no time limit. A summary of the types of issues, examples, and the adjustments after round 1 is described in Table 2.

3.1.2. Usability testing questionnaire (SUS)

The individual experts scored 75, 75, and 85, indicating sufficient usability but room for improvement. Concerning the overall user-friendliness, one expert rated it as 5 ("Good"), while two rated it as 6 ("Excellent").

3.1.3. Direct observations

During one of the practical exercises ("Daylight measurement using the mobile phone"), it was noted that the experts did not switch off the electric lighting when testing the downloaded light meter application.

3.2. Round 2 with target users

3.2.1. Usability testing interviews

All six participants gave neutral-to-positive feedback regarding the course ("easy to manage and read", "good readability/…/but the first three modules were more technical", "very interesting", "neither too difficult nor easy"). All of them found the instructions for the assignments easy to follow. Participants appreciated learning things grounded in research in an easily accessible way, guidance for practicing the acquired knowledge, the tips for further readings, and the links between factual information to practical exercises.

The number of usability issues identified in the interview data was significantly lower than in round 1. Issues in round 2 included occasional incomplete instructions and text-heavy pages. While some participants found the sections about the technical properties of lamps and lighting useful, two expressed that they were less interested in the subject but still found them relevant. A summary of the types of issues regarding one of the pre-determined main categories – "Perceived ease of use" – is described in Table 3. Three sub-categories were identified reflecting three aspects of design (originally developed for the design of websites by Söderström,

Table 2. Main issues with examples identified in round 1 with the experts (*N*=3) and adjustments

Category	Examples of issues	Adjustments
#2 Match between system and the real world	• Choice of words and the use of difficult technical terms	• Replaced certain words with more commonly used words, further explained technical terms (*e.g.*, circadian, chronotype, lux), removed too technical terms (suprachiasmatic nucleus)
#4 Consistency and standards	• Inconsistency when using "buttons" and "text links" • Missing acronym "pdf" in the link text, which provides direct access to an external PDF upon clicking	• Consistently used "buttons" and text links in written instructions • Included the title of the document and "pdf" in parentheses in the link text or the link to internal-only PDF
#5 Error prevention	• Error message when not ticking any of the response options in multiple-choice questions	• Added a response option ("Not applicable") that can be ticked when other options are not relevant
#8 Aesthetic and minimalist design	• Repetition of information on quiz pages • Repeated image description explaining image content in the body text (detected when using the speech-to-text software).	• Reformatted the quizzes • Shortened the image descriptions
#10 Help and documentation	• A bit unclear instruction in one of the quizzes • Confusion arising from not understanding the purpose of the test kit from start • Not switching off the electric lighting while taking daylight measurements with the downloaded light application (noted during direct observation)	• Clarified the quiz instructions to increase comprehension • Explained the purpose of the test kit • Clarified the written instructions ("complete the assignment during the daytime and do not forget to switch off the electric lighting before taking the measurement")

2001): "graphical design" – refers to liking what you see on the website; "information design" – refers to finding your way, understanding your current location and where a link takes you; and "interaction design" – refers to doings and actions.

The participants suggested potential future improvements, such as adding content related to dietary recommendations, a peer learning component, a page with frequently asked questions (FAQ), and supplemental video instructions. Main issues and examples are shown in Table 3.

Everyone gave positive responses concerning how useful the course would be to the participants. One participant responded that she would have to make changes concerning physical activity and her light environment at home. The course made her aware of the latter. Another participant responded "*[The course is useful] for anyone who would like good lighting at home and for anyone who wants to sleep better/…/It is I who can affect it using relatively easy methods*" (woman, 73 years old). Responses regarding the perceived usefulness of the course reflect "awareness and knowledge" (*e.g.*, the importance of lighting at home and for sleep), "reflection" (*e.g.*, why one sleeps poorly), and "simple methods for bringing about change" (*e.g.*, the light application and how to make walking more fun).

Two participants commented on the intended users and targeted problems listed in the introductory module. Potential course participants will probably not experience problems with all targeted behaviors (light related, physical activity, and sleep). However, taking the course might

Table 3. Main issues with examples, identified during interviews and observations in round 2 with the target users (*N*=6), and possible solutions to identified problems

Category	Examples of issues or sample quotes	Possible solutions
Perceived ease of use		
Graphical design	• Web pages containing several paragraphs need graphical elements to direct and capture the reader's attention	• Used boldface to highlight new content when subheadings were not appropriate.
Information design	• Difficulty to find one's way back to the previous web page after clicking a text link, *e.g.*, when a pdf document opens in the same browser tab (based on direct observation and interactions with participants in the test apartment)	• In the introductory module describing how to navigate, inserted a new subsection to explain the different types of text links
Interaction design	• Insufficient written stepwise instructions for one of the online assignments • Insufficient instructions for downloading and using the light application for iPhone (based on direct observation and interactions with participants in the test apartment)	• Added one more step in the instructions • Clarified instructions, used bold-faced text for critical instructions ("avoid blocking the daylight falling on the light sensor"), and added images displaying screenshots of the app
Potential future improvements		
Peer learning	• "Everyone sits by their computer and do module 1, 2, 3, *etc.*, but then you meet. What have you done?"	• Added in-person meetings or Zoom meetings for sharing experiences, or an online chat group
Supplemental video instructions	• Added video clips including 1-min demonstrations	• Video record, *e.g.*, how to use the cap in the practical exercise or show the difference between light and dark fabric on furniture
FAQ page	• "Every web-based course has limitations. So, I can open the computer whenever I want and use it for how long I want. But I would appreciate to get answers directly to any questions when they arise."	• Collect and post-questions asked by previous course participants
Extended content	• "Yes, foods./…/But you cannot give it too much space. Pick a few things. The course mentions coffee, tea and alcohol, but everyone knows that. But what types of foods affects all the organs?"	• Dietary recommendations in optional added modules
Perceived usefulness	• "Yes, I certainly think so. The course makes me motivated. Because I have problems being a bit tired, and I have a dark apartment. I realized that early in the course/…/there's a large house on one side and a big tree on the other, and I'm on the ground floor. I think the course will be useful for me if I apply it: starting by getting up early and going out in the morning. Not for a very long walk – just to go outside."	• Not applicable.

Abbreviation: FAQ: Frequently asked question.

reveal a lack of awareness or knowledge about, for example, the importance of having proper light at home, as one of the participants commented.

3.2.2. Usability testing questionnaire

The usability ratings were congruent with the participants' positive attitudes about the course content. Participants' SUS scores ranged from 67.5 to 97.5, as shown in Figure 5. All six participants rated 6 ("Excellent") for the overall user-friendliness.

3.2.3. Direct observations and interactions with participants

Based on interactions with participants in the laboratory, we found that (i) one participant had trouble following the written stepwise instructions for downloading and using the light application for iPhone and (ii) several participants had some trouble with finding their way back to the web page after clicking the link text to pdf documents that automatically opened in a new browser tab.

Online enrollment for the course faced unexpected issues because standard instructions developed by the university for course enrollment were not tailored to the participants. Some participants had trouble creating a password, while others did not complete the course registration by clicking the "accept" button. Three participants received support on the telephone, and one received in-person support.

Participants were logged into the course for 6 h on average (ranging from 3.5 to 10.4 h). Assuming they were active while logged in, four participants unexpectedly accessed and read the course from home.

3.2.4. Participants' written responses to the online assignment "Course expectations"

The content-based thematic analysis resulted in four key topics (number of participants who mentioned the topic): sleep (6), physical activity (3), light and darkness conditions at home (3), and alertness and energy (3). For example, one participant wrote about the importance of sleep and energy: (i) "I *want to increase my quality of life by using the time I'm awake better, doing what I've planned to do and not just letting time pass while taking a nap, talking on the phone and surfing the Internet on the tablet.*" (ii) "*More energy and better discipline. Get better sleep, and more regular sleep habits and eating habits, etc.*" (woman, 79 years old). Only one participant mentioned all four topics, which suggests that the participants' varying degree of interest in the targeted behaviors of the course is a factor to consider when deciding on inclusion criteria and course announcements.

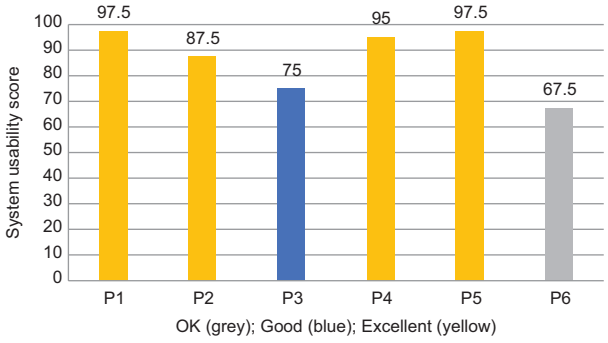

Figure 5. System usability scores in round 2 with target users (N = 6). Note: P = Participant.

3.2.5. Design changes after round 2

Changes to the course content included clarification of instructions and using boldface to highlight new content when subheadings were not considered appropriate. Based on participants written responses to the online assignment "Course expectations" and the interviews, the invitation to participate was modified as follows:

The course is beneficial to those who experience any of the following issues:

- Not having the appropriate lighting or feeling uncomfortable with your light environment;
- Not having routines for physical activity;
- Usually have mild sleep problems;
- More problems of low mood or lack of energy during autumn/winter than in other seasons.

4. Discussion

4.1. Main findings

The study aimed to develop a web-based course to encourage changes to routines and the home environment and to test for usability problems. Findings suggest potential for a web-based course to enhance knowledge about and awareness of the role of light and physical activity to improve sleep and well-being.

The two-step usability evaluation including experts and target users proved valuable, enabling refinement of the course content and significantly reducing the number of identified usability issues in the second round. All but one participant in the second round had a SUS score of 75 or higher, indicating high usability. The remaining usability issues in the second round were few and concerned the graphical design (formatting text), information design (difficulty to find one's way back after clicking a text link), and interaction design (insufficient steps in assignment instructions).

Findings suggest that the web-based course format has the potential for delivering web-based behavioral change interventions using a learning management system. Behavioral change interventions delivered on the internet often require extra security features (*e.g.*, a two-factor authentication) because sensitive data is collected (for example, Gasslander *et al.,* 2022). The evaluated web-based course described in this paper, however, did not collect any sensitive data online which made it possible to use a learning management system. There are several benefits of using such a system. Integrated accessibility features are helpful for content creators when material is uploaded to the system. The system can produce alternative formats such as audio for listening. The system includes pedagogical features allowing the content provider to incorporate quizzes and other interactive elements, an intuitive user-experience design, and direct online feedback on assignments from the instructor. The system is regularly improved by the software manufacturer and the license holder (which in this case is the university).

Based on participant feedback, a largely self-directed web-based course would benefit from a couple of physical meetings to enable further shared experiences and socializing with course participants. This type of hybrid format can, thereby, facilitate connection with others while creating learning opportunities. A change to a hybrid format adds potential for discussion and collaboration (working with others and the opportunity for peer feedback) to the types of learning that characterizes the web-based course in its current form: acquisition (receiving information through reading, watching, and listening to course materials provided on the digital platform), practice (improving skills by trying out what the course participants have learned), and production (applying the knowledge to create a tangible outcome, *e.g.*, a home lighting design) (Laurillard, 2002). The findings confirm what has been shown in previous research on older adults' motivation to engage in late-life learning in Sweden, namely staying active and socializing (Bjursell, 2019). A hybrid format including online learning and two in-person sessions might still provide the advantages of a web-based course. Course participants can set their own pace while navigating through course materials on the digital platform and access structured course content and recorded material (Walker *et al.,* 2021). Physical meetings might also increase motivation and adherence to home assignments (Alfonsson *et al.*, 2017).

The behaviors targeted by the course (light-related behavior, physical activity outdoors, and sleep) seem to meet the needs of the target users. Findings suggest that the motivation of potential target users can vary, but sleep in particular may be the targeted behavior that will attract future users. However, findings also indicate that the course can make participants aware of problems; they previously were unaware of and support them in making improvements – either in their home environment or changing their routines.

One suggestion from a couple of the participants in round 2 remains to be considered: should such a course be extended to incorporate an additional module targeting foods and diet? (O'Hearn, 2021). The course currently includes advice as to the most appropriate timing for meal intake but provides no dietary recommendations. There are always considerations to be made to both efforts (*e.g.*, the hours needed to complete a module and total time) and benefits (*e.g.*, learning outcomes, usefulness, or the enjoyment of participating in a course). Depending on future feedback, an extension of the course content may be considered in the next iteration following a usability evaluation in real-world homes with additional participants.

4.2. Strengths and limitations

One strength of the study was the setting – a test apartment – in which direct video observation was conducted to identify any problems when participants read the course material. The reason for such a setting was to provide a setting similar to the environment in which future course participants will be taking the course. However, the time-limited rounds in the laboratory restricted a complete usability evaluation. Most of the participants completed the online assignments (three in total) and evaluations after each module, but they were not able to do the home assignments (*e.g.*, record an activity diary and a sleep diary, reflect on possibilities for improvement of light/dark conditions in the home). Furthermore, some features, such as the email function, were not used by the participants. A full usability evaluation requires the course to be tested in real-world homes during the entire course period, which will be the next evaluation step followed by testing for intervention outcomes.

Another limitation is the sample, which only included women (no men or individuals with other gender expressions volunteered), and similar educational levels. One Swedish study indicated that there is an association between being highly educated and participating in education in later life (Bjursell *et al.,* 2017). We did not ask the participants about their level of formal education. Still, based on their description of their working life before retirement, they probably all had attended upper secondary school or had vocational education. A sample of only women may not be a disadvantage. According to limited research, men prefer to engage in informal education. In contrast, older women prefer formal or non-formal education (Bjursell *et al.,* 2017). The number

of participants was considered sufficient for identifying usability problems, based on findings by Nielsen (2012).

4.3. Practical implications

The findings should interest providers of late-life learning, *e.g.*, universities, study associations, and municipalities. One lesson learned was that the university's written standardized instructions for online course enrollment must be considered in late-life learning. If the instructions are not tailored to the target users, course enrollment might cause unnecessary computer anxiety.

The findings are also relevant for researchers developing educational and behavioral change interventions. Unlike other behavioral change interventions delivered online, this intervention uses an existing learning management system commonly used in formal education at universities. Provided no sensitive data must be collected during course participation, a learning management system offers several benefits, as mentioned in section 4.1. In addition, course providers should obtain user interface and user experience feedback from target groups who may not be used to digital learning when developing instrumental courses (*i.e.*, learning for practical use). The findings demonstrate how a user-centered iterative design approach can be incorporated into the design of a web-based course.

5. Conclusion

A learning management system seems promising for use in web-based behavioral change interventions. However, from a late-life learning perspective, written university instructions for completing online course enrollment must be considered to avoid a potential barrier to enrollment. We conclude that the course, supplemented with physical meetings, can benefit late-life learners because of the relevant easy-to-use content.

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Conflict of interest

The authors have no conflict of interest with respect to the research, authorship, and/or publication of this article.

Author contributions

Conceptualization: Kiran Maini Gerhardsson
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Writing – review & editing: Steven Schmidt, Susanne Iwarsson

Ethics approval and consent to participate

According to Swedish national legislation on research on humans, no formal ethical approval is needed for studies that do not elicit data concerning sensitive information and do not include any intervention to humans. National recommendations for proper research conduct (Swedish Research Council/ Vetenskapsrådet, 2017) and guidelines on information security at the authors' institution were followed. All study participants were informed of the purpose of the study and that identifying information will not be made available to anyone who is not directly involved in the study. All participants gave written informed consent before participation.

Consent for publication

All participants gave their permission to use the photographs.

Availability of data

Data used in this study is available from the corresponding author upon reasonable request.

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Appendix

Appendix 1. Checklist for evaluating the user interface

The checklist was developed for evaluating the user interface and course content. It is based on ten heuristic design principles developed to identify user problems, for example, on web pages (Nielsen & Molich, 1990). The principles are available at https://www.nngroup.com/articles/ten-usability-heuristics/. The purpose was to help the invited experts when they read the course content online. They were informed that they were not expected to find all problems during the sessions as the time was limited. If their response to a question was "no," they were asked to make a note about the issue and refer to the web page and section.

	Guiding questions	My notes
1	Does the user get direct visual feedback, for example, after clicking buttons or submitting assignments?	
2	Does the design speak the user's language (applies to both text and visuals)?	
3	Is there a clearly marked "emergency exit" in case the user performs actions by mistake, for example, a back button?	
4	Are the same graphics and terminology used when users are requested to perform a specific action?	
5	Does the design prevent user mistakes to avoid the need for error messages?	
6	Are potential actions and options visible to reduce the user's memory load?	
7	Are there shortcuts for experienced users?	
8	Do the content and visual design avoid distracting graphic elements or excessive information that distracts users from the information they need?	
9	Are clearly expressed error messages used rather than incomprehensible error codes?	
10	Are instructions provided to help users complete their tasks, for example, submit an assignment?	

My notes (continued): _____

Appendix 2. Usability of the online course (system usability scale)

For each of the following statements, please mark one box that best describes your reactions to the online course.

1. I think that I would like to use the online course frequently.
   Strongly disagree □ □ □ □ □ Strongly agree
2. I found the online course unnecessarily complex.
   Strongly disagree □ □ □ □ □ Strongly agree
3. I thought the online course was easy to use.
   Strongly disagree □ □ □ □ □ Strongly agree
4. I think that I would need the support of a technical person to be able to use the online course.
   Strongly disagree □ □ □ □ □ Strongly agree
5. I found that the various functions in the online course were well integrated.
   Strongly disagree □ □ □ □ □ Strongly agree
6. I thought that there was too much inconsistency in the online course.
   Strongly disagree □ □ □ □ □ Strongly agree
7. I would imagine that most people would learn to use the online course very quickly.
   Strongly disagree □ □ □ □ □ Strongly agree
8. I found the online course very cumbersome (awkward) to use.
   Strongly disagree □ □ □ □ □ Strongly agree
9. I felt very confident using the online course.
   Strongly disagree □ □ □ □ □ Strongly agree
10. I needed to learn a lot of things before I could get going with the online course.
    Strongly disagree □ □ □ □ □ Strongly agree
11. Overall, I would rate the user-friendliness of this product as:
    □ Worst imaginable
    □ Awful
    □ Poor
    □ Fair
    □ Good
    □ Excellent
    □ Best imaginable

Comments (optional): _____

Appendix 3. Interview guide

The following questions (and follow-up questions based on the responses) were used to understand participants' thoughts on the usability aspects of the web-based course accessed on their own devices. The enumerated questions were adapted from Nie *et al.* (2020). Invited experts were asked 11 questions related to usability in round 1, and older adults representing the intended users were asked 15 questions related to usability in round 2. The interviews were audio-recorded to enable transcription and further analysis.

No	Round 1	Round 2
	Your device: a. What digital equipment did you use (PC, Mac, tablet, *etc.*)? b. If you used a computer, how big was the screen? c. Which Internet browser did you use? – – –	*Your devices, computer use and experience:* a. What digital equipment did you use (PC, Mac, tablet, *etc.*)? b. If you used a computer, how big was the screen? c. Which Internet browser did you use? d. How often do you use the unit? e. For what activities (browsing the Internet, paying bills, social media, *etc.*)? f. Would you consider yourself to be an experienced Internet user?
	General opinions	*General opinions*
1	Please, give me your general impression of the online course "Light, activity, and sleep".	Please, give me your general impression of the online course "Light, activity, and sleep".
2	What did you like the most about the online course?	What did you like the most about the online course?
3	What did you like the least about the online course?	What did you like the least about the online course?
	Perceived ease of use	*Perceived ease of use*
4	Did you find this online course easy to use?	Did you find this online course easy to use?
5	Did you come across any difficulties or challenges when using the online course?	Did you come across any difficulties or challenges when using the online course?
6	Was the graphical design and layout clear?	Was the graphic design and layout clear?
7	Were the "practical exercises"/instructions frustrating or confusing to follow?	Were the "practical exercises"/instructions frustrating or confusing to follow?
8	How do you feel about the overall effort to use the online course?	How do you feel about the overall effort to use the online course?
		Perceived usefulness
9	–	Can you imagine the web-based course might be useful for you?
10	–	Do you think the web-based course could be beneficial to other people?
11	–	Do you think something like this would help you change your routines relating to activity outdoors? … relating to sleep?
12	–	Do you think something like this would help you or others make improvements in your home relating to lighting? … relating to darkness?
	Concerns	*Concerns*
13	Are there additional features of the online course that you would like to have?	Are there additional features of the online course that you would like to have?
14	Are there features of the online course that you find unnecessary?	Are there features of the online course that you find unnecessary?
15	Have you thought of anything else that I haven't covered?	Have you thought of anything else that I haven't covered?
	Closing questions	*Closing questions*
	Have you previously worked with: a. Course development or pedagogy? b. Interaction design? c. The intended users (older adults)? Please, describe your current occupation or your work activities.	What is your age? How many persons live in your household? Do you live in an apartment or a house? What is your current occupation? Have you previously worked with: a. Course development or pedagogy? b. Health in general? c. Specifically light, physical activity or sleep?

ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

"It's like an oak tree growing slowly across a barbed wire fence:" Learning from traumatic experience of bereavement by suicide in later life

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Abstract

Bereavement by suicide is a traumatic and life-changing experience. However, little is known about the lived experiences of people bereaved by suicide themselves, and older people's voices are notably absent from the current suicide prevention and intervention strategies. This paper seeks to understand the different individual experiences and pathways arising from the suicide research for people in later life who have been bereaved by suicide through the lens of transformational learning. Using a qualitative paradigm, we explored the critical themes and features evident in the meaning making, coping, and adaptation needs of 24 people aged 66 – 92 years who were bereaved by suicide. In-depth interviews led by researchers with lived experience generated two themes on the centrality of experience: Critical reflection and meaning making in later life following suicide trauma; and the journey of discovery and how this interacted with social and political rights. Findings suggest that further research is necessary to generate practice-based evidence, which identifies the impact of bereavement by suicide on people in later life and how their needs for support might be unique when being assessed and identified; and how to respond more holistically to older people with psychosocial problems, which stem from these learning experiences. Recommendations consider the potential for developing more service user-led social, community-based, and therapeutic interventions, which utilizes the authentic knowledge of older people with lived experiences.

Keywords: Bereavement; Suicide; Later life; Transformational learning; Peer support

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1. Introduction

Suicide is recognized globally as a public health priority (the World Health Organisation, 2014; 2021), warranting a multisectoral public health approach to strengthening suicide prevention strategies (United Nations, 2015; World Health Organization, 2019, 2021). In the United Kingdom, suicide rates are highest in midlife (45 – 54 years) (UK Parliament, 2022), and many who die by suicide may leave behind a bereaved older parent, carer,

or loved one. Bereavement by suicide has been shown to be a traumatic and life-changing experience (Arbuthnott & Lewis, 2015) and is a known risk factor for suicide of the bereaved-by-suicide person (Pitman *et al.*, 2016).

The experiences of suicide bereavement of those in later life however remain a significantly under-researched area. In this paper, a person bereaved by suicide in later life refers to someone who has lost a significant other (or a loved one) by suicide, is aged <60 and whose later life is changed due to the loss (Andriessen *et al.*, 2009).

A systematic review of studies of older adults bereaved by the loss of a significant other to suicide found that none fulfilled the inclusion criteria (Hybolt *et al.*, 2020a). Two subsequent qualitative empirical studies in Denmark (Hybolt *et al.*, 2020b) and the UK (Hafford-Letchfield *et al.*, 2022b) investigated the unique age-related factors for participants impacted by suicide and their re-orientation to life after such a devastating loss. These empirical studies, a broader review of suicide and aging research (Hafford-Letchfield *et al.*, 2022a), and a review of the validated screening tools used to assess for self-harm and suicide in later life (Gleeson *et al.*, 2022) have all highlighted the importance for unifying suicide bereavement research with policy themes on well-being and aging (UN, 2020), including how these interact with ageism (Burnes *et al.*, 2019). Emerging recommendations advocate for the greater use of community participatory research methods and expansion of our understanding of social and environmental determinants of thoughts and actions related to suicide, including bereavement (see also Hafford-Letchfield *et al.*, 2022b). Other evidence has shown that people in later life have increased resilience and emotional control if they have had more experience with death and are better prepared to cope with bereavement in comparison with younger people (Shah & Erlangsen, 2014). However, less is known about the underlying mechanisms and correlates that contribute to different bereavement outcomes in later life. Findings from a large population-based closed survey (Pitman *et al.*, 2019) to capture the use of a wide range of formal and informal support sources of people bereaved by suicide and any inequities in support could only be generalizable to young, bereaved women due to the age range sampled (18 – 40 years).

While it has been suggested that referral to specialist bereavement counseling and support can be helpful for people who actively seek it (De Groot *et al.*, 2007), knowledge about the efficacy of such interventions is currently limited (McDaid *et al.*, 2008). The involvement of peers and peer-led interventions is well-acknowledged in health and social care policy discourse (Collom *et al.*, 2019; Sun *et al.*, 2022) including those bereaved by suicide (Higgins *et al.*, 2022; Hybolt *et al.*, 2022). Achieving a deeper understanding of these different individual experiences and pathways, which are informed by the voices of older people and their advocates within suicide research, points to the potential for developing more service user-led, possibly age-related, and social and therapeutic interventions (Kashaniyan & Khodabakshi Koolaee, 2015; Heisel *et al.*, 2020; Hafford-Letchfield *et al.*, 2022b) that can be combined with medical and non-pharmacological interventions (Wand *et al.*, 2022). In summary, little is known about the lived experiences of people bereaved by suicide themselves, and older people's voices are notably absent from the current suicide prevention and intervention strategies (Andriessen *et al.*, 2019; Linde *et al.*, 2017). Further or wider research is required to generate practice-based evidence, which identifies the impact of bereavement by suicide on people in later life. This includes how their needs for support are currently assessed and identified and how to respond more holistically to people with psychosocial problems stemming from such experiences (Hybholt *et al.*, 2022), particularly those in a population with a high risk of comorbidities which may impact them differently to younger population groups (Linde *et al.*, 2017). In this paper, we suggest that looking at these issues through the lens of transformational learning theory may be a useful approach for understanding this potential to capitalize on the knowledge and experience of people with lived experiences in later life, and how they make meaning of these to enhance options for developing improved bereavement support that is tailored to their specific needs.

1.1. Contribution of lifelong learning to care in later life

We draw on educational gerontology to enable critical discussion of the implications for future research, policy, and practice, and focus on the application of transformation learning theory to examine traumatic bereavement experiences more closely. Using a problematic frame of reference can help to challenge any assumptions and expectations such as habits of mind, meaning perspectives and mindsets. Within ageing studies, educational gerontology brings very specific approaches to aging and learning and can be a valuable resource for considering how learning, particularly informal learning, facilitates more inclusive, discriminating, and open and reflective experiences that may generate beliefs and opinions that can be used to guide future action (Mezirow, 2003, pp. 58-59). Informal learning in this paper refers to the learning resulting from daily life activities, which may be related to work, family, or leisure. Informal learning may be intentional but in most cases is not so.

Based on hitherto unreported data from a qualitative in-depth study of the experiences of people in later life

who had been bereaved by suicide (Hafford-Letchfield *et al.*, 2022b), we have explored the potential of informal learning for developing and promoting the impact of research and associated community-based social support. The convergence of the lifelong learning agenda with social policy and social care has been shown to have potential by increasing interrelated and overlapping activity in both future policy and practice (Hafford-Letchfield, 2010; 2016), particularly given the emphasis on engaging with lived experience (NSUN, 2015). Given the continuous challenge of sustainability in the care and support of older people and the economic and mental health impact of the COVID-19 pandemic (Wand *et al.*, 2020), meaningful engagement with a holistic perspective and different strategies is required to shape and drive social change. Learning theorists for example have explored the way in which learning take place and seek to locate learning within its social, economic, and political context (Jarvis, 2001; Soulsby, 2014). Learning in later life is often put forward as product of interaction and as an interactive and interpretation process (Percy, 1990), which makes it useful for achieving a genuine participatory approach toward the quality of experience of older people using social care. Grappling with how people voice the sophistication of their desires around the themes of independence, dependence, and interdependence is one way of operationalizing concepts of lifelong learning. Further, recognizing and valuing learning as a means of improving the quality of support and through participation has been asserted as an under-explored means to demonstrate transformational change (Hafford-Letchfield & Formosa, 2016; Hafford-Letchfield, 2010; 2016).

The following questions were formulated: (i) How do older people bereaved by suicide describe any process of learning from their traumatic experiences? (ii) What process of transformation, if any, was evident as they adapted to this specific traumatic experience in later life and where there was evidence of transformation, what factors shaped the transformational learning process? (iii) How can transformative learning theory, practice, and research help to understand the support needs of people bereaved by suicide in their later life and if so, what are the implications for development of practice and research in suicide prevention? These questions were used as guidelines to explore the data for critical themes and features evident in the meaning making, coping, and adaptation needs of people in later life who have been bereaved by suicide.

1.2. Background to the study

The study was conducted in 2021 and explored the perspectives and experiences of 24 bereaved-by-suicide people aged 60 – 94 years, and how this impacted their specific support needs and help-seeking in later life. Some of the key themes have been reported elsewhere (Hafford-Letchfield *et al.*, 2022b), documenting the moral injury in the aftermath of experiencing a loss by suicide, distressing psychological, social, and behavioral impact on experiences. These themes captured the negative reactions from people in the bereaved person's network and the impacts on significant others in the immediate aftermath and longer-term, and the poignant and significant experiences in the personal journey of the bereaved person in later life. Within these reported themes, participants shared reflections about their own future, motivation, mortality, and accounts of help seeking and how they navigated transition and adaptation while still "living with the experience" in later life (Hafford-Letchfield *et al.*, 2022b).

In this paper, we returned to this latter area and conducted further analysis on the subthemes of "transformation" which often coincided with individuals' sense making of their experiences and their articulation of these alongside themes of activism and leadership with their peers through shared lived experience of being bereaved by suicide. The analysis and discussion drew on Mezirow's theories of transformational learning (Mezirow, 2000; Mezirow & Taylor, 2009), specifically "perspective transformation" as a reference for illustrating the potential of learning from within a critical paradigm of social care and social support to bring about change. Given the documented experiences of navigating and adapting to traumatic loss, we considered how the centrality of experience, critical reflection, meaning making, and the importance of relationships interacted with this journey and intersected with participants aging experiences.

2. Data sources and methods

This was a qualitative study which adopted a thematic analysis based on descriptive phenomenology (Sundler *et al.*, 2019) to explore the substantive issues. This research adopted collaborative study design and involved two trained peer researchers aged <60 years with lived experience of bereavement by suicide to conduct interviews. The researchers were equal partners in data analysis as well as reporting and discussion of the themes. The richness from the expertise by experience provided a deeper understanding to generate and enable findings that could promote the accessibility of research by grounding data collection in the experiences of those being researched and producing more relevant and practice-oriented knowledge (Berring *et al.*, 2016; Devota *et al.*, 2016; Faulkner *et al.*, 2021; MacIntyre *et al.*, 2019).

2.1. Sample and data collection

The target population of this study comprised people living in the UK, with experience of the loss of a significant other

by suicide at least 12 months before engaging in the research interview. Table 1 shows details of the 24 participants. As the study took place during the COVID-19 lockdown period, purposive and opportunistic sampling were deployed by recruiting through bereavement services, social media, and research networks and contacts with aging services. All interviews were conducted virtually by phone or video conferencing and were audio-recorded. Afterward, the interviews, each lasted for an average of 58 min, were professionally transcribed. Participants were inquired for the time since their suicide bereavement, since having endured bereavement for a minimum of 2 years is one of the inclusion criteria. This was collated and separated from the data.

Areas covered were the individual's experience of support after their loss at different time points, the sources of support identified, their own help-seeking and self-identified needs, and how these impacted their aging experiences. This flexible approach to interviewing encouraged reflective thinking and effort to explain their situation and response to it (Sandelowski, 2001).

2.2. Data analysis

Descriptive phenomenology was used as a framework for analyzing participants' lived experiences (Ozuem *et al.*, 2022; Sundler *et al.*, 2019). Emphasis was placed on openness, questioning pre-understandings, and adopting a reflective attitude throughout the research process. The conceptual confluence between thematic analysis and descriptive phenomenology is a theoretically rich construct for understanding and making sense of qualitative data (Ozem *et al.*, 2022). Two researchers read and coded every transcript and met on Zoom to discuss each transcript as well as identify and reflect on preliminary themes. In the transcripts, we looked for complex ideas, particularly age-related issues, metaphors, and critical moments and focused on understanding the breadth of experiences to build a picture of bereavement by suicide, and the meaning-making of participants in relation to their later life grounded in their own narratives. A series of team meetings took place where the whole team came together to present and discuss their analysis until we had worked through every transcript. These meetings were audio-recorded and the transcriptions were used to verify and report on the main themes. These processes provided a robust and rich source of reflection to illuminate and understand aspects of participant's experiences which were inclusive of insights from lived experience. The team also noted the contextual features of participants experience in relation to influences such as age, health, and well-being. We discussed the social and economic factors impacting participants' experiences and how they

Table 1. Characteristics of the 24 participants included in the study

Variable	N
Gender of participant	
Female	21
Male	3
Age of participant (years; mAvg = 72.0)	
60 – 64	6
65 – 69	4
70 – 74	7
75 – 79	3
80 – 84	2
85 – 89	1
90 – 44	1
Relationship to the deceased	
Aunt/Uncle	1
Grandparent	1
Parent	15
Parent-in-law	1
Sibling	2
Spouse/Partner	4
Sexual identity of participant	
Bisexual	2
Heterosexual	22
Time elapsed between the death and interview (between 1 and 20 years; mAvg = 6.8 years)	
Ethnicity of participant	
Black, African	1
White, British	1
White, English	13
White, European	2
White, Northern Irish	1
White, Scottish	5
White, Welsh	1
Disability	
Yes	3
No	21
Religion/Belief of participant	
Buddhism	1
Christianity	11
Judaism	1
No religion	9
Prefer not to say	1
Quaker	1
Location of participant in UK	
England	17
Northern Ireland	1
Scotland	5
Wales	1

perceived their situated relationships and networks in both personal and professional settings (Matua & Van de Wal, 2015). This constant comparison (Miles & Huberman, 1994) helped uncover participants' meanings and further understandings toward phenomenology (Charmaz, 2006). The team observed data saturation after approximately 17 interviews. While some participants did talk about the time that elapsed since the bereavement spontaneously in their interview, this was not a direct question and, in hindsight, this would be a variable useful for describing different experiences.

2.3. Ethics

Ethical approval was provided by the University of Strathclyde Ethics Committee. A key ethical consideration was the impact of talking about bereavement and suicide on researchers and participants (McKenzie *et al.*, 2017). The protocol drew on established guidance for working with people bereaved by suicide (Samaritans, 2020), which included a structured debriefing and signposting support for participants. We established processes for the peer researchers through training on interviewing techniques and data analysis. One team member was a digital artist, and the team concluded the project with a workshop using visualization techniques to debrief and share their experiences of working with sensitive and distressing experiences. Team members also had access to a clinical psychologist. The team established a project advisory group comprising members working in suicide prevention, bereavement support, mental health social work, and a lay older person. This group reviewed the research protocol and tools and commented on the findings from the interim report (Hafford-Letchfield *et al.*, 2022b). Six weeks after the interviews took place, we invited participants to complete a short survey on their experiences of taking part in the research and 16 people responded.

3. Key findings

Here, we discuss the data that underpinned two relevant themes addressing the research questions: (i) the centrality of experience, critical reflection, and meaning making in later life following suicide trauma and (ii) the journey of discovery and how this interacted with social and political rights in later life.

3.1. The centrality of experience, critical reflection, and meaning making in later life following suicide trauma

As shown in Table 1, participants had experienced bereavement by suicide in different points in their lives. Their narratives were dynamic with constant emerging and changing perspectives – about the person who died, their own identities and how they negotiated different relationships with their loved ones – which were often combined with the necessity of taking up new roles, although not always voluntarily, to support those left behind.

The temporality of their experience appeared to follow phases commonly described in bereavement and trauma research. There gave rise to rich, vivid, and visceral descriptions of the participants learning about the suicide and its immediate aftermath such as severe shock, numbness, and sometimes disembodied experiences due to acute psychological trauma (Neimeyer & Sands, 2017). Some participants reflected critically on the content of the grief itself, focusing on (Jordan, 2001) how it was dramatically different from their other experiences of bereavement and loss experience through embodiment. These often involved agonizing self-questioning, self-stigmatization, and isolation, and the significance of such a life-changing event in their life course. Many reflected on whether it was possible to ever get back to the person that they were:

> *"Something that is really pissing me off at the moment is this thing about post-traumatic growth. And, you know, it's these little memes, you know, that imply you've come of it better and stronger, you know, or a nicer person…. But I just think, I was quite a nice person before, you know? I didn't need this to make me grow….the way I would describe getting over [Name 55:14]'s death is, you know, if you see a tree that's grown next to a barbed wire fence, and it sort of grows across, so that the barbed wire's going through the middle of it, and it comes out either side?……that's what it feels like to me. So, on the outside it's all healthy, but inside that barbed wire will always be there….and trees grow quite slowly."* (Grandmother, 60 – 64 years old)

This participant's suicide loss had coincided with her plans for retirement and alongside other participants, she reflected a mixture of anger, despair, and anxiety about the constant presence of psychological pain and her loss of control over her future. Other elements of her narrative on her expressive needs illustrated an intolerance of being subject to what she considered to be inauthentic communication from others which belied a discomfort or dismissal of her experience and her need to internalize and manage the effects as a result.

When reflecting on their individual potential for recovery and the investment and learning needed to develop better coping strategies going forward, another said:

> *"Well, I was thinking about this thing about being over 60 because I'm just wondering if age, I mean there are*

some things that are age specific, like I said to you about the interplay of the physical and emotional health, and how much time you've got to, I wouldn't say recover, I'd say make some accommodation, you know, enough to do different things?" (Parent, 65 – 69 years old)

This theme on expectations of how (later) life will go on following the loss was not only just about what the individual could learn or do or to adapt, but also grappling with the idea of accepting that there may be *limited time* to adapt and/or limited resources or recourses available to people in later life. Where these coincided with a potential loss of health and wellbeing, sometimes directly related to the loss for example in relation to a deterioration of mental health, there was a cumulative effect. The anticipation of getting support from the person who had died for their own future and reversal of caring roles for those left behind and a general diminishing of other networks of social support which could be dramatic. As one participant stated:

"I was thinking, it really is key I think, that you don't try and get back to who you were, "cause you're not who you were, you must accept who you are now……. I think that's definitely the older a person is, when the bereavement happens, I think the more age does have an impact from isolation point of view, or lack of grand-children, or lack of somebody coming in to do your washing for you, or whatever it might be. The older you are, the less time you've got to sort of get your life back together again in some way or other." (Parent, 75 – 79 years old)

A few participants compared their sense of isolation since the death of their loved one to the experiences of people during the lockdown conditions of the COVID-19 pandemic and some felt validated for the first time and able to share valuable insights and coping mechanisms:

"Welcome to my world, it's been like this for, you know, since my son died. And you're sort of not being able to see anybody, not being able to go out, not being able to do this, or whatever. I haven't wanted to. And, you know, now everybody was in the same boat in a way." (Parent, 70 – 74 years old)

There were several instances where individuals questioned their ability to survive and looking for meaning in their motivation to survive, particularly in relation to what they described as 'losses of the future' and regrets:

"I'm okay today, but I think last weekend, I sometimes feel I can drive my car into a wall. I just get fed up with it, I can't take anymore. Aye, I think of suicide a lot. I don't think I'd do it, but I sometimes wish I wasn't here." (Partner, 84 – 85 years old)

3.2. Sense of self-worth in later life and the impact of external and internal influences

Many interviewees were forced to re-evaluate previously taken-for-granted relationships. The reaction of friends and family, both immediate and long-term, for example, was key to how individuals coped and expressed their loss. For example, almost everyone referred to friends avoiding them physically and the emotional neglect, they experienced where there was a lack of insight or understanding of what they were going through. This often forced people to look elsewhere for support, and a theme of peer or alternative networks of support started to emerge:

"Because with my friends I tended not to weep and wail and gnash my teeth, the only people I've cried, really cried, in front of are the ones who are also bereaved who completely get it." (Parent, 65 – 69 years old)

Others made conscious decisions to terminate their relationships with friends who they may have felt let down by, in some instances, long-term or significant friends from whom they experienced disappointments when looking for support. There were observations on the feeling of invisibility as an older person which manifested itself by having to prioritize the needs of those who subsequently became dependent on them, often at the expense of their own expressive and coping needs. This repositioning of self and relationships, which can feature in transformative learning, can become evident especially when significant people no longer share or even oppose a person's newly adopted world view (Sand & Tenant, 2010).

Relationships with professionals following a suicide also varied. Nearly, all the participants yearned to know every detail of their loved one's interactions and actions leading up to their death and were constantly questioning and seeking very detailed information from professionals who may have been involved. This led to many examples of disappointment in professionals, personal anger, and frustration where professionals withdrew after the death was reluctant to be in contact or to share information. This reflected a defensive culture which provided the conditions for conflict and suspicion and served to complicate the participant's bereavement further:

"Obviously I had to tell the hospital, the (name) and the consultant there just shut off all communication completely. The mental health team that came didn't come on the Friday afternoon all came to the funeral, the three nurses. But trying to have any correspondence with him, you couldn't speak to him, his secretary wouldn't put you through to him and he didn't reply to correspondence, and I thought that was poor". (Partner, 75 – 79 years old)

This refusal or inability to share information from professionals did not help with bereaved person's comprehension of what had happened. One participant who lost his wife referred to how his wife's psychiatrist used to regularly assess her suicide risk using a scale to score her risk factors:

> *"But he never, at any point, said to me, just be careful, you know, keep your eye out, do this, do that. There was no kind of protocol to the carer, to the partner, which I thought was a massive gap in what could easily have been provided."* (Partner, 84 – 89 years old)

This individual, like many other participants researched, read widely and cited their attempts to rapidly familiarize themselves with guidance, knowledge, and skills used by professionals to benchmark and understand what had occurred in their own situations and scenarios. They were extremely active in trying to make sense of what might have gone wrong for their loved ones or to use their sources of information to directly challenge the way in which services had dealt with the individuals, rightly or wrongly. There were significant and vivid experiences described of poor interaction with professionals particularly around the time of the death even where these had occurred many years earlier. These involved either being given inappropriate information in an insensitive way or being denied some basic communication on the circumstances that prevailed or what they could expect in terms of support. These poignant moments provided a trigger several years later for participants actively taking up causes where they were determined that another person would not have to have the same experience:

> *"In my letter back to the chief exec who said, if you have any further questions, I thought, yes, I do, I've said, how are you going to change your organization's culture of blame and judgment and lack of learning?"* (Mother, 60 – 64 years old)

A key professional that virtually all participants named as someone they inevitably talked to in their journey was the family doctor. Many felt that their general practitioner should be proactive in contacting bereaved people if they knew the person who died by suicide. The general practitioner was someone who was viewed as both an objective expert in offering support and advice as well as being known more intimately to both the person who died by suicide or bereaved person and any assertive outreach or proactive recognition of the suffering caused was highly valued:

> *"Yeah, yeah. I mean, when I went to the doctors for something, I had a little health issue not long afterward and she said, have you got PTSD? And I went, don't be daft. And she looked at me and she went, well, you do know if you need to tell you can come talk to me. I went, bye. But I wouldn't've said I had at the time, but apparently some… I don't know the circumstances and I know you can't say how… You've lost somebody, but she said, well, the way you found your husband, she said, that's not nice."* (Partner, 60 – 64 years old)

Likewise, some expressed a distinct lack of agency or resilience in dealing with the challenges that followed a suicide loss and described external and internal influences around ageism and sensitivities to their socioeconomic status that provided further barriers to seeking and receiving support. The following participant tried to seek solace by volunteering at a local stable but ended up being bullied:

> *"No, because they're really upmarket and they're really, like, semi-professional quite a lot of them and because I'm an oldie, with my wee horse and I'm not very experienced, I don't know why, but they don't invite me out with them. And that hurts me. And, as I said again, I keep saying, my daughter she says, well, you just to have accept these things Mum and so I, kind of, gave up trying. So, I'm not one to go in and asking them but if they don't ask me, I just get hurt. I'm…I'll tell you what's happened since the death, I am so easy hurt, I'm so sensitive. You know, to everything in life. I feel like I can't take on anything else."* (Mother, aged 70 – 74 years old)

3.3. The journey of discovery and how this interacted with social and political rights in later life

This theme captured participants new perspectives and meaning making from their direct experiences particularly in relation to challenging the stigma of suicide and self-discovery where participants actively used their experiences to influence and support others in the field of suicide bereavement. For at least a third of our participants, this gave rise to expressions of hope and optimism, particularly in relation to how their own learning and actions would benefit of others with whom they could had identified as having shared experiences. This activism at different levels led to direct offers of support or guided actions that were often practical, tangible, and inspirational.

One person whose daughter died on the railway had a very bad experience of how she was given news of her daughter's death by the British Transport Police. At the time of the interviews, she had been invited to rewrite guidelines for the police on how to "give bad news" and recorded a podcast. She had also been involved in developing an information sticker for police to place on the dashboards of their vehicles with concrete tips in working with people bereaved by suicide. She had some valuable insights to share:

"But I think they are also very uncomfortable and that's why they come out with these things like, "I'm delivering the dead message," all that sort of stuff is just because of their discomfort. And we're not good at sitting with people's pain and that's what we need to learn to do, we can't fix it so we couldn't try?" (Mother, 70 – 74 years old)

One woman who was an activist earlier in life when working with HIV/AIDS utilized her skills to get involved with a bereavement organization and it took some time for her to recognize and value the contribution she was making:

"I said, if there is anything I can do? And in fact, I've sort of become, I don't know what I am really. I am on their steering group, and I keep saying, but you don't ask me to do anything, I think I'll step down. And they keep saying, no, no. And I think I'm just a wise old woman. And I said to somebody once, I think that's what I've done, I've surrounded myself with AA, TCF, the Quakers, Proud to Be, which is the LGBT group, with people who know about fragility and vulnerability." (Mother, 80 – 84 years old)

Becoming active in the community also appeared to coincide with some participants own help seeking, self-care and self-compassion, by taking up opportunities for counseling and therapies, often for the first time since the suicide and after a significant time had already passed:

"I think one of the other most…again this is for me… one of the other most helpful things I've done is to give myself full compassion. And in fact, it was when I did it, it was the few years…it wasn't immediately, but it was incredibly cathartic on the course. It was like there was this deep well I realized which I'd never really allowed myself to look into." (Parent, 70 – 74 years old)

3.4. Reassessing one's experiences of later life

A subtheme in this journey of discovery was the temporal nature of adapting to grief and how this interacted with any changes in health and well-being as people got older. Many participants naturally attributed negative changes in their physical health to their bereavement and accepted this as a natural consequence of grief.

"Well, I find sometimes that something's bothering me or upsetting me, or I'm feeling down, I think well is this [Name 40:49] or is just getting old? I think, am I attributing all of this to the bereavement, when in actual fact, I'd be feeling like this anyway?… you can't rush grief… But, at the same time, I'm conscious of the fact that if I don't try, I'm not going to finish grieving before I die." (Grandparent, 60 – 64 years old)

Becoming more active in processing or engaging with grief reactions was related to an increasing awareness of one's own mortality and making the most of opportunities:

".what I worry about is that, that when I do get older, and I get, I mean, I kind of, if I do realize, if I get to that chance to realize my mortality, and you know, I'm reaching the end of my existence, that I'll start to become more mentally challenged… Because my belief is that if you suppress it, it doesn't go away, it just goes deep, and when you get older, it then begins to come out, in all sorts of ways." (Parent, 70 – 74 years old)

In short, many of the impetus to getting involved in relevant organizations, help seeking, and peer support were in response to participants' own wish for a more structured and organized response to the aftermath of suicide, something they felt they had been denied but was a right they wanted to fight for on behalf of others. These included signposting, information in writing that they could revisit after the initial trauma of suicide that provided relevant contacts and support. They also fought for the availability and time given by people attending the suicide to be recognized in relation to other sudden deaths in society.

3.5. Engagement with peer support

Approximately one-third of our participants were actively engaged in peer support at the time of interview. This was an area where participants spoke passionately and earnestly about any transformational turns in their journey with suicide bereavement in later life. Engaging with relevant groups and organizations provided a vehicle for voicing their loss and an opportunity to challenge stigma of suicide through public discourse to raise awareness about suicide.

"But almost by example they can see that you've…and lots of people have said this to us, well actually talking to you and realizing that you have lived through this, and you can come through it different, you will forever be changed, but it's about that little bit of hope really." (Parent-in-law, 60 – 64 years old)

One participant was very active in his local suicide action group, using his professional skills in networking and fundraising after retirement through which he successfully helped several relevant charities. Others found immense relief through opportunities for peer group work which focused on well-being initiatives, such as meditation, group therapies, and special interest groups that encouraged new hobbies and interests.

"Nobody tried to stop it, nobody tried to comfort me, it was like I was just being held in a loving whirl of compassion. They didn't ask…I didn't have to talk about it, they just let me get on with it." (Parent, 64 – 69 years old)

Some individuals provided detailed descriptions of transformation moments in which they were actively

reflecting and taking purposeful action to improve their own well-being:

> *"It was a combination of all the different things I was doing. I think it was a combination of talking to my counselor, talking to friends, going to (name of organization). Clearing some people out of my life who I felt were not being helpful. Exercise helped me as well and when I say exercise, let's be sensible, walking, walking the dog."* (Aunt, 80 – 84 years old)

The bereaved person often commented on their motivation to honor the person they lost to suicide and how their sense of guilt of having failed that person could be readdressed through the act of giving something back and to replace negative emotions and memories with more positive ones:

> *"Well, I wish with every fiber of my being that I hadn't had to live through this. I also feel that everything I do now around suicide bereavement postvention all those…suicide bereavement support and postvention and all that stuff, I do to make meaning and to keep [name]…to make meaning of what she did, to keep…it's a way of honoring her. I wish I did…I wish I hadn't had to do this, but I often think I wonder what she'd think about it, would she think, oh mum why is you doing this? But I hope she would be okay with it. I hope she'd be okay with. I think she probably would be; I think she probably is. I think as I say it's my way of honoring her and giving something…making…not letting her last…if you like it's not letting her lasting legacy be just tragedy but of providing some hope and support for other people."* (Parent, 65 – 69 years old)

This sense of agency transformation was also evident in someone who had since trained as a mental first aider:

> *"So, from my brother's death, what has…it's…I have transformed my life in a positive way, because people come to me all the time now that have problems. And I'm not…and I can't fix them because I'm not a professional, but I talk about my experience or where they may be able to go to get help, which is what being a mental health first-aider is."* (Sibling, 80-84 years old)

This recognition of making meaning through traumatic experience, the coming together of pain and optimism by giving oneself over to finding motivation for living and utilizing their experiences in different ways was succinctly expressed by another individual as follows:

> *"A lot of my life seems to be spent around suicide now and there are times when I think I need to step back for a while. Fortunately, the other people I work with who help me with facilitating the group, we're a really good team and we all look after each other. And sometimes I'll put a message on WhatsApp saying I've just had a really difficult phone call or whatever it might be and they just…they're always there, they're always there, and we're always there for each other sort of thing. So that's been…I have to say it's been a real privilege to meet some of the people who've lost somebody and to realize how…and everybody does it their own way and it's just…but it is unbelievably painful. I wish I wasn't doing any of this because I wish I didn't know about it, but in some way, it's given me some meaning in life."* (Partner, 80 – 84 years old)

This was not true for everyone as some participants talked of a lack of feeling any empathy or compassion toward other older people, and four participants talked about the constant battle with their own suicide thought but with the benefit of insight into what this would mean for others. The changing nature of their emotional pain was one that changed over time but one they became more familiar with and developed strategies to live with it as the following metaphors illustrate:

> *"So, I said, well, I'm packing up my anger and I'm sticking it under this bench and I'm not coming back to pick it up again, and I left it there. So, I had so much to support me because I think people want the truth and they want justice and they want accountability and I had that, I had the truth. I don't ever use the word, closure."* (Parent, 65 – 70 years old)

4. Discussion

This paper drew on data from a study that explored how those bereaved by suicide construct meaning about the impact of the death on their later life and how they make sense of their ongoing role with their families, support networks, their own sense of time remaining, their health and well-being, and the value of their contribution to society alongside meeting their own coping and expressive needs. While some of their experiences were found to be in common from what we already know about suicide bereavement experiences in younger groups, there were many age-related experiences worthy of comment here.

4.1. Learning from traumatic experiences of people in later life bereaved by suicide

Rich accounts were provided on how individuals bereaved by suicide describe their traumatic experiences and share about how they adapted. Those interviewed demonstrated a range of informal learning from coping and expressive needs to more transformational learning experiences in which they harnessed their knowledge to support

themselves and others, moved from introspection and for some to taking up a leadership role. Grief is often referred to as a process of adaptation (Sand & Tenant, 2010) over time periods in which those impacted revisit and rework their loss experiences, make sense of them, and cope with them eventually (Hybholt, *et al.*, 2020b).

In our study, the trajectory of the individual's lifespan and the impact of other significant life events (such as going through a divorce, retirement, other bereavements, or deterioration in their physical health) varied through different stages of participants getting older. These influenced the range of recourses that they had to draw on and to navigate more traumatic bereavement experience. Given that older people tend to have more or cumulative experiences of bereavement, participants made connections with how this process can be complicated by ageism where less value may be given to the person's loss or how they are expected to deal with it (Hafford-Letchfield *et al.*, 2022). Participants referred to periods where they did not question changes to their physical and mental health or actively seek help but instead, they tended to internalize the impact, and the result of which was adopting a reduced expectation about their quality of life going forward. Relevant to our participants, and different to younger cohorts, Fegg *et al.* (2016) have documented that in later life, chronic physical and mental health are a contributing factor to suicide.

Participants' expressive needs were often curtailed by others due to their perceived position in society, for example, by taking on new caring roles, hiding or burying their own feelings to protect others. There was a decline in opportunities for social activities for those who had lost a child, who expressed feelings of invisibility and even becoming avoidant with their own peers who had children and grandchildren. This self-silence or the recognition of societal taboos were sometimes connected with wider structural influences which marginalize people in later life (Naef *et al.*, 2013). These experiences highlight generational differences in dealing with traumatic events as our participants revealed more stoic or adopted avoidant coping styles as well as finding comfort through open dialogue (Chatterji *et al.*, 2015). Other studies have noted that contrastingly, younger individuals tended to conceal their emotions and suffering. Further, younger people may be more likely to turn to the internet and be more active in reaching out to their peers (Koo *et al.*, 2016; Hafford-Letchfield *et al.*, 2022). Knowing these points on the journey might highlight gaps and needs where earlier interventions can be targeted and understanding these different experiences is a first step toward developing the nuances required in responding to older people who have experienced bereavement by suicide which might harness their sense of agency and wider structural influences for learning. Some people in this study were able to clearly articulate their needs from interrogating their own experiences but had fewer actual vehicles for engagement in support. Providing opportunities for enabling people to develop their potential from the perspective of service providers means also not making assumptions about aging, and levels of motivation to learn (Withnall, 2010).

There are a wide range of learning practices which recognize that learning takes place right through life and is life-wide. These take place in everyday contexts and need to be enduring and connective at both personal and community levels (Burke & Jackson, 2007). This is noteworthy given that suicide prevention is under-developed for older people where strategies for younger people have been given much more attention (Hafford-Letchfield *et al.*, 2021; 2022).

4.2. Evidence of transformation in adapting to traumatic experience in later life and the factors shaping the transformational learning process

Looking at these accounts through the lens of learning demonstrated a clear conscious process and/or state of critical consciousness on behalf of the older person when faced with change or new situations following the suicide trauma and challenges of later life. Other methods such as the assimilation model (Stiles & Brinegar, 2007) describe a developmental sequence. Within this latter approach, psychological experiences are treated as agentic internal voices through which the mechanism of psychotherapy enables assimilation of emotional and cognitive review. Individuals are then enabled to develop insight and provided a meaning bridge between problematic experience and the larger community of voices within the person. However, transformational learning enables the experience of what Jarvis calls this "disjuncture" (Jarvis, 2009), through the rapid need to reassess one's expectations and perspectives on current and future later life. This demands reflection, reflexivity, and support so that meaning could be attributed and provide the conditions for potential transformation and continuing positive engagement in society. Cranton (2006) suggests that learning occurs when "an individual encounters an alternative perspective and prior habits of mind are called into question;" and it occurs as a dramatic event or a "gradual cumulative process" (p. 23). For Mezirow, transformative learning "may be epochal, a sudden, dramatic, reorienting insight, or incremental, involving a progressive series of transformations in related points of view that culminate in a transformation in habit of mind" (2000, p. 21). These were evident in the experience of those who became more active and even political, in using

their experience to benefit others and their own selves in the process illustrating that transformative learning can be as much a process of everyday occurrences as it is what Dirkx (2000; 2006) termed a "burning bush" phenomenon. This latter concept refers to the deeply emotional learning experiences that can evoke powerful feeling, such as fear, grief, loss, regret, and anger, but also joy, wonder, and awe and the sense that we cannot go back to the way we were before the experience. This "messy work" (Kegan & Lahey, 2009, p54) of the trials and tribulations that participants were navigating both at micro and macrolevels helped to progress more complex ways of adapting to such a traumatic event as suicide bereavement in the life course. In this regard, transformative learning theory is most interested in the cognitive process of learning, the mental constructions of experience, and the creation of meaning. Similarly, Jarvis (2009) theory of the experience of disjuncture from which people learn can occur in the cognitive, emotive or action domains, and questioning and analyzing experiences can spark the reaction to learn and to restore.

Less was discovered about the factors which shaped these different processes in the context of what is known about transformation learning theory, practice, and research to help understand the support needs of people bereaved by suicide in their later life and its messages for suicide prevention. Further, research is necessary to generate practice-based evidence which identifies the impact of bereavement by suicide on people in later life; how their needs for support are currently assessed and identified; and how to respond more holistically to people with psychosocial problems which stem from these experiences (Hybholt *et al.*, 2020a). Prevention of complicated grief may be successful in this population with high risk for comorbidities (Linde *et al.*, 2017) by capturing and building on the knowledge and experience of people with lived experiences. In a smaller study with nine older adult participants, Moon (2009) affirmed that perspective transformation can occur through late life bereavement characterized by an oscillatory process shaped by biographical and life stage developmental contexts. Given what is known about the loss of autonomy and physical conditions or worrying about their coming and impact as risk factors for suicide in later life, it is important that those in contact with older people bereavement by suicide investigate the possible presence of suicidal ideation (see also Hafford-Letchfield *et al.*, 2022). Medical practitioners especially who are likely to be more in touch with isolated older people should conduct suicide risk assessment in addition to identification of physical illnesses (Chatterji *et al.*, 2015). Further, providing learning and development opportunities through signposting and taking an interest in people's experiences can encourage those who want to be active in supporting others. Barlow & Coleman's (2003) evaluation of a peer support program developed for survivors of suicide suggested that an intervention protocol that is collaboratively developed and delivered by peer supporters and professionals can offer cost-effective person-centered support. These economic arguments are also highly relevant in the context of debates about the rising costs of supporting people in later life and how best to invest in prevention.

While support to those bereaved by suicide is included in suicide prevention strategies, they have been treated as a homogenous group without distinguishing between different age groups. The intensification of time pressure in later life reflected by participants had both negative and positive impacts on how the process of living beyond the bereavement played out and heightened suicide thoughts in some (Hafford-Letchfield *et al.*, 2022). Some studies (Pitman *et al.*, 2017) have supported specific associations between suicide bereavement and suicide-related outcomes, justifying the inclusion of people bereaved by suicide in national suicide prevention strategies. Most of this research has examined this in relation to younger people. Participants in our study demonstrated a greater awareness of their own end of life, associated with later life and possibly with a reduced fear of death or wish to die made more explicit in relation to their loss and potential losses. There is little acknowledgment in suicide prevention services that that older people who may experience a higher prevalence of being alone, being a carer, and long-term health conditions or comorbidities that may be unable to access current resources and networks or need something that draws on their peer experiences. It would be useful to capture in future research some of the nuances between the different age groups (Koo *et al.*, 2017).

Illeris (2007) defines the concept of learning as "any process that in living organisms leads to permanent capacity change and which is not solely due to biological maturation or aging" thus implying that learning is something much broader and more complicated. Learning also integrates two very different processes, between the learner's internal psychological process of elaboration and acquisition with their social, cultural, or physical environment. Both are significant and useful to consider when looking at how people interact with services in later life (Hafford-Letchfield, 2016). This interactive dimension (Illeris, 2009) takes place as perception, transmission, experience, imitation, activity, participation, *etc.*, and serves the personal integration in communities and society and thereby also builds up the sociality of the learner (p11). Investment in these community networks through

suicide prevention strategies would be key to engage in the potential for peer support and advocacy in later life. This offers a different lens to understanding the assimilation model referred to earlier (Stiles & Bringar, 2007), which utilizes a continuous developmental and therapeutic process. Assimilation seeks to join the problematic voice with the community of voices, which also opens the possibility of joint action, thus turning the problem into a resource. The potential of learning offers greater extension to this process, and this study is the first in our knowledge to explore the potential of transformation learning theory for understanding bereavement by suicide in later life.

Mezirow defined transformational learning as the process by which "we transform problematic frame of reference to make them more inclusive, discriminating, open reflective, and emotional able to change" (2000, p92) and these were in evidence for participants at different levels. Transformations may be epochal and often associated with a significant life crisis such as bereavement by suicide. They may also be cumulative with a progressive sequence of insights, for example, where participants had to reimagine their aging future, reconsider their networks of support, and discover new motivations and strengths such as those many brought to the peer support community. These are all central to the initiation of the transformational process (Sand & Tenant, 2010). Again, there may be some important messages for suicide prevention strategies in this strength-based approach to providing community-based support. Given that peoples experiences of bereavement by suicide in later life has been hitherto neglected in suicide research and practice, Mezirow's theories of transformational learning (2000, 2009) provide a useful reference for illustrating the potential of learning from within a critical paradigm of social care to bring about change. The concept of perspective transformation coheres with idealized aspects of professional practice with older people that emphasize the centrality of experience, critical reflection, meaning making, and the importance of relationship, which, in this study, was the exactly opposite of what happened to individuals in many cases. Participants found that both professionals, friends, and family turned away from them. Finding the right design of services and methods to engage people in suicide bereavement support can be a powerful way of bringing older people's voices in to capitalize on the assets that they themselves bring. In Mezirow's formulation, the process of transformative learning commences with a "disorienting dilemma," which leads to a self-examination with others (in mutual dialogue), a critical assessment of internalized assumptions, and finally to a "perspective transformation" or new "meaning perspective" that are more inclusive, discriminating, and reflective: "Such frames of reference are better than others because they are more likely to generate beliefs and opinions that will prove more true or justified to guide action" (Mezirow, 2003, pp. 58-59).

Fielden (2003, p82) talks about the "moving on mode" in which people bereaved by suicide came to realize the finality of their loved one's death and to develop an acceptance that their own life could never be as it was before the suicide. Some participants moved clearly from their survival mode and from searching mode in which they wanted answers to ask why their significant other had suddenly died. They began to focus their attention outward again by looking forward and participation. These strengths should be recognized and harnessed within ageing and well-being strategies.

4.3. The role of transformative learning theory, practice, and research in understanding the support needs of people bereaved by suicide in their later life and the implications for development of practice and research in suicide prevention

The UK national suicide prevention strategies (Department of Health and Social Care, 2012; 2019; UK Parliament, 2023) have repeatedly stated that those bereaved by suicide should be provided with better information and effective, timely support. As demonstrated in this study, the experience of difficult emotions increases risk of several negative outcomes for the bereaved person. For those bereaved by suicide in later life, there are particular, but often unacknowledged, challenges including a reduced and limited social network, a greater degree of emotional and social loneliness (Shah & Meeks, 2012), and problems with recovery and restorative tasks which can also be hindered by the physical and cognitive impact of disabilities and long-term health conditions that sometimes accompanies aging (Hansson & Stroebe, 2007). Many of our participants had lost a child, and this has been shown to result in psychiatric morbidity and precipitate the person's own suicide (Clarke & Wrigley, 2004). This unique population is likely to present to care services in different ways, and not always directly, for example, with medically unexplained symptoms, self-neglect, and problematic substance use (Hashim *et al.*, 2013). At the same time, the strengths and resilience of this group of people may be unrecognized and under-utilized in postvention strategies (activities developed by, with, or for suicide survivors, to facilitate recovery after suicide and to prevent adverse outcomes). While this study was conducted in the UK, it illustrates how people in later life can be marginalized from suicide prevention policies despite a global rise in their suicide rates.

At the heart of using learning theory or educational gerontology in social care is the potential for democratization

of knowledge production and using this democratization process to improve well-being in later life (Nind, 2017; Hafford-Letchfield, 2016). To the best of our knowledge, this is the first study that has examined the role of learning theory to nuance our understandings and capitalize on people's experiences of bereavement in later life. This was further supported by the adoption of participatory research methods which helped to envision experience and provide a more nuanced understanding of the complexity of suicide bereavement and discover knowledge that might otherwise go unnoticed (Faulkner *et al.*, 2021). There were also challenges in relation to process to build into the project design and timeline, sufficient resources to provide authentic and realistic support for peer researchers who were coming from a different learning standpoint themselves in terms of rigor and keeping an audit trail regarding data analysis, which some projects are not able to do.

4.4. Limitations

This study has several limitations. First, the participants in this study came from a UK context which may not be translatable to other global regions. Second, the recruitment took place through established contacts and through social media which may have influenced the participant sample to those with existing access. Third, in hindsight, we did not ask participants directly about the time that elapsed since the bereavement in their interview which could have been a useful variable to explore different experiences over time in relation to the research questions.

5. Conclusions

This study enabled an in-depth understanding of the lived experiences of people bereaved by suicide and examined these through the lens of transformational learning to articulate new meanings on how people in later life can adapt and navigate their way through traumatic experiences. To the best of our knowledge, it is the first study that has examined the role of learning theory as a means of nuancing this understanding which was enhanced by the use of participatory research methods and brought added benefits in being able to articulate findings through the added lens of those who also had lived experience. Findings suggest that further research is necessary to generate practice-base evidence, which identifies the impact of bereavement by suicide on people in later life and how their needs for support can be better understood to improve assessment and support. By capitalizing on informal and formal learning opportunities, a more holistic response could lead to developing more service user-led social, community-based, and therapeutic interventions, which utilize the authentic knowledge of older people with lived experiences.

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Conflict of interest

The authors declare no conflicts of interest.

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Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of The University of Strathclyde (UEC21/10). Informed consent was obtained both written and verbally from the study subjects before their participation in the study.

Consent for publication

Informed consent was obtained from study subjects for publishing their data in an anonymized form.

Availability of data

Data can be made available on reasonable request from the corresponding author.

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REPORT

Climate change, natural disasters, and mental health of adolescents: A qualitative study from Bangladesh

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Abstract

Bangladesh is among the countries severely affected by climate change, experiencing annual flooding in certain regions during the rainy season. These floods force people from affected areas to seek refuge in temporary shelters. However, life in these shelters presents significant challenges, including physical and mental health concerns, as well as socioeconomic challenges. Despite this, the mental health of adolescents living in flood shelters in natural disaster-prone areas remained understudied. This study aimed to examine the mental health of adolescents residing in flood shelters. Qualitative research tools are particularly effective for investigating mental health issues among specific age groups during disasters. Therefore, we conducted in-depth interviews with 53 adolescents who lived in shelters during the 2022 floods in northeastern Bangladesh. Our findings revealed a concerning prevalence of mental health issues among adolescents affected by floods. Rates of depression, psychological distress, and post-traumatic stress disorder (PTSD) were notably elevated. Approximately 60.72% of the boys were suffering from PTSD, with around 71.42% of them experiencing depression. Among girls, 80% were affected by PTSD, while 84% were suffering from depression. Our research also highlights a gender disparity, with girls exhibiting higher levels of depression and trauma than boys. These findings provide valuable insights to guide both government and non-government organizations in formulating future policies regarding natural disaster management.

Keywords: Adolescents; Climate change; Flood shelters; Mental health; Natural disaster

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1. Introduction

Global climate change has led to an increase in the frequency and severity of natural disasters in coastal countries, resulting in a negative impact on the mental health of victims

(Monsour *et al*., 2022; Sattler & Smith, 2020; Wortzel *et al*., 2022). Rapid, massive industrialization, deforestation, and urbanization across the globe have contributed to increased air pollution and waste generation, consequently driving global climate change (Crowley, 2000; Stern & Kaufmann, 2014). As a result, the frequency and severity of natural calamities have escalated across the globe.

The effects of natural disasters on the physical infrastructure and human physical health have been extensively studied (Paraskevopoulou *et al*., 2022; Wolfson *et al*., 2022). Many researchers have identified the presence of mental shocks due to climate change and natural disasters (Heeren & Asmundson, 2023; Obradovich *et al*., 2018; Sattler & Smith, 2020). However, some are very specific to the mental health effects of adults only (Bozick, 2021; Burrows *et al*., 2021). Monsour *et al*. (2022) explored the impact of climate change-induced tropical cyclone (TC) and sea level rise exposure on the prevalence of mental illness symptoms. They found an elevated risk of mental illness symptoms from exposure to high-intensity TCs and identified demographic variables that may contribute to this risk (Monsour *et al*., 2022). On the other hand, Acheson (2023) reviewed two articles relating to the mental health implications of climate change for children and young people. The review reveals mixed results regarding the effects of climate change on the mental health of young people and children (Acheson, 2023). More importantly, the studies were carried out in the European context.

Massive industrialization, deforestation, and urbanization have altered the planet's climate by releasing greenhouse gases and accumulating various forms of pollution (Sale & Agbidye, 2011; Singh *et al*., 2017). Figure 1 shows the conceptual structure of the relationship among the factors and effects of climate change. The three factors connected to climate change are industrialization, urbanization, and deforestation (Naz *et al*., 2021; Raihan *et al*., 2022). The effects of climate change have been categorized as global warming and natural disasters.

In South Asia, Bangladesh, as a coastal country, is one of the victims of climate change and one of the most flood-prone countries in the world. Heavy monsoon rain generates frequent floods in the area that harm lives, property, crops, and physical infrastructure. Apart from Bangladesh, India and Pakistan also experience more frequent floods (Hasnat *et al*., 2018). Global climate change has increased the frequency, amplitude, and extent of floods in South Asia (Mirza, 2011). Between 1985 and 2009, floods accounted for 40% of all natural catastrophes, resulted in significant financial losses, and affected a large number of people (Jonkman & Vrijling, 2008a; 2008b). There were 7348 big disasters between 2000 and 2019, with 1.23 million casualties, 4.2 billion affected (many more than once), and worldwide economic damages of over $2.97 trillion (Yang *et al*., 2023). The flood sweeps away everything around, leaving nothing of the property, houses, or crop fields undamaged (Doocy *et al*., 2013). Thus, flood-affected people have to take temporary shelters in nearby public buildings (shelters) such as schools, government buildings, and community centers. Many people huddled together in very small and congested areas until the floodwaters receded (Rahman *et al*., 2015).

Floods affect human physical health (Bei *et al*., 2013). The previous studies have reported the incidence of malaria (Kondo *et al*., 2002), diarrhea, respiratory problems (Kunii *et al*., 2002), mild injuries (Duclos *et al*., 1991), and disaster-related deaths (Dietz *et al*., 1990). Besides, scientists have assessed the impacts on the mental health of the flood-affected people. They found post-traumatic stress disorder (PTSD) (Fredman *et al*., 2010; Verger *et al*., 2000), anxiety (Otto *et al*., 2006; van der Velden *et al*., 2007), depression (Apisarnthanarak *et al*., 2012; Otto *et al*., 2006), suicide (de Leo *et al*., 2013), and psychological distress (Wind & Komproe, 2012). The aforementioned results provide some corroboration to the hypothesis regarding the effects of calamities on psychological well-being (Cianconi *et al*., 2020; Makwana, 2019). The fundamental concept underlying this theory posits that natural disasters or climate change-induced calamities result in significant environmental alterations. Consequently, it has an impact on the affected individuals. This population manifests a range of cognitive alterations and challenges (Taylor & Zarb, 2022).

All previous studies on floods have covered either climate change impacts on floods or physical health, mostly focusing on water-borne infections in Bangladesh, due to their prevalence during post-flood seasons (Bingnan *et al*., 1991). However, there have been limited studies on mental health. Findings from these studies indicate that both children's and adults' behaviors change drastically following floods (Durkin *et al*., 2011; Jahan, 2015).

However, it is still unclear what psychological impacts the floods in Bangladesh have had on adolescents. This article aims to address this gap in the study. Hence, this study analyzed the mental health of adolescents living in flood shelters during floods through qualitative research. The following sections of the report cover the flood situation in Bangladesh and detail the study's methodology, findings, discussions, and conclusion.

1.2. Flood conditions in Bangladesh

Due to its location and topography, Bangladesh is among the most flood-prone regions on Earth and has experienced the worst floods in 1988, 1998, 2004, and 2007

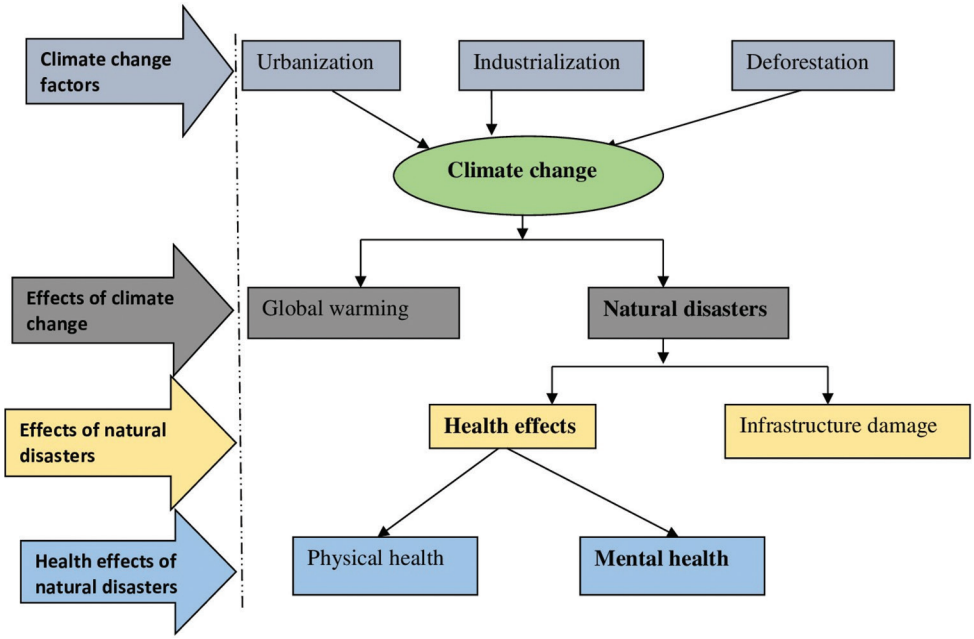

Figure 1. Conceptual structure of the factors and effects of climate change.

(Hofer & Messerli, 2006). The country's susceptibility to flood disasters has increased significantly due to changes in nature, rapid population growth in floodplains, and widespread poverty that forces people to live in floodplains (Dewan, 2015). Even in "normal" years, approximately 20% of the area of Bangladesh (31,000 km^2) is flooded, while as much as 80% of the land area is at risk of flooding (Monirul Qader Mirza, 2002; Varis *et al.*, 2008).

The effects of floods on people's livelihoods are disproportionately severe, particularly regarding income and employment (Parvin *et al.*, 2016). As a result of losing homes and means of support, many victims of floods are left defenseless. Particularly vulnerable are the impoverished, who reside in rural locations prone to flooding (Shimi *et al.*, 2010; Younus & Harvey, 2013). One to 2 million tons of grains, or 4 – 10% of yearly rice output, were lost due to devastating floods in 1988, 1998, 2004, and 2007 (Islam *et al.*, 2010).

Recently, in the middle of 2022, another devastating flood spread widely in the northeastern part of Bangladesh. Households and properties were washed away. Countless deaths have been reported (Daily Star, 2022). The Ministry of Disaster Management and Relief of Bangladesh (MDMR) stated that around 7.28 million people were affected, around 0.2 million houses were damaged, and the economic loss was 1.030 million USD (MDMR, 2022).

2. Methods

The qualitative study conducted as a part of this research used purposeful sampling as its primary data collection technique. To gather evidence, inductive reasoning was utilized through complete interviews with 53 teenagers (25 girls and 28 boys) living in flood shelters in the eastern-northern portion of Bangladesh from June to July of 2022. Simple random sampling was used for participant selection. The Patient Health Questionnaire (PHQ-7) and the post-traumatic stress disorder (PTSD-2) were used to assess depression and PTSD, respectively, drawing evidence from the interviews. In addition, a large number of secondary sources, including journals, publications, conference papers, newspapers, and government documents, were extensively explored and reviewed to triangulate the collected data. To make comparisons, interviewees' points of view were consistently taken into consideration throughout the process. Verbatim transcription was used to offer an in-depth account of how floods affect teenagers' mental health and provide a thorough picture of their mental condition. Variations and patterns in the data emerged as the research progressed, resulting in an accurate study that guided researchers in the direction of the subject or person to be further investigated to evaluate or contrast the growth of the data analysis. All data were analyzed and interpreted manually.

3. Results

Floods have significantly disrupted the everyday routines of those affected, leading to a noticeable shift in their lifestyles, especially among adolescents. As schools were shut down, there was no place to play, adolescents were forced to remain in the same location, and there was no

opportunity for anyone to move around or seek relief. All these factors, along with others, such as the loss of a loved one, contributed to an increase in mental health problems. The severe socioeconomic impacts and the heightened mental stress that resulted from the flood contributed to the deterioration of the problem.

Our research revealed that a significant proportion of boys and girls experienced PTSD and depression. Specifically, approximately 60.72% of boys and 71.42% of girls were affected by PTSD, while 80% of girls and 84% of boys suffered from depression.

3.1. Post-traumatic stress disorder

The destruction caused by water can be witnessed firsthand, leaving a deep emotional impact on those who experience it. In many instances, floods have taken away people's beloved pets, adding to the emotional toll. In addition, the loss of loved ones due to such disasters can be particularly distressing. It is the major contributor to post-traumatic stress disorder, and our research revealed that girls were more prone to PTSD than boys (Table 1).

The participants reported experiencing symptoms of PTSD due to stress associated with their current living conditions. Moreover, they expressed feelings of trauma and fear.

14-year-old Tarifa said:

> "There was very little water in the evening. We fell asleep in our room. Everyone got up after the bed got wet at night. We don't have a boat of our own. Hence, everyone spent the night sitting on the roof of the house. Grandmother died of wet pneumonia in the rain. There was a lot of trouble in burying her body. Grandma could not be buried next to our house. I can't sleep well at night now. Suddenly, I woke up. I have nightmares. I dream of drowning. Then, I woke up screaming."

16-year-old Yunus said:

> "As the flood waters began to penetrate the home, we quickly packed up our belongings and fled to the upper floors of a nearby grocery store. The home disappeared under flood waves. Everything else in the home has also disappeared. I saw everything washed away. My father now has paralysis. Everybody is at grave risk. And I'm having nightmares every day, can't sleep well."

3.2. Depression

The living conditions in the shelters were not conducive to good health, as there was a lack of recreational and amusement opportunities. Moreover, students abandoned their education after the flood. The lack of space for movement further exacerbated the situation. Due to the challenges, the unavailability of resources remained a major issue as it was not only the poor who relied on humanitarian aid for sustenance. The overall environment of the shelters was harsh, which led to a rise in adolescent depression, as shown in Table 2.

Some of the responses of participants battling with depression are listed below:

17-year-old Tahir said:

> "We were a well-to-do family with a beautiful house. Our beautiful house could not shelter us from the flood. It drowned completely. We never thought this would happen, and that the water would rise so high. I feel that we have 'run out of gas,' emotionally."

16-year-old Jumon said:

> "We never asked anyone for help. However, this flood destroyed all the values. We have to eat relief foods. However, we were able to relieve ourselves. Now I feel very depressed. I can't accept what was happening around me."

14-year-old Emon said:

> "I am studying in class seven. Currently, the school is closed. There is flood water everywhere in the house. So, we're in the shelter. Everyone comes from different backgrounds and families. There are a lot of problems every day. Quarrels are regular issues here. I am going through a strange time. I think it would have been better if I had died."

According to the data, girls were facing more problems and demonstrated higher levels of depression compared to boys. The environment of the flood shelter was particularly harsh for the girls.

15-year-old girl, Bushra mentioned:

> "The girls have the most problems here. Girls need a little privacy in everything. However, everyone has to

Table 1. Percentage of PTSD according to gender

Gender	Total	Yes, *N* (%)	No, *N* (%)
Male	28	17 (60.72)	11 (39.28)
Female	25	20 (80)	5 (20)

Table 2. Percentage of depression according to gender

Gender	Number of respondents		
	Total	Yes/*N* (%)	No/*N* (%)
Male	28	20 (71.42)	8 (28.58)
Female	25	21 (84)	4 (16)

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be crammed into the shelters. There are no opportunities for privacy. We live with people I do not know. Many boys look badly at us. I understand that when I see their eyes. However, there is no point in telling anyone about this. All of this is an increasing frustration. Day after day, this frustration continues to grow."

15-year-old Maisha said:

"How nice it was to be home. In this case, many people must stay in a single room. There was a significant amount of heat in the room. All around is full of stenches. I'm not getting enough sleep. We have many little kids here. There is always someone crying. Many are sick. The environment is very dirty. Everyone is bound to live in polluted environments. Being a girl, I can't accept all this."

3.3. Psychological distress

The mental health of people deteriorated for various reasons, including the extended shutdown of schools due to the COVID-19 epidemic. Then, the flood forced the shutdown of the school once again. Moreover, the management of the shelter was inadequate. Collectively, the behavior of teenagers became irregular. They exhibited extremely short tempers when they were angry. They engaged in altercations and disagreements with one another. The gender-wise difference was evident here; the boys were more distressed than the girls.

17-year-old Rubel mentioned:

"Sitting in this shelter is annoying. We have so many people living together. I can't play, I can't study. It's all off. COVID-19 had come, and we had to stop studying. Now flood again. What is happening? I am not getting peace of mind. Nothing looks good anymore. I don't know why I suddenly got angry. I just can't take anything easily."

16-year-old Mamun said:

"Our city has never seen a flood before. Before, the villages used to be flooded. Water has never been here. That's where we went to distribute relief. Now, we need to provide relief. How difficult it is to be in a shelter! It's miserable! Everyone has a mentally difficult time. No one is mentally fit. As a result, people have started arguing with each other for several reasons. The kids were crying at all times. Many are sick. There's an acute lack of food. There is no pure water. Who could stay calm or good to see all of this? None of us are good here."

4. Discussion

Natural catastrophes, such as floods and cyclones, destroy both lives and property on a massive scale. This research aimed to identify the mental health problems of all the adolescents who had lost their homes, farms, companies, towns, or loved ones as a result of the flood. A significant psychological influence was observed in adolescents. Adolescents who have experienced a traumatic event may experience anxiety, panic, depression, anger, violent conduct, apathy, social isolation, sleep difficulties, somatization, and pessimistic thinking (Auger *et al*., 2000; Maltais *et al*., 2000; Schonfeld, 2002; Vranda & Sekar, 2011).

A few psychological symptoms, such as increased PTSD, depression, and psychological distress, were reported by adolescents who participated in this study. We observed that females staying in flood shelters after the crisis had higher rates of PTSD and depression than boys.

Adolescents who participated in this research reported experiencing various psychological symptoms, including increased PTSD, depression, and psychological distress. Girls were more depressed and had more PTSD than boys living in flood shelters during the disaster.

In this instance, a gender imbalance was noticed while discussing the effects of any natural catastrophe; the same applies to flooding. There are situations in which males suffer more than females and vice versa (Ajaero, 2017; Salvati *et al*., 2018). Studies found that girls are more prone to PTSD, depression, and other psychological disorders caused by natural disasters (Hassan *et al*., 2018; Nisha *et al*., 2014). Our study also revealed that gender played a significant role in the results. We discovered that girls experienced higher levels of depression and PTSD compared to boys. Based on the findings of this investigation, PTSD is found in varying severity in both male and female participants. Previous research has indicated that a significant number of adolescent survivors of floods have been found to suffer from PTSD (Mathew *et al*., 2021; Uttervall *et al*., 2013). The results of this study are consistent with those of other studies, which found that women were more severely affected by natural disasters than males (Neumayer & Plümper, 2007) and girls had more PTSD than boys, which is similar to other studies (Bokszczanin, 2007; Liu *et al*., 2006).

Scientists have found depression and depressive symptoms among adolescents who have survived the flood (Otto *et al*., 2006; Paranjothy *et al*., 2011; Telles *et al*., 2009). Our study revealed similar results. The adolescents living in the flood shelters were indeed suffering from depression. Moreover, we found that girls were more prone to depression than boys, which also matched with previous research (Asim *et al*., 2022; Felton *et al*., 2013). Adolescents' mental health and the quality of their lives in areas relating to their mental health declined dramatically after the flood (Alderman *et al*., 2013). There was psychological distress due to having to live in shelters like that. Lack of facilities,

the harsh environment of the shelters, the food supply, and the loss of everything poured into mental health issues there (Dewan, 2015; Rahman *et al*., 2015).

PTSD, depression, and psychological distress appear to be affecting adolescents who have been forced to live in harsh conditions in flood shelters due to the loss of their loved ones. The shutdown of their schools due to the flood water further exacerbated the situation. The living conditions in the shelters are challenging, and scarcity of resources, including food, is prevalent. Relying on relief efforts for sustenance has had a negative impact on their self-esteem. All of these factors fueled their psychological irregularities.

According to the findings, it is evident that mental health concerns and harm reduction strategies should be given paramount importance when addressing the needs of adolescents affected by floods; similarly, individuals with mental issues should be included in this consideration. The stakeholders and relevant authorities should actively support adolescents grappling with mental health and facilitate their access to the required resources and support networks.

Acknowledging adolescents who are vulnerable to developing significant psychological health complications is a crucial measure in mitigating their frequency and intensity. To mitigate the disintegration of individuals, households, societies, establishments, and communities, it is imperative to implement psychological interventions that prioritize the development of coping mechanisms and resilience.

4.1. Limitations

The study presents several noteworthy limitations. First, the sample size of 53 adolescents may limit a comprehensive understanding of the mental health outcomes of teenagers affected by floods. In addition, the data collection method based on flood shelter attendance and voluntary participation may have restricted the representativeness of the sample. This cross-sectional study design did not depict the evolving nature of mental health outcomes over time. Furthermore, it limits the capacity of the study to establish a temporal relationship between flood experiences and mental health outcomes. Longitudinal research can provide a better understanding of this issue. Future surveys should be door-to-door rather than shelter-based.

5. Conclusion

The mental health of adolescents in Bangladesh has been significantly affected by recurrent and devastating floods. This study provides a big picture of the effects of such natural disasters on the mental well-being of this vulnerable population. Our findings underscore the fact that adolescents are particularly susceptible to the adverse consequences of floods. Mental health challenges intensify with school closure, restricted mobility, and the trauma of losing loved ones. Notably, the research revealed that a substantial percentage of adolescents exhibited symptoms of PTSD and depression, with percentages varying between genders. These findings emphasize the urgent need for a comprehensive support mechanism for addressing this issue. All stakeholders must prioritize the provision of mental health resources and resilience-building strategies. Therefore, a collective effort to mitigate these challenges is required. By prioritizing mental health support and resilience-building, communities can be better fortified, and the well-being of those most affected by climate change-induced disasters can be enhanced.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: Md Abu Bakkar Siddik
Formal analysis: Md Abu Bakkar Siddik
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Supervision: Zobayer Ahmed
Writing—original draft: All authors
Writing—review and editing: Md Abu Bakkar Siddik, Zobayer Ahmed

Ethics approval and consent to participate

Before taking part in the study, both the participants and their parents gave their written approval to take part in the research.

Consent for publication

There was formal agreement for the publication of the participants' data from both the participants themselves and their parents.

Availability of data

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

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ACCSCIENCE PUBLISHING

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COMMENTARY

Understanding how children are coping with climate change anxiety by exploring coping strategies and supportive interventions

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Abstract

Climate change presents a significant threat to both the planet and humans, impacting our physical health and mental well-being. The challenges that it presents underscore an imperative to execute immediate and concerted actions. These threats, even if circumvented timely, will have repercussions persisting into the future, implying that (i) our children have been born into unprecedented times and (ii) as future adults, they will find themselves facing the major consequences of climate change. These ramifications can negatively affect their mental health and well-being. In this commentary, we put forward our viewpoints regarding the effect of climate change anxiety on this population group and discuss the coping strategies and supportive interventions used to cope with said anxiety. Empowering children to engage in climate action has been recognized as a coping strategy while equipping them with knowledge and resources on climate change and providing safe spaces and experiences in nature are identified as supportive interventions. However, further empirical research evidence is needed to determine the next steps to address the extent of the impact of climate change anxiety and prepare our children for the future.

Keywords: Children; Climate change; Climate change anxiety; Well-being; Coping; Interventions

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1. Introduction

The Intergovernmental Panel on Climate Change (IPCC, 2021) Sixth Assessment report confirms that the climate is changing, a change caused by the release of greenhouse gasses from human activities, which are warming our planet. Between 1901 and 2020, the global temperatures had increased by 1.1°C (NOAA, 2021) and as a consequence, occurrences such as rising sea levels, droughts, wildfires, biodiversity loss, and flooding have become a commonplace, which in turn affect human health. Power generation, manufacturing, growing transportation networks, overconsumption of resources, food production, and deforestation all contribute to human-induced climate change.

Adding to the pressure on our planet is an increasing world population, along with a misplaced commitment to economic prosperity. Nevertheless, efforts to address the causes of climate change remain extremely slow.

Recently, the concept of a zero-carbon future and global commitments to change have attracted the attention of the world, but a successful shift toward this ideal direction requires more urgent global actions. This imminent requirement for significant global action means that our children have been born into unprecedented times. Indeed, UNICEF (2021) highlights that one billion children will be at extremely high risk of stress caused by climate change. This could be a direct impact of living in a changing environment (Xu *et al.,* 2023) or population displacement (Palinkas, 2020). The stress can also be from an indirect impact after they are exposed to media reporting on catastrophic extreme weather events (Robie & Marbrook, 2020). These experiences could significantly impact how our children perceive the world. Without the implementation of radical and urgent measures to reverse the adverse impacts of human behavior on the environment, our children who will become the next generation of adults will have to brace for the environmental damages and climatic disasters engendered by the people of this generation. While it is inevitable that our children will need to cope with these global challenges, we must at least explore how these cataclysmic events will impact them and what measures we can devise to support them.

There has been extensive discussion regarding the impacts of climate change on physical health (IPCC, 2022; WHO, 2021), contributing to an increased awareness of its deleterious health impacts in the long term (Berry *et al.*, 2018). Children are particularly vulnerable to the effects of climate change such as heat waves (Dreisbach, 2019). The enormous challenges global populations face from the changing climate are also "creating stressors that worsen the mental health of individuals" (Meier *et al.*, 2022 p.6). Indeed, climate change is considered "the biggest threat to global mental health in the coming century" (Charlson *et al.*, 2022 p.6), in the form of physical and mental health impacts, with the latter being triggered by the negative anticipation and perception of climate-induced events (Clayton & Karazsia, 2020). The relationship between climate change and mental health is an area requiring further investigations (Berry *et al.*, 2018). On a similar note, Prencipe *et al.* (2021) and Majeed & Lee (2017) specifically highlight the paucity of research concerning the impact of climate change on children's mental health and well-being. Mental distress about climate change is commonly referred to as climate change anxiety, which is causally tied to the inadequacy of the human response and resources (Rothschild & Haase, 2023). Children are reported as particularly vulnerable to climate change anxiety (Wu et al., 2020) and children's experience in this regard has been explored qualitatively. In clinical and research settings, Hickman (2020) reported that children commonly express feelings of severe anxiety, fear, guilt, shame, being misunderstood, betrayed, and abandoned by adults, all of which are associated with rage toward and blaming of adults. Strife (2012) reported that the majority of the 50 children interviewed expressed apocalyptic and pessimistic feelings. There is also a study in which both parents and educators specifically identified children suffering from climate change anxiety (Baker *et al.*, 2021).

The unique characteristics of climate change anxiety are that: (i) it is rational and thus unfit to the traditional criteria for anxiety disorders (Kotera & Taylor, 2022) because it is a practical response to the possibly life-threatening phenomenon, which drives the person in that situation to take preventable actions, and (ii) it is complex and can be detrimental because the person cannot make a considerable change to the possibly life-threatening phenomenon (Kotera *et al.*, 2022). Therefore, this paper aims to explore how children are coping with climate change anxiety and the possible interventions to support them. Finally, it will identify gaps in understanding the impact on the well-being of this population group.

2. How children are coping with climate-anxiety

How children cope with climate change and climate change anxiety is a growing research area. Through a narrative synthesis of 51 studies on youth perceptions of climate change, Lee *et al.* (2020) reported that younger children (11 – 16 years) were more concerned with climate change than older children (17 – 18 years), and primary-age children showed more willingness to address climate change than secondary-age children did. Swim *et al.* (2022) demonstrated that the disparity in the levels of concern and willingness increases with the age difference between two generation groups under comparison. There is a growing body of evidence supporting engagement with climate change as a strategy for coping with associated harmful psychological effects. For instance, van Nieuwenhuizen *et al.* (2021) suggested fostering pro-environmental behaviors and activism in children, while Sampaio & Sequeira (2022) recommended organizing community climate action events to promote efficacy and restore the children's faith in the future of our planet.

In theory, climate activism falls within the realm of positive coping strategies of problem-focused and

meaning-focused coping, rather than avoidant coping strategies (Ojala, 2012). Similarly, efficacy beliefs of Italian university students have also been shown as positively associated with climate change anxiety (Maran & Begotti, 2021). Meaning-focused coping is a critical enabling strategy to facilitate problem-focused coping whilst protecting against the overwhelming stress induced in the process of engaging in climate change activism (Ojala & Bengtsson, 2019). Although the application of these theoretical coping strategies on children has been corroborated by studies conducted in different countries, it is yet to be determined whether the efficacy of these strategies may vary among children nurtured in different cultures. According to Hickman (2020), societal trust is lacking in many children, highlighting the need to address intergenerational misunderstanding. The platform given to Greta Thunberg by the United Nations' Climate Action Summit in 2019 is a good example of the efforts made to bridge the misunderstanding gap. For children to feel hopeful and empowered, bequeathing them the floor to express for themselves in big events, for instance, is symbolic of enfranchising them through representation in the media and policy creation, consistent with a sentiment voiced by the UK adolescents in a qualitative research (Thompson *et al.*, 2022).

Jalin *et al.* (2022) reported that individuals with limited access to psychological resources for stress coping are particularly vulnerable to climate change anxiety and thus recommended psychotherapy complemented with stress management as a means to improve climate change anxiety. As Clayton (2020) observes, emotional coping strategies, such as denying or downplaying the threat, are not appropriate for the pervasive threat posed by climate change. However, for those experiencing significant impact from climate change anxiety, stabilizing unregulated emotion and stress through cognitive exercises is likely to be a necessary preliminary to engagement in meaning- and problem-focused coping.

3. When to talk to children about climate change

At present, there is no consensus on the appropriate time to discuss climate change with children. The discussion with them may start with helping them understand that extreme worry, fear, and distress are common reactions in individuals who are concerned about climate change (Marks *et al.*, 2021). It is important to sensitively engage in the discussion about climate change and its impact, with the hope that the children are empowered to adaptively overcome and confront the crises awaiting them, as opposed to feeling helpless and powerless (Budziszewska & Jonsson, 2021). Nevertheless, parents and guardians who provide advice and support to children will find this a daunting task due to the parent's anxiety concerning climate change or the ill-equipped scientific information, they can convey to their minors in a child-appropriate manner (Gaziulusoy, 2020). It has been recognized that providing guardians with educational resources that can promote emotional well-being is a monumental step toward fostering effective discussion with children, which aims to snowball into their proactive engagement in climate change action (Baker *et al.*, 2021).

Reducing the impact of climate change and assisting children to be part of this process requires a holistic approach and collective action of many parties (Lawson *et al.*, 2019). Therefore, the onus of empowering children in responding to climate change should not only be left on parents; instead, educational systems such as schools and colleges, governments, researchers, clinicians, and practitioners who work with families as well as community activists must be included in the education process. Majeed & Lee (2017, p. 95) recommended that clinicians treating children with mental illness should familiarize themselves with methods that have the potential to relieve their mental health problems related to climate change. This tactic entails utilizing an evidence-based approach concerning climate change anxiety as psychological treatment for children who present with climate change anxiety, which must be treated differently than other anxiety disorders such as generalized anxiety disorder.

4. Possible interventions to support children with climate change anxiety

Potential interventions to support children with climate change anxiety include but are not limited to, providing safe spaces (online or physical), resources and tools for children to share their fears or concerns about climate change, acknowledging the existence of these feelings, and providing assistance to address the silence, fear, and shame — the feelings after they are shunned by their parents (Burke *et al.*, 2018). In addition, ample support should be given parents who are not knowledgeable enough to discuss the topic of climate change with their children. Lewandowsky *et al.* (2013) argued for bridging the gap in levels of knowledge between expert and the public, so that parents, guardians, schools, and communities, which are the key members of the public, have access to expert knowledge and resources tailored to their needs to support their children in understanding climate change.

Compared with simple talks about climate change, creating environments where parents can spend time with their children and children can appreciate the beauty of nature has been proven to be beneficial (Burke *et al.*,

2018; Rao & Powell, 2021). Local or national museums or community venues should be encouraged to host projects specifically on sustainability to deepen the understanding of children about sustainability since they are young (Engdahl, 2015). Parents can also encourage their children to join relevant organizations dedicated to promoting sustainability or upholding the climate change agenda to help boost their confidence. The key is to help children to identify the main figures and organizations who are contributing to positive change in the environment at the local, national, or international level (Burke *et al.*, 2018). In addition, parents may support their children to engage in actions that cultivate climate change awareness; participating in local conservation projects that promote environmentally friendly practices or involving in the conceptualization of environmental projects are among the recommended actions that can be performed together with their peers (Kurup *et al.*, 2021). Finally, it is imperative to amplify children's voices and involve them in developing and influencing environmental policy for the future (Thompson *et al.*, 2022).

5. Addressing research gaps

Since the prevailing attitudes toward climate change (Fisher *et al.*, 2018) and the eco-behaviors being modeled at home are rather diverse (Rhead *et al.*, 2015), and the parents are at heightened risk of climate change anxiety (Ekholm & Ollafsson, 2017), it is vital that a consistent evidence-based approach be adopted to address its psychological effects. Such an approach should attempt to bridge the generational gap perceived by children, by developing a shared understanding through parent-child communication (Hickman, 2020; Jackson *et al.*, 2022; Spiteri, 2020). Therefore, there is an urgent need for further empirical research into the emotional impact of climate change on children. This call is supported by Helldén *et al.* (2021) who highlighted the lack of research attention afforded to health impact of climate change, and by Charlson *et al.* (2022) who propounded ten priority areas for future research in this field. Further, considering the significant expectations placed on this population group as tomorrow's adults, Wu *et al.* (2020) advocate that "making investments to improve their mental health and well-being will provide dividends now and, in the future". This signals an essential need to offer preventative care for children in terms of mental health (Kotera & Fido, 2022).

6. Conclusion

Climate change presents a significant threat to the health and well-being of children. Their growing understanding of the human-induced impact on our planet and the realization of their unenviable position as the future generation who are required to spearhead the combat against the imminent crisis has augmented the levels of climate change anxiety. Despite the availability of coping strategies and supportive interventions, further empirical research evidence is still needed to help formulate strategies for reducing the impact of climate change anxiety and preparing our children for the future world where combating the environmental and climatic issues head-on is an unavoidable task for everyone.

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ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Two-way employment-driving effect of manufacturing and producer services: Evidence from China

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Abstract

Employment holds paramount importance in people's lives, and the employment interaction between manufacturing and producer services plays a crucial role in steadily expanding employment opportunities, thereby achieving high-quality full employment. This paper delves into the data of A-share listed companies in China from 2012 to 2020, exploring the two-way effects of producer services on manufacturing and vice versa. The results reveal a significantly positive two-way employment-driving effect between manufacturing and producer services. Notably, the employment-driving effect of producer services is stronger than that of manufacturing enterprises. The results of the heterogeneity test based on the breakdown types of producer services and manufacturing highlight that the employment-driving effect of high-tech services on manufacturing is more prominent, approximately 2.85 times greater than that of non-high-tech services. This suggests a clear and substantial scale technology effect. Conversely, the employment-driving effect of high-tech manufacturing on producer services is found to be insignificant. In conclusion, the findings underscore the significant impact of producer services in driving manufacturing employment. It is imperative for the government to enhance its support for producer services enterprises and broaden employment opportunities within these sectors.

Keywords: Manufacturing employment; Employment in producer services; Employment-driving effect; Simultaneous equation

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1. Introduction

Employment stands as a fundamental aspect of livelihood. As a worldwide topic, the issue of employment is of great concern to all countries. Countries with large populations often grapple with heightened employment pressures, and China, with its huge population base, bears greater aggregate pressure. The decline in economic growth has disrupted this landscape, as the new demand for labor fails to compensate for job losses resulting from the shift in industrial structure. Despite China's population reaching its peak and shifting to negative growth, coupled with an accelerating decline in the working-age population, this does not signal a relaxation of employment pressure. Instead, it denotes a shift from aggregate to structural pressure.

In the past decades, China's economic growth has mainly relied on investment and exports, while the structural challenges of weak domestic demand growth and insufficient consumption have persisted. Since 2013, a noteworthy shift in the characteristics of economic growth has taken place, and the "new troika," particularly the "Belt and Road" initiative, has played a pivotal role in promoting the development of the service-oriented economy. Consequently, this has led to the expansion of employment within the services industry. In the era of global value chains, the separation of manufacturing from service activities is increasingly challenging (Miroudot, 2019). The interaction between manufacturing and services industries, especially in knowledge-intensive services, has not only become closer but also exhibits a trend of integration (Ciriaci & Palma, 2016; Castellani *et al*., 2016).

It is well-documented that the service industry exerts a positive impact on manufacturing productivity. Consequently, when formulating industrial policies, the government should thoroughly consider the interaction between manufacturing and service industries (Berardino & Onesti, 2018). In the course of China's industrialization process, the integration of manufacturing and service industries helped the nation's economy break through the development dilemma and achieve transformational development (Berardino & Onesti, 2020). Employment serves as the economy's barometer, with stable employment growth being the premise of both economic development and social stability. Ensuring and expanding employment stands as an important consideration for the government when formulating economic policies. The industry serves as the carrier of employment. In the context of mounting downward pressure on the economy, the employment interaction between manufacturing and service industries significantly influences the steady expansion of employment. In the future, as the employment absorption capacity of manufacturing diminishes, job creation increasingly depends on the support of the service industry. Therefore, clarifying the relationship between manufacturing and service industries, particularly in producer services industries, and understanding the mechanism of employment creation in producer services industries is not only theoretically significant but also holds practical importance for ensuring employment stability and addressing structural problems.

1.1. Literature review

The existing literature on the employment interaction between manufacturing and producer services industries mainly focuses on developed countries, with abundant research undertaken from both qualitative and quantitative perspectives. Henning (2019) delves into the labor mobility pattern among manufacturing, business services, and knowledge-intensive business services, utilizing the whole population geocoding registration data of Swedish workers and their labor market changes from 2010 to 2014. The results highlight important two-way characteristics in the labor mobility between manufacturing and service industries. In a study using American data, Moretti (2010) explores the leading role of manufacturing employment in producer services employment. The results reveal that every new job in manufacturing can generate 1.59 jobs in producer services. However, the driving effect varies among different manufacturing sectors, with the high-tech manufacturing sector exhibiting the largest impact, approximately 1.57 times the average employment-driving effect of the manufacturing sector. Moretti & Thulin (2013) further compare the employment-driving effect of manufacturing on producer services between the United States (U.S.) and Sweden: For every new job in manufacturing, producer services increase by 0.49 jobs in Sweden, indicating a considerably lower employment-driving effect compared to the U.S. Numerous scholarly studies consistently demonstrate that in developed economies almost everywhere, employment growth in the service sector is often accompanied by a contraction in the manufacturing sector, both in absolute terms and as a share of total employment (Baumol, 1967; Berardino & Onesti, 2018). Thus, it is evident from the literature that studies in developed countries have primarily focused on the one-way perspective of "industry-driven," lacking the two-way research of "industry interaction."

Therefore, some studies have shifted their focus to developing countries. Taking China as an example, Gao & Li (2011) examine the interactive development relationship between various sectors within producer services and manufacturing. Chen & Zhang (2020) determine that manufacturing and producer services exhibit complementary in space and region based on China's provincial panel data. They, further, conclude that a significant two-way employment bonus exists between high-tech manufacturing and employment in different types of service industries, providing quantitative evidence for the interaction between industries and employment. While scholars have employed macrolevel data to discuss the employment interaction between manufacturing and producer services, such research has certain shortcomings. First, macrodata belongs to aggregate data and, when used for measurement, may yield results with inherent limitations. Second, China's huge population base creates substantial employment pressure, making macrolevel data far from enough to analyze the employment interaction between manufacturing and producer services. Therefore, it is necessary to seek microlevel evidence to support macro

policies. Zhang (2015) employee micropopulation survey data to measure the one-way impact of manufacturing employment on service employment at the micro level. Specifically, for every job increase in manufacturing from 2000 to 2005, approximately 0.4 jobs in the services industry were created. It is not difficult to see that existing literature either relies on macrolevel research or microlevel one-way research, lacking comprehensive microlevel two-way driving research.

In summary, there is a limited body of literature exploring the microlevel "industry interaction" perspective in developing countries, and the theoretical mechanisms in the existing literature remain vague. This paper conducts a detailed study on the two-way employment-driving effects between manufacturing and producer services at the micro level, using China's A-share listed companies in Shanghai and Shenzhen. It further delves into the current state of industrial development in China, highlighting significant differences in the development status of producer services and manufacturing subsectors. The study, then, explores the employment-driving effects based on the industry heterogeneity between them. This paper attempts to make the following marginal contributions: First, the previous studies have mostly focused on the one-way interaction of employment between industries, paying less attention to the two-way employment-driving effect between manufacturing and producer services. The present study calculates the two-way employment-driving effect of manufacturing and producer services in detail at the microlevel, providing a micro basis for the formulation and implementation of macro policies. To the best of our knowledge, this paper is the first to employ enterprise-level data to study the two-way employment-driving effect of manufacturing and producer services. Second, by employing the constant elasticity of substitution (CES) production function to construct a novel theoretical model, this study derives a more general conclusion regarding the two-way employment-driving effect between manufacturing and producer services. Building on this theoretical framework, a simultaneous equation model is employed for analysis, effectively addressing endogenous problems.

1.2. Theory

1.2.1. Employment-driving effect of manufacturing and producer services

Based on the model constructed by Li *et al.* (2017), this paper addresses the employment-driving effect of manufacturing and producer services from both the demand and supply sides. It combines the conditions of consumer utility maximization and producer profit maximization. First, a two-sector model for a city is developed, assuming the existence of two types of production sectors in the city, *i*: the manufacturing sector, *M*, and the producer services sector, *F*, the number of laborers absorbed by the two sectors is denoted as L_M and L_F, respectively. The relationship between them is expressed as:

$$L_M + L_F = \varphi L \tag{I}$$

where φ denotes the urbanization rate. It is assumed that labor is not transferable between the manufacturing and producer services sectors; however, surplus labor is freely transferable. In addition, all of the workers' income, *Y*, is spent on the products of the two sectors, *E*. The problem of maximizing consumer utility and producer profit between the two sectors, as represented by the simplified production function, can be expressed as:

$$U = \left(M^{\rho} + F^{\rho}\right)^{\frac{1}{\rho}} \tag{II}$$

where, $0<p<1$. The form of the Baumol production function is borrowed here to represent the form of the production function for the representative manufacturing and producer services sectors. An implicit assumption is made that the role of factors other than labor (e.g., capital) is fixed. The functions for the representative production sectors are as follows:

$$M = A_M L_M e^{\varphi g_M} \tag{III}$$

$$F = A_F L_F e^{\varphi g_F} \tag{IV}$$

where *M* and *F* denote the number of products in the manufacturing and producer services sectors, respectively. A_M and A_F denote the level of technological progress in the two sectors. L_M and L_F denote the number of laborers in the respective sectors, $A_M L_M$ and $A_F L_F$ denote the number of effective laborers, and g_M and g_F denote the growth rate of labor productivity in the two sectors. In addition, assuming that the product prices in the two sectors are P_M and P_F, respectively, the consumer constraint is:

$$Y = P_M M + P_F F \tag{V}$$

The consumer utility maximization is expressed as:

$$\begin{cases} \underset{U}{\text{Max}}\ U = \left(M^{\rho} + F^{\rho}\right)^{\frac{1}{\rho}} \\ s.t. Y = P_M M + P_F F \end{cases} \tag{VI}$$

Solving the utility maximization condition and the above equation yields:

$$\frac{M}{F} = \left(\frac{P_M}{P_F}\right)^{\frac{1}{\rho-1}} \tag{VII}$$

The conditions for profit maximization by a manufacturer under perfectly competitive market conditions are as follows:

$$P = MC = \frac{W}{MP} \quad \text{(VIII)}$$

Here, Wrepresents the wage level of effective labor. The marginal output of effective labor in the manufacturing sector and the producer services sector is given by first order condition:

$$MP_M = e^{\varphi g_M} \quad \text{(IX)}$$

$$MP_F = e^{\varphi g_F} \quad \text{(X)}$$

According to the conditions for maximizing the manufacturer's profit:

$$\frac{P_M}{P_F} = e^{\varphi(g_F - g_M)} \quad \text{(XI)}$$

By incorporating the conditions for maximizing consumer utility and manufacturer's profit, we further solve expressions for labor relations between the manufacturing sector and producer services sector by substituting Equations III, IV, and XI into Equation VII. Collating them, we obtain:

$$L_F = \frac{A_M}{A_F} \times L_M \times e^{\varphi(\rho+1)(g_M - g_F)} \quad \text{(XII)}$$

$$L_M = \frac{A_F}{A_M} \times L_F \times e^{\varphi(\rho+1)(g_F - g_M)} \quad \text{(XIII)}$$

It is evident that employment in the manufacturing sector and producer services sector has a two-way and positive promoting effect, as indicated by Equations XII and XIII. This provides a solid theoretical basis for further studying the strength of the employment-driving effect of manufacturing and producer services.

1.2.2. Theoretical analysis

Building on the above setting, this paper discusses the two-way employment-driving effect of manufacturing and producer services from two perspectives. First, considering the perspective of specialization, the deepening of the social division of labor improves the efficiency of each sector. The expansion of the manufacturing industry depends on intermediate goods input, stimulating the supply of producer services. The increased supply of producer services naturally results in an expansion of their scale, subsequently increasing the demand for labor. In other words, manufacturing has a positive effect on the employment of producer services. Second, examining the perspective of industrial upgrading, as the global value chain undergoes upgrading, the transformation and upgrading of the manufacturing industry encounter difficulties related to low productivity and insufficient power for technological innovation. Producer services absorb more labor due to increased labor productivity and wage growth. At the same time, serving as an intermediate input in the production process of the manufacturing industry, the increased supply of producer services has a dual impact. On one hand, it reduces the cost for the manufacturing sector, providing an incentive for it to expand its scale and thereby drive employment. On the other hand, the development and growth of producer services increase the input of intermediate products in the manufacturing sector. From the perspective of extending the industrial chain, the middle link of the manufacturing industry chain expands, accommodating more labor. In essence, producer services play a positive role in manufacturing employment.

Next, consider a twin-city model featuring cities A and B (Li *et al.*, 2017), where the employment-driving and spillover effects of manufacturing and producer services subsectors are based on the principle that when a manufacturing manufacturer producing product *i* in City A is subject to a technology shock, and if this technology shock originates from the producer services sector as an intermediate input, and the technology shock is positive (i.e., the shock comes from a high technology in the producer services sector), the labor productivity of sector *i* will significantly increase, directly raising wage and employment levels in sector *i*. Accordingly, the demand for the producer services sector will also rise, thus directly driving employment. Due to the "profit-seeking" nature of factors, employees in the producer services sector in City B will "flow" to City A, and the "spillover effect" will be prominent. In other words, the manufacturing sector in City A has a positive effect on the employment of the producer services sector. Based on the above theoretical analysis framework, the following hypotheses are proposed.

(i) Hypothesis 1: The employment promotion effect of manufacturing and producer services is positive.
(ii) Hypothesis 2: The high-tech services industry has a more prominent employment-boosting effect on manufacturing.

2. Materials and methods

2.1. Data sources

The data in this paper are mainly sourced from the CNRDS database of A-share listed companies spanning 2012 – 2020. As there is minimal repetition of companies across the study period, the obtained data are analyzed as a cross-

section. In conjunction with China's National Standard GB/T 4754 – 2017, the producer services are subdivided into seven industries: electricity, heat, gas, and water production and supply; construction; transportation, storage, and postal services; information transmission, software, and information technology services; wholesale and retail trade; finance; and leasing and business services. In the actual process of data processing, non-manufacturing enterprises and non-producer services enterprises were initially excluded. Subsequently, the samples were refined by further eliminating missing values of key variables such as operating time, nature of enterprise equity, enterprise assets, and the number of employees. The manufacturing enterprises and producer services enterprises were, then, matched using the propensity score matching method, adopting a one-to-one nearest neighbor matching of balanced samples. The final sample comprises 562 pairs. Macrodata was sourced from the China Statistical Yearbook.

2.2. Measurements

2.2.1. Dependent variables

The previous studies have demonstrated two common approaches to measuring the employment-driving effect at the enterprise level: one involves the employment scale index, measured by the annual number of employees (John *et al*., 2013). The alternative is the employment growth index, gauged by the average growth rate of employees over a specific period (Song & Li, 2018). Due to data limitations, the second method, measuring the employment-driving effect through the growth index, is impractical. Thus, we opted for the first measure. The dependent variables in this paper are as follows:

(i) Number of employees in producer services: When studying the driving effect of manufacturing, the core explanatory variable is the number of employees in producer services, expressed by the number of employees in producer services enterprises.
(ii) Number of employees in manufacturing: When studying the employment-driving effect of producer services, the core dependent variable is the number of employees in manufacturing, expressed by the number of employees in manufacturing enterprises.

2.2.2. Independent variables

As this paper examines the employment-driving effect of manufacturing and producer services, naturally, the core independent variables corresponding to the above dependent variables are the number of manufacturing employees and the number of producer services employees, respectively. The specific measurement method and meaning are consistent with those detailed above.

2.2.3. Control variables

The control variables in this study are as follows:

(i) Enterprise equity nature: All listed companies are divided into two types of enterprises: Atate-owned enterprises and non-state-owned enterprises, represented by values 1 and 0, respectively.
(ii) Operation duration: The duration of operations correlates with the level of expertise within the business, the utilization of fixed resources, and other factors. As the scale expands, there is a subsequent increase in the number of employees.
(iii) Employee wage level: Higher salaries generally correspond to increased motivation, making good salary treatment highly attractive to employees.
(iv) Employee welfare: Companies with excellent retirement and other benefits are assigned a value of 1; otherwise, they are assigned a value of 0.
(v) Staff safety production training: This variable indicates whether the company provides production safety training to its employees and is measured as a binary variable (0/1).
(vi) Research and development (R&D) innovation: Measured by enterprise R&D expenditure.
(vii) Enterprise assets: Measured by the value of the enterprise's existing assets.
(viii) Unemployment rate: Measured by the surveyed urban unemployment rate at the provincial level.
(ix) Gross domestic product (GDP) per capita: Matching is done according to the data, specifically measured by GDP per capita at the city level.

2.3. Analytical analyses

2.3.1. Descriptive statistics

According to the research framework of this paper, statistical analysis was conducted separately for manufacturing and producer services. Two conclusions can be drawn from the descriptive statistics, as shown in Table 1.

First, concerning the mean level, producer services exhibit a stronger ability to absorb employment among A-share listed companies. Data in Table 1 reveal that the number of employees in producer services companies is approximately 1.1 times higher than that in manufacturing companies. Notably, producer services companies appear to invest more in "soft power," such as employee safety training, making them more attractive to employees. A "high incentive" corporate culture might explain why producer services in A-share listed companies have a more robust employment-absorbing ability than manufacturing companies. Second, the R&D innovation ability of producer services companies in A-share listed companies is weaker than that of manufacturing companies. Manufacturing

Table 1. Descriptive statistics of the studied variables

Variable	Panel A: Manufacturing				Panel B: Producer services			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Number of employees	11063.17	17095.57	119.00	168600.00	12334.02	29573.61	105.00	293592.00
Enterprise equity nature	0.68	0.47	0.00	1.00	0.70	0.46	0.00	1.00
Operation duration	21.26	5.91	7.00	40.00	20.85	6.84	3.00	39.00
Wage level	11.99	0.45	10.61	13.33	12.04	0.52	10.07	13.73
Employee welfare	0.75	0.44	0.00	1.00	0.73	0.45	0.00	1.00
Staff safety production training	0.58	0.49	0.00	1.00	0.63	0.48	0.00	1.00
R&D innovation	47742.11	104397.89	0.00	1496713.48	45286.18	159213.23	0.11	2187415.10
Log of enterprise assets	23.40	1.35	20.52	27.55	23.71	1.42	19.83	27.81
Unemployment rate	3.03	0.74	1.21	4.61	2.95	0.79	1.21	4.61
GDP per capita	105727.12	42890.03	19436.00	203489.00	121676.24	41270.41	16248.00	467749.00

Notes: R&D: Research and development; GDP: Gross domestic product; SD: Standard deviation.

companies in A-share listed companies are predominantly high-tech manufacturing industries with stronger technical innovation capabilities. In contrast, producer services companies, primarily service industries, are more exposed to "subservient business" and lack innovation dynamics.

2.3.2. Modeling strategies

The theoretical analysis of the mutual employment promotion between producer services and manufacturing industries suggests that the dependent and independent variables do not exist independently in the economic system; instead, there is an inverse causal relationship. Thus, addressing the endogeneity of the model becomes crucial. Single-equation models can only reflect the unidirectional causality of the model and cannot effectively address the endogeneity of the model. Furthermore, the existence of endogeneity leads to bias and inconsistency in the estimation results (Pan *et al*., 2019; Yu *et al*., 2018). To tackle this issue, this paper constructs a simultaneous equations model and applies the three-stage least squares method (3SLS) for regression analysis. In this paper, the simultaneous equations are set as follows:

$$\begin{cases} manuf_i = \alpha + \beta_0 produc_i + \beta_i Z_i + \sum_{k=1}^{3} area_k + \varepsilon \\ produc_i = \partial + \rho_0 manuf_i + \rho_i Z_i + \sum_{k=1}^{3} area_k + \delta \end{cases} \quad \text{(XIV)}$$

where $manuf_i$ denotes region i manufacturing. Z_i denotes the control variable group, that is,

$$Z_i = (ownership_i \quad time_i \quad wage_i \quad welfare_i \quad train_i \quad innov_i \quad asset_i \quad jobless_i \quad perGDP_i) \quad \text{(XV)}$$

and the control variables in parentheses denote the nature of enterprise equity, operation duration, employee welfare, staff safety production training, R&D innovation, enterprise assets, unemployment rate, and per capita GDP, respectively. $produc_i$ denotes the number of employees in producer services in region i, α, and ∂ denote the constant terms, β_0 and ρ_0 denote the regression coefficient of the core independent variables, and β_i and ρ_i (for i=1,2,3,…,10) denote the regression coefficients of the control variables affecting the number of employees in manufacturing and producer services, respectively. $\sum_{k=1}^{3} area_k$ denotes the inclusion of region dummy variables, which are divided into eastern, central, and western regions based on the setting of the questionnaire. ε and δ denote random disturbance terms.

3. Results and discussion

3.1. Discussion on endogeneity

Through the theoretical analysis and empirical model setting outlined above, an endogeneity test of the model is conducted before the empirical regression with the simultaneous equations model to confirm the existence of a two-way causal relationship between manufacturing and producer services. The common method for an endogenous test is the Hausman test, where the original hypothesis assumes that all explanatory variables are exogenous. The results in Table 2 show that the relationship between manufacturing and producer services and producer services is exogenous. p-values of the regressions from manufacturing to producer services and from producer services to manufacturing pass the significance tests at 5% and 1%, respectively, indicating the presence of an endogeneity problem if the ordinary least squares method is used. Therefore, the subsequent empirical analysis was conducted using the joint cubic equation model.

Table 2. Endogeneity test

	χ^2	*p*-value
Manufacturing to producer services	12.16	0.0005**
Producer services to manufacturing	50.57	0.0000***

Notes: *p<0.1, **p<0.05, ***p<0.01.

Table 3. Endogeneity Durbin-Wu-Hausman test

	χ^2	*p*-value
Manufacturing to producer services	13.01	0.0003**
Producer services to manufacturing	54.34	0.0000***

Notes: *p<0.1, **p<0.05, ***p<0.01.

Considering that the traditional Hausman test may not be valid in the case of heteroskedasticity, a heteroskedasticity-robust Durbin-Wu-Hausman (DWH) test was conducted. In Table 3, p-value of the DWH test for manufacturing to produce services is less than 0.01, passing the 1% significance test, confirming the presence of an endogeneity problem. Similarly, p-value of the DWH test for producer services to the manufacturing is also below 0.01, passing the 1% significance test, indicating the existence of endogeneity and further validating the earlier conclusion.

3.2. Baseline regression

Table 4 presents the estimated results of the full sample under 3SLS. The coefficients of the two independent variables are consistently significant and positive at the level of 1%, confirming their role in promoting employment and supporting Hypothesis 1 of this paper. Regarding control variables, enterprise equity nature and staff safety production training show no significance in the two-way employment drive, while the remaining variables are significant, at least at the level of 10%. At the same time, concerning the unemployment rate and GDP per capita, they play different roles in the two-way employment drive of producer services and manufacturing.

Table 4. Employment-driving effects of manufacturing and producer services

Variable	Three-stage least squares method	
	Number of manufacturing employees	Number of producer services employees
Number of manufacturing employees		0.3306** (2.48)
Number of producer services employees	0.4343*** (18.62)	
Enterprise equity nature	482.6678 (0.59)	−297.5408 (−0.20)
Operation duration	−151.0392** (−2.36)	−300.8916*** (−3.00)
Wage level	−2327.796** (−2.42)	−10084.13*** (−5.83)
Employee welfare	−31.6869 (−0.04)	2357.812* (1.82)
Staff safety production training	653.4455 (0.92)	52.6525 (0.04)
R&D innovation	−0.0051 (−1.33)	0.0534** (0.0241)
Log of enterprise assets	4548.856*** (10.76)	0.1031*** (10.25)
Unemployment rate	−2120.22* (−1.87)	4389.486*** (5.15)
GDP per capita	0.0203* (1.72)	−3779.701** (−2.24)
Province	Yes	Yes
Constant	−64143.51*** (−4.58)	−0.0120 (−0.90)
Observations	537	537
R-squared	0.7115	0.7021

Notes: t-values are shown in parentheses; *p<0.1; **p<0.05; ***p<0.01.

3.2.1. Analysis of the estimation results of the manufacturing equation

From the estimation results of the manufacturing equation, it can be seen that for every increase in employment in producer services, employment in manufacturing will increase by 0.4343.

The results of the baseline regression indicate that the enterprise equity nature and R&D innovation do not significantly contribute to the employment-boosting effect of producer services enterprises on manufacturing enterprises. Typically, as an intermediate input to manufacturing, producer services effectively improve the value of output and operational efficiency at different stages of the production process. However, the results of the baseline regression show that this efficiency-boosting process is independent of the type of producer services enterprises. The promotion effect of enterprise assets on manufacturing employment passes the 1% significance test, and the regression coefficients indicate that as enterprise assets, specifically the total assets of firms in this paper, expand, the greater the effect on promoting employment in manufacturing firms. This finding is consistent with the expected direction.

In particular, the unemployment rate exhibits a significant negative impact at a statistical level of 10% on the employment drive in the manufacturing sector. Conversely, it shows a significant positive impact at a statistical level of 1% on employment drive in the producer services sector. This can be explained in the context of China's macroenvironment. As China's traditional industries, especially manufacturing, undergo urgent transformation and upgrading, their enterprises are also in the process of transformation and adjustment. The

higher the unemployment rate, the weaker the current ability of China's manufacturing enterprises to absorb employment. In recent years, the contribution of producer services to GDP has shown a significant upward trend, and its role in absorbing employment is strengthening. In conjunction with the growing trend of industrial services, when manufacturing "squeezes out" part of the labor force, resulting in a higher unemployment rate, producer services demonstrate a more robust ability to drive employment. Employee welfare and employee safety training show no significant effect on the one-way employment of manufacturing enterprises by producer services enterprises.

3.2.2. Analysis of the results of the estimation of the equation of producer services

The results indicate that for every increase of 1 person in manufacturing employment, employment in producer services increases by 0.3306. The regression results show that the promotional effect of manufacturing on employment in producer services in A-share listed companies is smaller than the promotional effect of producer services on employment in manufacturing. This coincides with the current trend of servitization of manufacturing in China, which is conducive to manufacturing enterprises gaining competitive advantage and efficiency advantages, thereby improving their employment-driving ability.

Regarding control variables, the nature of enterprise equity shows no significant effect on the employment drive of producer services enterprises, consistent with both manufacturing enterprises and producer services enterprises. It is noteworthy that employee welfare and R&D innovation play a positive role in the employment drive of manufacturing, influencing producer services. This differs from the employment drive of producer services on manufacturing. With the growing trend of service-oriented manufacturing, especially where R&D innovation plays an important role, a higher level of employee welfare and technological innovation strengthens their employment drive on producer services. At the same time, it also shows that, at present, producer services enterprises in China's A-share listed companies are mainly characterized by a soft culture. The inclusiveness of enterprises and the soft skills of employees play an important reference role in the expansion of the employment scale of enterprises.

Another point of concern is that the employee wage level exhibits a suppressive effect in both manufacturing enterprises and producer services enterprises, being statistically significant at least at the 5% statistical level. This can be attributed to two main reasons. First, enterprises allocate a certain budget for recruitment, and in the case of enterprises with limited fault tolerance, an increase in employee wage levels naturally leads to a reduction in staff size. Second, with an expanding staff size and no significant increase in corporate assets, the benefits that employees can enjoy within the enterprise may diminish, affecting the employment-driven ability to improve. In the process of transitioning toward a market-oriented society, manufacturing enterprises serve as the cornerstone of a country's development, with the industry playing an important role in supporting the country's steady progress. Given the extended history of industrial development, government support for manufacturing enterprises has accumulated and surpassed the "inflection point" for promoting employment. Clearly, the government should be more inclined to support the producer services, while manufacturing enterprises themselves should focus on the improvement of "quality," fostering a corporate culture for employees and cultivating their own soft power.

In the preceding analysis, a particularly noteworthy phenomenon is the greater employment-driving effect for producer services on manufacturing compared to that of manufacturing on producer services. This constitutes one of the core conclusions of this paper, warranting further exploration.

Specifically, the following theories can be combined to analyze:

(i) Industry association theory: With the deepening of international division of labor and specialization, producer services have become distinct from manufacturing. Serving as an intermediate input for manufacturing, producer services initially rely on knowledge-intensive and innovative manufacturing enterprises. As industrialization progresses and producer services themselves develop and grow, the industrial linkage strengthens. The scale of producer services expands, becoming an important part of the national economy. Benefitting from economies of scale, producer services become suppliers for various manufacturing subsectors, with other industries increasingly dependent on their resources. Producer services take a leading and supporting role, providing specialized services for manufacturing and engaging in R&D, procurement, and marketing for manufacturing enterprises, naturally leading to a significant increase in the number of employees in each link.

(ii) Outsourcing theory and comparative advantage theory: Manufacturing enterprises outsource non-core business to producer services enterprises for profit maximization, thereby increasing the demand for producer services. For manufacturing enterprises, technological innovation is one of the important

strategies to reduce costs and maintain survival, necessitating strong support from knowledge-intensive service industries and consequently increasing demand for producer services industries. From a demand-supply perspective, producer services, as an important supply side for manufacturing, significantly boost employment.

3.3. Robustness tests

To further confirm the results and theoretical analysis of this paper, we adopt the index measurement method by replacing the dependent variables and conducting 3SLS regressions. Following the employment-driving effect measurement approach (Zhou & Li, 2006), the employment-driven index from manufacturing to producer services is replaced by the proportion of employees in this manufacturing enterprise relative to all employees in manufacturing enterprises. Similarly, the employment-driven index from producer services to manufacturing is replaced by the proportion of employees in this producer services enterprise relative to all employees in producer services enterprises. The results of the robustness tests are presented in Table 5.

Apparently, the results of the robustness test indicate that the role of the independent variables remains unchanged, all of which are significant, at least at the 5% statistical level, demonstrating a positive promotion. While the regression coefficients only change in size, the crucial observation that the employment-boosting effect of the producer services sector on manufacturing firms is stronger than the employment-boosting effect of the manufacturing sector on producer services firms remains unchanged. Based on the confirmation of this two-way employment-boosting effect, we proceed to classify producer services and manufacturing into different types and study their employment-boosting effects separately. This raises the need to further explore the classification of producer services and manufacturing industries into different types and study their employment-driving effects, respectively.

Table 5. Robustness test

Variable	Three-stage least squares method	
	Number of manufacturing employees	Number of producer services employees
Number of manufacturing employees		0.2965** (2.48)
Number of producer services employees	0.4842*** (18.62)	
Control variables	Yes	Yes
Province	Yes	Yes
Constant	−0.0103*** (−4.58)	0.0064** (2.43)
Observations	537	537
R-squared	0.7115	0.7021

Notes: *t*-values are shown in parentheses; *p<0.1, **p<0.05, ***p<0.01.

3.4. Heterogeneity of producer services

Based on the data availability and the classification standard of producer services in China's National Standard GB/T 4754-2017, this paper divides producer services into seven categories. Following the division of the high-tech services industry by the National Bureau of Statistics, producer services are further divided into high-tech services and non-high-tech services. High-tech services include internet and related services, telecommunications, radio and television, and satellite transmission services, as well as information transmission, software, and information technology services. Other industries are classified as non-high-tech services.

The regression results of the analysis on the driving effect of producer services on manufacturing employment are presented in Table 6. The results reveal that, when accounting for other control variables and regional dummy variables, both the high-tech services industry and the non-high-tech services industry exhibit a significant positive promotion effect on manufacturing. In addition, the employment-driving effect of the high-tech services industry is more prominent, approximately 2.85 times that of the non-high-tech services industry, highlighting a distinct scale technology effect.

The rationale behind this lies in the evident technological innovation characteristics of the high-tech services industry. With the rapid development of high-tech industries, such as the digital economy, its radiation penetration effect on the high-tech services industry has strengthened, leading to the gradual formation of talent

Table 6. The employment-driving effect of the subdivision type of producer services on manufacturing

Variable	Number of manufacturing employees
Number of high-tech services employees	1.1993*** (30.48)
Number of non-high-tech service employees	0.4214*** (16.49)
Control variables	Yes
Province	Yes
_cons	−267.5363 (−0.09)
Observations	98
R-squared	0.9838

Notes: *p<0.1, **p<0.05, ***p<0.01.

Table 7. The employment-driving effect of manufacturing subdivision types on producer services

Variable	Number of producer services employees
Number of high-tech manufacturing employees	0.0997 (0.63)
Number of non-high-tech manufacturing employees	0.6297*** (2.36)
Control variables	Yes
Province	Yes
_cons	89934.77** (2.51)
Observations	439
R-squared	0.7077

Notes: *p<0.1, **p<0.05, ***p<0.01.

density. The high-tech service system, concentrated in knowledge and high in added value, supports and propels the development of the economy, industry, and enterprises. It yields significant technology multiplication and scale effects, holding significant importance for expanding employment, cultivating new economic growth points, and optimizing industrial structure.

Research studies in the U.S. reveal that for every additional high-skilled job in the city, five consumer service jobs are created, including both skilled occupations (e.g., lawyers, teachers, and nurses) and unskilled occupations (e.g., service industry, hairdressers, and carpenters). For example, Apple, a representative high-tech company with a world-class R&D team, employs 12,000 people in the Cupertino area and creates over 60,000 additional local service jobs, including, among others, 36,000 unskilled jobs and 24,000 skilled jobs. This illustrates the more significant employment-driving effect of high-tech services on manufacturing (Moretti, 2012). Therefore, vigorously developing high-tech producer services remains the future direction.

3.5. Heterogeneity of manufacturing

Considering the data availability and the classification of high-tech manufacturing by the National Bureau of Statistics, manufacturing is divided into high-tech manufacturing and non-high-tech manufacturing. High-tech manufacturing includes pharmaceutical manufacturing, aerospace manufacturing, chemical products manufacturing, computer manufacturing, general equipment manufacturing, electrical machinery manufacturing, and instrument manufacturing, while the remaining manufacturing falls under non-high-tech manufacturing.

From the regression results as shown in Table7, it is evident that the employment-driving effect of high-tech manufacturing on producer services is not significant. In contrast, the employment-driving effect of non-high-tech manufacturing on producer services is statistically significant at the 1% level. This disparity can be attributed to findings from the "2022 Report on the Demand and Development Environment of High-tech Manufacturing Talents" released by China's major recruitment websites. The report indicates a remarkable 28.2% job growth rate in high-tech manufacturing during the first 4 months of 2022, far exceeding the industry average of 8.4%. This surge reflects a substantial demand for high-tech talents rather than through producer services. The strengthening of manufacturing servitization predominantly demonstrates a fusion of non-high-skilled services industries and new industries, thereby developing into a new growth point to drive economic growth. In addition, it demonstrates positive promotion for producer services.

4. Concluding remarks

Utilizing data from the CNRDS database of A-share listed companies spanning 2012 to 2020, this paper delves into the two-way employment-driving effect of manufacturing and producer services. The results reveal: (i) the two-way employment-driving effect of manufacturing and producer services is significantly positive, with producer services exhibiting a stronger effect on manufacturing enterprises, aligning with the findings of Li *et al.* (2017). (ii) Different subdivisions of producer services and manufacturing manifest distinct driving effects on their two-way employment. Both high-tech producer services and non-high-tech producer services exert a significant positive promotion effect on manufacturing, with high-tech producer services displaying a more prominent effect, approximately 2.85 times that of non-high-tech producer services, indicating a clear scale technology effect. However, high-tech manufacturing shows no significant driving effect on the employment of producer services, whereas non-high-tech manufacturing exerts a significant driving effect on employment in producer services at the 1% statistical level.

In most developed countries, the services industry is the primary source of new jobs. The results of this study indicate that producer services exert a stronger driving effect on manufacturing employment. The government should enhance its support for producer services enterprises and expand the employment opportunities within this sector, with particular attention to fostering synergies between producer services and emerging strategic industries such as the internet. At present, many of China's manufacturing industries are labor-intensive, and the "re-industrialization" of manufacturing industries has achieved little success. While China has achieved

remarkable success through the super-large-scale factor market inputs, relying solely on resource input is insufficient in the era of marketization. There is a pressing need to accelerate the service transformation of manufacturing industries and create an industrial development model suitable for China. In the current landscape, the vigorous development of digital technologies, such as artificial intelligence, big data, cloud computing, and the internet, uniquely blesses the transformation of the manufacturing services industry with digital technology. For producer services, high-tech industries such as information transmission, software, and information technology services should leverage digital technology to improve productivity and achieve comprehensive development. Meanwhile, low-tech industries such as wholesale and retail should be empowered by digital technology, transforming the quantitative advantage of the labor force into a qualitative advantage. This empowerment by digital technology provides an inherent innovation advantage for the servitization transformation of manufacturing.

Undeniably, this paper has certain limitations. Due to the limitation of data availability, the investigation of the two-way employment-driving effect of manufacturing and producer services is solely based on the data from the listed company. Given the substantial development gap among different regions in China, the concentration of listed companies is notably higher in the economically developed eastern regions. Consequently, we face the challenge of not being able to analyze whether this two-way employment-driving effect varies across different regions. Future research endeavors should encourage researchers to focus on enterprises in diverse regions, emphasizing the collection of data from unlisted companies. This approach would facilitate an in-depth exploration of the two-way employment-driving effect of manufacturing and producer services in different regions.

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Conflict of interest

The authors declare that they have no competing interests.

Author contributions

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Writing – original draft: All authors
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ACCSCIENCE PUBLISHING

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RESEARCH ARTICLE

Examining the effect of demographic and socioeconomic factors on household food insecurity in Lideta subcity, Addis Ababa, Ethiopia

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Abstract

Food security and vulnerability assessments in Ethiopia have traditionally focused on rural regions. In contemporary policy discussions, urban food security has garnered significant attention. Notably, there is a lack of empirical substantiation of urban food security and its impact on the livelihoods of city dwellers as they grapple with escalating food prices. The present study aims to determine the extent of household food insecurity and identify correlated factors among 692 households in three randomly selected Woredas (districts) within Lideta sub-city, Addis Ababa, Ethiopia. Six Ketenas (villages) were selected using a probability proportional-to-size technique from three Woredas between February and March of 2023. Data were collected through a validated survey administered by trained individuals, and household income and expenditure were used to measure food insecurity access. Chi-square (χ^2) and logistic regressions were used to identify factors associated with food insecurity in the region. The overall prevalence of household food insecurity in the study area was found to be 66.5%. Regression results indicate that seven of the hypothesized nine demographic and socioeconomic determinants of household food insecurity significantly influence the probability of experiencing food insecurity ($p < 0.05$). Household food expenditure, household dependency ratio, age, sex, educational status of the household head, access to savings and credit, and the urban productive safety net program were identified as significant determinants of urban household food insecurity. This study underscores that food insecurity in Ethiopia is not limited to rural areas but also affects urban regions, mainly due to high urban poverty rates. Strategies to reduce household size, improve the household dependency ratio, and enhance socioeconomic factors can empower households to build resilience against food insecurity. Policymakers should adopt measures to stabilize the food insecurity improve living standards, and enhance the economic capabilities of urban households.

Keywords: Factors; Food insecurity; Household; Lideta Sub City; Ethiopia

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1. Introduction

The world's population has experienced a remarkable increase, growing from 1 billion in 1800 to a staggering 8 billion today. At present, less developed countries in Africa, Asia, and Latin America account for 85% of the world's population but contribute to 99% of the global population growth (United Nations, 2022). These regions exhibit the highest fertility rates and childhood mortality rates, and they are predominantly found in the poorest and food-insecure countries (Boliko, 2019; FAO, 2020). Surprisingly, more than 800 million people worldwide suffer from undernourishment, with over 97% residing in developing countries. The global rate of undernourishment is on the rise, affecting 9.9% of the global population (FAO, 2021). Sub-Saharan Africa is experiencing the fastest population growth of any major region in the world, currently with a population of 1.3 billion (17% of the world population) (United Nations, 2022).

Ethiopia remains one of the world's most impoverished and food-insecure nations, with 30.8% of its population living below the poverty line (Odekon, 2022). The majority of urban households in Ethiopia, representing approximately 80%, experience food insufficiency, and they heavily depend on market mechanisms to meet their food needs. According to the Interim Report on 2015/16 poverty analysis study conducted in Ethiopia (FDRE, 2017), an estimated 14.8% of the urban population is categorized as falling below the food poverty line. In Addis Ababa, an estimated 19.1% of individuals experience food insecurity, defined as their inability to afford consumption items providing a minimum of 2,200 kcal (PDC, 2019). Similarly, in Lideta subcity, one of the most deprived subcities in Addis Ababa, an estimated 29.3% of the population suffers from food insecurity. The estimation indicates that nearly one-third of the population cannot access an adequate food intake (MOFED, 2018).

Urban food security is often a persistent issue influenced by increasing urbanization rates, fluctuations in food prices, and market instability (Boliko, 2019; Riley *et al.*, 2019). This chronic condition can last for extended periods, even throughout people's lifetimes (FAO, 2020), and is closely associated with urban poverty. A study conducted by Belachew *et al.* (2012) in Ethiopia demonstrated that chronic food insecurity in households can result in persistent malnutrition due to the inability to consistently access an adequate food supply. In situations where there is a surge in food prices, households that do not engage in food production, particularly in urban areas, are compelled to procure food through alternative means, predominantly food purchases. The purchasing power of these households is contingent on their income, making them vulnerable to the adverse effects of rising food prices and potentially limiting their access to an adequate food supply (Boliko, 2019).

While numerous investigations in this field have predominantly focused on national and regional contexts, they often overlook disparities within localities and subcities. The empirical data provided may not definitively authenticate circumstances that transpire at a fundamental level and may inadequately expose the magnitude of food insecurity predicaments within regional domains. As of late, there has been mounting concern over food insecurity among households residing in urban settings in Ethiopia. This predicament has correspondingly transpired as a repercussion of soaring food prices as well as conflicts that have arisen in certain areas of the country (CSA, 2022a; IDMC, 2021). The occurrence of the aforementioned unfavorable situation distinctly affects the food security of households residing in urban areas, thereby necessitating interdisciplinary research endeavors to determine the precise nature and degree of food security statuses. Consequently, the primary objective of this study is to bridge the existing gap in the relevant scholarly literature by comprehensively investigating the phenomenon of household food insecurity, including the identification of pertinent causal factors underlying it.

1.1. Theoretical framework

The phenomenon of food insecurity is intimately linked to the interrelated factors of food availability and access, as well as the attendant risks that may arise as a result of insufficient availability or restricted access to food. A household's capacity to overcome food insecurity depends on its human, material, and institutional resources, commonly referred to as "food security factors" in scholarly literature. These factors encompass educational attainments, employment opportunities, household demographics, urban agriculture practices, asset ownership, access to financial savings and credit facilities, the provision of clean water and sanitation, and the cost of living conditions (Ayele *et al.*, 2020; Dinku *et al.*, 2023; Ejigayhu & Edriss, 2012; Gazuma, 2018; Gezimu, 2012; Habte *et al.*, 2019; Opiyo *et al.*, 2018; Otekunrin *et al.*, 2021; Syafiq *et al.*, 2022). The most useful approaches for examining factors contributing to household food insecurity include Food Availability Decline (FAD), Food Entitlement Decline (FED), and the Political Economy Approach.

Food Availability Decline has garnered attention from scholars and policymakers in recent years. This phenomenon manifests in two distinct iterations. The

initial perspective attributes environmental phenomena, such as drought and floods, as primary factors contributing to reduced food production, whereas the subsequent viewpoint places emphasis on population growth (Taheri & Azadi, 2019). The concept of FED was introduced as a viable alternative to the notion of FAD (Burchi & Muro, 2012). According to the present approach, the occurrence of famine can be attributed to the inadequacy of entitlement, where disparate segments of the population are unable to attain control over their sustenance. Sen's (1981) analysis suggests that entitlement failure can result from either a direct cause, such as a decrease in production due to drought or flood, or an indirect one, including exchange-related factors or trade failure resulting from shifts in food prices.

The political economy framework, on the other hand, has identified various environmental and socioeconomic factors contributing to the predicament. These factors include accelerated population expansion, conflicts and civil wars (internal hostilities), drought, ecological deterioration, inadequate governance practices, asymmetric resource distribution, weak markets, institutional shortcomings, and political turmoil. According to Plümper & Neumayer (2009), the impact of this phenomenon can be mitigated through the provision of free or partially subsidized food allocation, the creation of job and income-generating opportunities for affected populations, the containment of epidemic outbreaks, and ensuring adequate access to health-care services. Evidently, the effectiveness of such measures is heavily contingent upon the specific nature of both the governing political system and pertinent state institutions.

Numerous studies have been conducted to assess household food insecurity in various contexts. The majority of the existing literature, including the present investigation, has utilized the political economy framework, with a specific focus on demographic and socioeconomic factors, to explore the various determinants of household food insecurity. For instance, a study conducted in the South Wollo zone of Ethiopia demonstrated a significant association between the sex of household heads and household food insecurity, where male-headed households were found to be more food secure than their female counterparts (Agidew-Meta & Singh, 2018). In the Woliso district of Ethiopia, another study revealed a statistically significant relationship between household food insecurity and both the dependency ratio and the educational attainment level of the household head, with a headcount ratio indicating that 25.2% of households were food insecure (Dula, 2019). Similarly, a study conducted in Wolaita, Ethiopia, found that household size and the educational level of household heads significantly influenced food insecurity, with a headcount ratio indicating that 71.6% of households were food insecure (Mota *et al.*, 2019). In Maphumulo Local Municipality, South Africa, a study indicated that education significantly affected food insecurity (Ngema *et al.*, 2018). A study conducted in Khamuan province, Laos, highlighted the importance of household size, food prices, monthly household income, and the sex of the household head in determining household food insecurity (Phouvong, 2020).

The study conducted by Tadesse *et al.* (2017) in Sodo town, Ethiopia, revealed that out of ten explanatory variables, five variables, namely the status of being a single household head, family size, number of daily laborers of household heads, monthly income, and food expenditure, exhibited significant influence on the food security status of households. According to the headcount ratio, 37.6% of the sampled households were deemed food insecure. Similarly, in Dessie and Combolcha cities in north-central Ethiopia (Dinku *et al.*, 2023), analysis using the binary logistic regression model demonstrated that three of the seven explanatory variables were statistically significant. These variables were sex, employment status, and house ownership. According to the headcount ratio, 33.1% of the sampled households were found to be food insecure. Furthermore, another study (Habte *et al.*, 2019) utilizing the logistic regression model indicated that monthly food expenditure, age of household head, and level of education were significant factors in determining urban food insecurity. The headcount index revealed that 69.6% of the total households fell below the food insecurity line.

Numerous investigations conducted in this field have demonstrated a preference for examining national and regional contexts (Dinku *et al.*, 2023; Donn *et al.*, 2016; Dula, 2019; Gebre & Rahut, 2021; Habte *et al.*, 2019; Phouvong, 2020; Tariku & Ayana, 2022), often giving less attention to disparities within localities and subcities. The empirical data provided in these studies may not definitively authenticate circumstances that transpire at a fundamental level and may inadequately reveal the magnitude of food insecurity predicaments within regional domains. Any of these investigations have primarily focused on rural environments, with limited attention given to metropolitan regions. The present study aims to investigate the prevalence of household food insecurity in the urban region of Lideta subcity, located in Addis Ababa, Ethiopia. The present study endeavors to identify and analyze the factors that correlate with household food insecurity within this specific subcity.

2. Data and methods

2.1. Study design and area

The study was conducted in Lideta subcity, located in the central-western area of Addis Ababa, bordered by Addis Ketema, Arada, Kirkos, Nifas Silk-Lafto, and Kolfe Keranio. The subcity is divided into ten Woredas. For the purpose of this study, three Woreds were randomly selected, and data were collected from respondents at their residencies within the subcity. Lideta subcity covers an area of 9.18 km^2 and has a total population of 284,208, comprising 134,372 males and 149,836 females. This study focuses on a densely populated and economically disadvantaged district in Addis Ababa, which has a population density of 30,960 people per km^2 (CSA, 2022b).

2.2. Sampling design and procedure

A cross-sectional study design was employed, and data between February and March 2023 in Lideta subcity were collected. The sampling strategy for this study was determined by the pre-established enumeration areas within the subcity, delineated by the Central Statistical Service of Ethiopia. Samples were drawn from the population using a multistage random sampling technique. In the multistage random sampling, three Woredas were randomly selected in the first stage. Subsequently, within each Woreda, different Ketenas were identified, and from each of these three Woredas, two Ketenas were selected using random sampling methods. In the final step, a total of six Ketenas were included in the selection process to yield 692 respondents (household heads). To further clarify, Woredas 01, 03, and 10 were selected through a lottery system. These three Woredas collectively encompass 12,078 households, and the selected Ketenas account for a total of 3,930 households. Sample households were then chosen using systematic random samplings, with selection proportional to their population within the randomly selected Ketenas.

2.3. Study variables

The outcome variable for this study is household food insecurity, which pertains to the availability of the financial resources required to consistently access food for the purpose of satisfying dietary, nutritional, and societal requirements. In this context, households capable of affording the purchase of consumption items that generate 2,200 kcal (daily caloric requirement) are classified as food secure, while those unable to do so are considered food insecure. Predictor variables and covariates include a range of demographic and socioeconomic variables, such as the age and sex of household head, marital status, family size, household dependency ratio (the percentage ratio of household members aged under 15 and above 65 to those aged 15 – 64), level of education, income and food expenditure, employment status, urban agriculture, access to savings and credit, and participation in the urban productive safety net program.

2.4. Statistical analysis

The data were collected using KoboCollect version 3.5 and subsequently meticulously entered into SPSS 24 software. A data cleansing method was employed to assess correctness and identify inconsistencies, ensuring data completeness and minimizing errors. The Chi-square test (χ^2) was employed to identify variables that exhibited a statistically significant association with household food insecurity. In this study, the variables with a $p < 0.25$ underwent a thorough examination for multicollinearity issues utilizing the variance inflation factor. Following the preliminary assessment, the identified variables were incorporated into the logistic regression model to determine their effect on the outcome variable (household food insecurity). Adjusted odds ratios, along with their respective 95% confidence intervals (CIs), were computed. A significance level of 0.05 was considered statistically significant in this study. To identify the most influential independent predictors of household food insecurity, logistic regression was conducted using a stepwise selection (LR) method.

2.4.1. Measurement of household food insecurity

The caloric value of foods that meet the recommended threshold of 2,200 kcal, as established by the Food and Agriculture Organization (FAO, 2004) for sustaining a healthy and moderately active adult, is determined by their corresponding national average prices, establishing what is known as the food poverty line. In the 2016 Interim Poverty Analysis Report, the estimated cost was 3,772 Birr per year per adult person in Ethiopia. However, this cost may not be feasible and needs to be adjusted based on the current food prices. Notably, the overall inflation rate has soared to 122.2% from June 2016 to January 2023. Calculating the annual food inflation, the estimated cost has risen to 11,524.52 Birr per year per adult (CSA, 2022a; NBE, 2022). Accordingly, the cost of one kcal is projected to be 0.0143 Birr.

In this paper, the national food poverty line was used to assess food insecurity status. The food poverty line determines whether a given household can have enough daily income to meet its members' minimum daily calorie needs. Therefore, households that cannot afford the money or are unable to source consumer goods for these daily calorie needs are considered to be food insecure. However, individual access to food depends on household food distribution and gender parity, which in practice means

that consumption patterns are not uniform (Battersby, 2011). Often, children, women, and older household members consume less food compared to male adults (Claro *et al.*, 2010). Per capita adult person equivalent estimate is obtained by dividing the total daily income/calorie by all household members, assuming a uniform food consumption pattern for families with different compositions. Therefore, if this adult person equivalent estimate was taken, 31.46 Birr/2,200 kcal would be used as a standard threshold to identify food-insecure households from those that are not. However, such an approach could make households food-insecure that was almost certainly not insecure since they fail to consider the presence of household members with distinct energy needs. Thus, in this paper, an adult-equivalent estimate of the calorie availability scale that has an adult-equivalent conversion factor was used (Appendix). The application of an adult-equivalent scale effectively narrows the variance between estimated and actual food intake, thereby enabling the discernment of the relative contributions of distinct household members toward the overall dietary pattern of the household, which is not feasible with the utilization of per capita metrics.

3. Results

3.1. Demographic and socioeconomic characteristics of respondents

Table 1 presents an overview of the demographic and socioeconomic characteristics of the participants in this study, encompassing a total of 692 households. Notably, approximately 64.3% of the household heads fall within the age bracket of 31 and 45 years old. In terms of marital status, the distribution of respondents is as follows: 442 individuals were married (63.9%), 119 were single (17.2%), 96 were divorced (13.9%), and 35 were widowed (5.2%). The majority, almost 80%, of the respondents had a household dependency ratio ranging from 0 to 100%. More than 50% of these households had family sizes exceeding 6 members, while the remaining 143 (20.7%) consisted of 3-member households. Educational attainment among the respondents varies, with the majority of respondents (38.7%) having completed secondary school, followed by those with a primary school education (24.6%). In addition, 14.6% held technical and diploma degrees, and only 10.0% had attained a tertiary level of education. In terms of employment, 13.7% of the heads of households were not engaged in any income-generating activities, while a substantial majority (86.3%) of the respondents were employed in various labor sectors at the time of the survey. Financially, the majority of respondents, approximately 83.1%, had access to savings and credit facilities. Furthermore, a significant proportion of respondents (54.5%) used the urban productive safety net program, with only 5.8% of respondents engaged in urban farming activities. When it came to monthly food expenses, almost two-thirds of heads of households (approximately 81.8%) reported spending 1000 – 3000 Birr. Moreover, an assessment of household food security status revealed that 66.5% of the sampled households were classified as food insecure, while the remaining 33.5% were categorized as food secure.

3.2. Factors associated with food insecurity in Lideta subcity

To determine the variables suitable for logistic regression, a Pearson's Chi-square test (χ^2) was conducted. Based on pre-defined criteria, the sex and age of household heads, educational status, household dependency ratio, employment status, participation in the urban safety net program, and monthly food expenditure were identified as suitable candidates for logistic regression. Although household size exhibited significance in Pearson's chi-square test (χ^2) at $p < 0.25$, it was excluded from the model due to concerns about multicollinearity with the level of household dependency ratio. After controlling for confounding factors, it was observed that the age and sex of the household head, household dependency ratio, food expenditure, level of education, access to savings and credit, and participation in the urban productive safety net program were statistically significantly associated with household food insecurity at a 95% CI (Table 2). Efforts were undertaken to assess the extent to which the necessary assumptions for the application of logistic regression were satisfied. In this context, the Hosmer–Lemeshow test for goodness of fit was performed to assess the fitness of the model, yielding a value of 0.317. The Nagelkerke R-squared model explained 65.1% of the variation in the observed data, providing insights into factors contributing to food insecurity in urban households.

The results of the study reveal that households led by male individuals exhibited a significantly higher likelihood of experiencing food insecurity, with an odds ratio of 2.72 when compared to households headed by female individuals. The age of the household head exhibited a positive correlation with the probability of food insecurity, with a high level of statistical significance denoted by $p < 0.05$. The study revealed that households led by individuals aged 31 – 45 years and those aged above 45 years face a heightened risk of food insecurity. Further analysis of the results discloses that households headed by individuals aged 31 – 45 years when compared to those led by individuals aged 15 – 30 years, exhibit a 3.69-fold increased likelihood of experiencing food insecurity.

Table 1. Demographic and socioeconomic characteristics of the respondents

Variables	Food insecure, % (*n*=460 [66.5%])	Food secure, % (*n*=232 [33.5%])	Total, % (*n*=692 [100%])	Chi-square test	
				χ^2	Significance
Sex of household head					
Female	59.6	40.4	47.3	13.01	0.000
Male	72.6	27.4	52.7		
Marital status of household head					
Married	69.9	30.1	63.9	66.48	0.308
Single	36.1	63.9	17.2		
Divorced	82.3	17.7	13.9		
Widowed	82.9	17.1	5.1		
Household size					
1 – 3	38.5	61.5	20.7	78.00	0.000
4 – 6	69.8	30.2	62.7		
≥7	88.7	11.3	16.6		
Age of household head					
15 – 30	45.2	54.8	18.2	32.95	0.000
31 – 45	72.6	27.4	64.3		
>45	66.1	33.9	17.5		
Household dependency ratio					
0 – 50%	57.7	42.3	42.1	21.90	0.001
50 – 100%	69.4	30.6	40.2		
>100%	80.5	19.5	17.8		
Education of household head					
Uneducated	94.2	5.8	7.5	80.30	0.000
Informal	65.6	34.4	4.6		
Primary	82.9	17.1	24.6		
Secondary	65.7	34.3	38.7		
Diploma and above	42.9	57.1	24.6		
Employment status					
Employed	60.9	39.1	46.5	15.41	0.001
Self-employed	67.3	32.7	39.7		
Pensioner	93.7	6.3	2.3		
Unemployed	81.0	19.0	11.4		
Access to savings and credit					
No	87.2	12.8	16.9	27.07	0.000
Yes	62.3	37.7	83.1		
Engaged in urban agriculture					
No	67.2	32.8	94.2	0.041	0.859
Yes	70.0	30.0	5.8		
Participation in urban safety net program					
No	31.4	68.6	55.6	1.71	0.191
Yes	36.2	63.8	44.4		
Monthly food expenditure (Birr)					
0 – 1000	95.2	4.8	9.5	297.68	0.000
1000.1 – 2000	89.8	10.2	45.0		
2000.1 – 3000	64.6	35.4	27.3		
3000.1 – 4000	22.7	77.3	13.5		
>4000	6.5	93.5	4.7		

Table 2. Coefficients and odds ratios of urban household food insecurity in Lideta subcity (*N*=692)

Demographic and socioeconomic variable	B	*p*	Exp (b)	95% CI of exp (b)	
Sex of household head (Reference group: "Female")					
Male	1.00	0.000	2.72	1.58	4.70
Age of household head (Reference group: "15 – 30 years")					
30 – 45 years	1.31	0.000	3.69	1.99	6.85
>45 years	1.63	0.000	5.12	2.12	12.38
Household dependency ratio (Reference group: "<50%")					
50 – 100%	0.72	0.008	2.06	1.21	3.52
>100%	1.89	0.000	6.68	2.97	14.99
Educational attainment of household head (Reference group: "Uneducated")					
Informal	−2.24	0.011	0.11	0.02	0.59
Primary	−1.39	0.050	0.25	0.06	1.00
Secondary	−1.84	0.007	0.16	0.04	0.61
Diploma and above	−2.17	0.002	0.11	0.03	0.45
Access to savings and credit (Reference group: "No")					
Yes	−1.00	0.012	0.37	0.17	0.80
Participation in urban safety net program (Reference group: "No")					
Yes	−0.95	0.000	0.39	0.24	0.64
Monthly food expenditure (Reference group: "≤1000")					
1000.1 – 2000	−0.57	0.390	0.56	0.15	2.08
2000.1 – 3000	−2.44	0.000	0.09	0.02	0.32
3000.1 – 4000	−4.50	0.000	0.01	0.00	0.05
>4000	−6.85	0.000	0.00	0.00	0.01

Moreover, for those headed by persons aged 45 years and above, the risk is even more pronounced at 5.12 times when compared to households led by individuals aged 15 – 30 years. Their corresponding 95% CIs are 1.99 – 6.85 and 2.12 – 12.38, respectively. In addition, the study's results indicate that households exhibiting a higher degree of dependency ratio, particularly within the ranges of 50 – 100% and >100%, exhibit a significantly elevated likelihood of experiencing food insecurity when compared to households with a dependency ratio of 0 – 50%. The odds ratios for households with dependency ratios of 50 – 100% and >100% were found to be 2.06 and 6.68, respectively.

The results of logistic regression analysis indicate notable variations in the probability of experiencing household food insecurity across different levels of education. Specifically, as educational attainment increases, there is a significant decrease in the likelihood of experiencing food insecurity. Moving from having no education to completing informal and primary education is associated with a significant decrease of 89% and 75%, respectively, in the likelihood of experiencing food insecurity. Moreover, moving from a lack of education to secondary education or obtaining a diploma and degree was also found to reduce the risk of food insecurity by 84% and 89%, respectively. In addition, household heads with access to savings and credit facilities experienced a significant reduction in the likelihood of food insecurity, estimated at 63% compared to those without such access.

The results of this study reveal a statistically significant association between participation in the urban productive safety net program and household food insecurity, with a significance level of $p < 0.05$. Specifically, households with access to urban safety net programs are significantly less likely to face issues of food insecurity. The odds of experiencing food insecurity are reduced by approximately 61% for households utilizing urban safety net programs compared to those without access to such programs. Furthermore, the present study identified an inverse correlation between the amount of monthly food expenditure and the extent of household food insecurity. This relationship holds statistical significance across all groups except for the 1000.1 – 2000 Birr group. Increasing the level of monthly food expenditure for sustenance from ≤1000 Birr to 2000.1 – 3000 Birr and to 3000.1 – 4000 Birr leads to a substantial decrease in the likelihood of encountering food insecurity by approximately 91% and 99%, respectively.

4. Discussion

The study reveals that 66.5% of the sample households experienced food insecurity. This finding is consistent with previous studies conducted in Addis Ababa City and Areka Town, Ethiopia, which reported rates of 71% and 69.6%, respectively (Habte *et al.*, 2019; Mota *et al.*, 2019). However, it deviates from the findings in the Woliso district, where the rate was 28.4%, and Addis Ababa city, which was reported having a higher prevalence at 75% (Birhane *et al.*, 2014; Dula, 2019). The observed discrepancies in these results could potentially be attributed to variances in study areas and data acquisition periods. This assertion suggests that the scale and severity of the issue may have been underestimated. Utilizing seasonal data and conducting multiple surveys could provide more robust and comprehensive evidence (Shone *et al.*, 2017; Tariku & Ayana, 2022).

4.1. Demographic characteristics and household food insecurity

The age of the household head demonstrated a positive association with household food insecurity, a finding corroborating several studies (Habte *et al.*, 2019; Mekonen *et al.*, 2023; Shone *et al.*, 2017). However, this observation contrasts with findings in other research (Mota *et al.*, 2019; Phouvong, 2020). The observed disparity could be attributed to recent changes in governmental policies and societal conditions, particularly in relation to younger demographics and factors such as technical and vocational education. Elderly household heads typically exhibit a lower tendency to engage in various income-generating activities compared to their younger counterparts. These households may also lack active income-generating household members and heavily rely on pensions as their primary source of sustenance (Habte *et al.*, 2019).

The sex of household heads was found to be a significant factor in determining household food insecurity at $p < 0.05$. The study's results indicate that households headed by males experience higher levels of food insecurity in comparison to those headed by females. This finding resonates with previous studies conducted in Dire Dawa City, Ethiopia and Kindo Didaye District of Southern Ethiopia (Aschalew & Ayalneh, 2009; Tabrizi *et al.*, 2018) but contrasts with other evidence (Dinku *et al.*, 2023; Mekonen *et al.*, 2023; Negesse *et al.*, 2020; Phouvong, 2020). The observed differences can plausibly be attributed to variations in socioeconomic factors across the study areas and the progression of female empowerment in professional employment and strategic influence (Minale, 2019). It can be posited that female heads of households exhibit a heightened sense of responsibility, leading them to prioritize the needs of their families and allocate ample attention to their family members. The presence of a female as the head of the household exerts an influence on an increased calorie supply, which may be attributed to the variations in expenditure preference observed between households headed by males and their female counterparts (Aschalew & Ayalneh, 2009).

The present study has revealed that households with a lower dependency ratio are more likely to achieve food security compared to those with a higher dependency ratio. All other factors being equal, household food insecurity increases nearly 6.68-fold when the dependency ratio increases by more than 100%, in contrast to households with dependency ratios of 0 – 50%. This finding is consistent with the findings from previous studies conducted in Addis Ababa and the Woliso district of Ethiopia (Birhane *et al.*, 2014; Dula, 2019; Tariku & Ayana, 2022). The rationale behind this observation can be attributed to the non-contributory role played by dependent members in generating income designated for purchasing food. Instead, resources are shared among dependent family members for other necessities such as children's education, clothing, nutrition, and health-care expenses for older family members who rely on others for support (Akukwe, 2020; Tariku & Ayana, 2022).

4.2. Socioeconomic characteristics and household food insecurity

The level of education was also found to be a significant determinant of urban household food insecurity at $p < 0.05$. The results indicate that households headed by individuals with higher levels of education are more likely to experience food security compared to those led by illiterate household heads. This finding aligns with studies conducted in different regions of Ethiopia (Dula, 2019; Mota *et al.*, 2019; Ngema *et al.*, 2018; Tadesse *et al.*, 2017). The plausibility of this observation stems from the belief that education has a significant impact on various aspects of individual and societal progress. This impact includes enhancing work proficiency, developing competencies, diversifying income sources, and fostering a vision for creating a conducive environment for educating dependents. This strategy can ultimately pave the way for long-term improvements in living conditions, a stark contrast to the dire circumstances typically experienced by individuals lacking such education (Akukwe, 2020; Habte *et al.*, 2019).

Household heads with access to savings and credit were found to be food secure compared to those without access to savings and credit at $p < 0.05$. This finding corroborates with several past studies (Ejigayhu & Edriss, 2012; Mekonen *et al.*, 2023) but contradicts the findings of other previous studies (Phouvong, 2020; Tadesse *et al.*,

2017). Membership in a savings association, accompanied by a sufficient account balance, implies the presence of surplus funds that can be allocated to alleviate household food insecurity. Alternatively, access to credit facilitates the household's participation in ventures aimed at generating income, thereby enhancing financial resilience and purchasing power, ultimately mitigating the risks associated with food insecurity (Ejigayhu & Edriss, 2012; Sani & Kemaw, 2019).

Similarly, households that participated in urban productive safety net programs were found to be food secure compared to those without access to such programs ($p < 0.05$). This finding is consistent with previous studies (Fan & Cho, 2021; Yibrah, 2014). The rationale behind this phenomenon can be attributed to the fact that these programs empower urban communities that grapple with persistent issues related to food insecurity. Moreover, these programs facilitate the establishment of assets and the cultivation of resilience, ultimately contributing to the realization of food self-sufficiency objectives (Welteji *et al.*, 2017; Wondim, 2018).

The level of household food expenditure was also found to be a significant determinant of household food insecurity at $p < 0.05$, and this finding corroborates several previous studies (Habte *et al.*, 2019; Phouvong, 2020; Tadesse *et al.*, 2017). This association can be attributed to the diminished purchasing capacity of households in the low-income bracket, which impedes their ability to consistently and timely procure food provisions to cater to their familial requirements. The occurrence of food insecurity and poverty within urban households in the sub-city can be attributed to the escalation of food inflation (Habte *et al.*, 2019; Tariku & Ayana, 2022).

4.3. Strengths and limitations

The study findings have been substantiated by employing rigorous statistical analysis techniques and achieving high response rates in the data collection process. Moreover, the use of a thoroughly validated structured questionnaire has likely reduced the potential for instrumental and inter-rater biases. However, it is essential to acknowledge that despite the extensive exploration of determinants of urban household food insecurity and adjustments for potential confounding variables, the cross-sectional design of the dataset limits our ability to establish definitive cause-and-effect relationships between the outcome and independent variables.

5. Conclusion

The present study delineates the demographic and socioeconomic attributes of individuals experiencing food insecurity in the Lideta subcity of Addis Ababa. Its objective is to discern the underlying factors contributing to urban household food insecurity through the implementation of the logistic regression model. The findings of the regression model revealed that seven out of the eleven independent variables exhibit statistical significance. It is worth noting that the magnitudes and directions of the significant parameters varied, as predicted by common expectations. When controlling for all other confounding variables, it was observed that sex, age, household dependency ratio, education level, participation in the urban productive safety net program, and access to savings and credit had a significant impact on household food insecurity in the sub-city. Therefore, it is anticipated that stakeholders will engage in collaborative efforts across diverse sectors, expanding urban productive safety net initiatives, job creation endeavors, food market stabilization strategies, and initiatives aimed at strengthening women's economic empowerment. The overarching goal is to ensure that households within the Lideta subcity have reliable access to food. These collective endeavors are expected to yield optimal outcomes in ensuring that the population has consistent access to an adequate and diverse food supply. Continuous, long-term surveys and the use of standardized measurement tools, such as the Household Food Insecurity Access Scale, should be employed in future studies to establish causal relationships among variables and discern the various levels of food insecurity. This is imperative in establishing a comprehensive understanding of the phenomenon under investigation.

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Conflict of interest

The authors declare no conflict of interest.

Author contributions

Conceptualization: Ephrem Tadesse Goda, Terefe Degefa Boshera
Formal analysis: Ephrem Tadesse Goda
Methodology: Ephrem Tadesse Goda
Writing – original draft: Ephrem Tadesse Goda
Writing – review & editing: All authors

Ethics approval and consent to participate

A letter of support was obtained from Addis Ababa University, College of Development Studies, and the Center for Population Studies. Letters were distributed to all respective Woredas. Informed consent was obtained from participants before the commencement of data collection. The purpose of the study was explained to both the respondents and the Woreda experts.

Consent for publication

Informed consent was obtained from participants before the commencement of data collection.

Availability of data

The datasets can be obtained from corresponding author following formal request.

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Appendix

Appendix: Conversion factor for estimation of adult-equivalent calorie requirements

Age (years)	Adult-equivalent conversion factors
Newborn	
0 – 1	0.29
Children	
1 – 3	0.51
4 – 6	0.71
7 – 10	0.78
Men	
11 – 14	0.98
15 – 18	1.18
19 – 24	1.14
25 – 50	1.14
>51	0.90
Women	
11 – 14	0.86
15 – 18	0.86
19 – 24	0.86
25 – 50	0.86
>51	0.75

Source: Claro *et al.* (2010). Per capita adult-equivalent estimates of calorie availability in household budget surveys. *Cademos de Saúde Pública*, 26 (11).

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REVIEW ARTICLE

LGBTQI+ asylum seekers and refugees: Recognition and public policies for protection

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Abstract

The LGBTQI+ and refugee agendas are interconnected, and there are frequent instances where LGBTQI+ asylum seekers and refugees experience mistreatment and rights violations during the asylum process. Since the first LGBTQI+ refugee requests took place in the 1990s, the topic has not yet been satisfactorily debated. Although states have been creating norms and programs targeting this population, some of these initiatives do not seem to reach local realities, and persistent gaps hinder the ability of LGBTQI+ asylum seekers and refugees to fully enjoy their rights, especially when specific subgroups are isolated and analyzed. Shedding light on the migratory policies established in Europe and acknowledging that some specific migrant populations have received modest academic attention; thus far, this work seeks to investigate the main issues discussed thus far by the literature on the specific hardship, violence, and intersectional discrimination suffered by LGBTQI+ asylum seekers and refugees during the asylum application and procedure. It also aims to disseminate the role public policies play in protecting and encouraging social inclusion and rights, not only for this portion of the population as a unified group but also for this acronym that encompasses a relatively diverse population in need of innovative policies for comprehensive inclusion.

Keywords: LGBTQI+ asylum; Asylum seekers; Refugees; Public policies; Systematic literature review

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1. Introduction

The 21st century has started with a significant increase in the number of forcibly displaced persons. Calculating the exact size of this migrant population is challenging. However, in the past 10 years alone, at least 100 million people have fled home, either seeking refuge outside their home countries or staying within their states' borders. These numbers have shown no sign of decreasing since 2011; in fact, they had more than doubled from 2011 to 2019 (from 38.5 to 79.5 million people). This increase can be mainly attributed to conflicts and humanitarian crises in Syria, South Sudan, Ukraine, Myanmar, Venezuela, Afghanistan, Iraq, Libya, Somalia, Africa's Sahel region, Central African Republic, Ethiopia, Democratic Republic of the Congo, Yemen, and Ukraine (United Nations High Commissioner for Refugees, 2020). These statistics are far from insignificant in numerical terms, and they hold significant meaning for a region recognized for its role in protecting individuals and preserving lives.

In this scenario, literature reports cases of asylum seekers and refugees facing hostility, physical and psychological violence, as well as denials of adequate protection, information, fundamental rights, and access to specialized personnel and services (Zaun, 2017). Furthermore, some states place asylum seekers in isolated, remote, or inaccessible locations and impose mandatory detention and confinement, which often results in torture, refoulement, and other rights violations. Even when these issues are raised or questioned, they often devolve into a matter of the state's word against the victim. This is primarily due to the absence of proper complaint mechanisms or inter-state accountability, which would otherwise help prevent or mitigate such violations and disregard for international obligations that happen regularly (Gammeltoft-Hansen, 2011).

The "banalization" of rights violations affecting asylum seekers – among other migrant populations – appears to challenge the legal system responsible for ensuring the observance of certain rights. These rights, due to their essential nature in protecting individuals, are categorized as human rights and are incredibly crucial for members of vulnerable social groups (Ramos, 2018). On a similar note, politicians and the media also contribute to the marginalization of asylum seekers and refugees, as well as the harsh response toward migrants and their rights, by encouraging xenophobia and deep-rooted prejudice against these populations (Whittaker, 2006).

LGBTQI+ (lesbian, gay, bisexual, transgender, queer, intersex, and other sexual and gender identities) asylum, more specifically, has received relatively modest attention, and everything indicates that it falls short of the importance and grandeur that the phenomenon should arouse. The first decisions date back to the 1990s, coinciding with a particular consolidation of the LGBTQI+ movement following the Stonewall Uprising, which catalyzed the demand for rights in Europe and the United States of America. Taking into consideration the high number of asylum seekers and refugees worldwide, the reported violations of their rights, the particular vulnerability of LGBTQI+ individuals, and the continuously expanding literature on both LGBTQI+ individuals and LGBTQI+ asylum, this article aims to raise awareness of the vulnerability faced by LGBTQI+ asylum seekers and refugees, especially those who find themselves in a position where their intersectional characteristics are overlooked by public agents. In addition, it seeks to disseminate the role that public policies play in protecting and encouraging social inclusion and rights for this segment of the population.

Based on the premise that cultural diversity is indispensable to humanity and that migration is a means for constructing a more solidary and diverse planet, besides being a human right (Freitas Júnior *et al.*, 2017), it should be noted that mass migratory movements give rise to planned actions (Whittaker, 2006) to prevent them from reaching the magnitude of an avoidable scourge. The strategy of using research to garner public interest is corroborated by Jung (2015), who affirms that research-based actions concerning LGBTQI+ asylum seekers and refugees can influence public opinion, practices, and policies. A comprehensive literature search reveals a scarcity of literature on LGBTQI+ issues within scientific databases (Zanin, 2019), which appears to corroborate Jung's statement, as this segment of the population has, if not stressed enough, often been put in a subaltern position since the inception of its organized movement. Therefore, addressing LGBTQI+ asylum contributes to raising awareness and improving the services provided by the states (Ferreira, 2011).

2. Human rights violations and LGBTQI+ individuals as a particular social group

Despite human dignity being inherent in every human being, which should be sufficient to protect them from discrimination and ensure minimum survival standards (Ramos, 2018), the reality does not comply with such a maxim. On the contrary, LGBTQI+ individuals are constantly denied fundamental rights and marginalized due to their non-conforming sexual orientation and gender identity (Donnelly, 2013). The origins and reinforcement of hatred toward LGBTQI+ individuals seem to have diverse roots, encompassing not only religious beliefs but also so-called principles, cultural preservation, anti-Western nationalism, and colonial heritage (Holley, 2015), especially the sodomy laws left behind as a legacy by the British colonial rule (Bruce-Jones, 2015; Han & O'Mahoney, 2014; Ibrahim, 2015). As "the education of colonial subjects complements their production in law" (Spivak, 2010, p. 57), LGBTQI+ individuals are still denied access to fundamental human rights such as employment, housing, and health care (Flage, 2019; Jovanović, 2020; Sherriff *et al.*, 2019; Yilmaz & Göçmen, 2016), and continue to be persecuted by both public and private parties (Makia, 2019). LaViolette (2010) affirms that violent acts against sexually minoritized groups, whom the author defines as LGBTQI+ individuals, are often committed by private parties rather than state agents. These acts may include assault, rape, torture, and pressure to conform to social rules regarding gender roles. Despite this, LGBTQI+ persecution was not included in the core motivations for seeking asylum, as outlined in the 1951 Refugee Convention, nor in any subsequent convention. However, due to the denial of rights, discrimination, and

the threat of harsh criminal penalties faced by LGBTQI+ individuals, it gradually became apparent that the category of "membership of a particular social group," as provided for in Article 1A(2) of the Refugee Convention, should include LGBTQI+ individuals through a human rights approach to the Refugee Convention. According to the current UNHCR guidelines, membership of a particular social group is defined as:

> "[...] a group of persons who share a common characteristic other than their risk of being persecuted, or who are perceived as a group by society. The characteristic will often be one which is innate, unchangeable, or which is otherwise fundamental to identity, conscience, or the exercise of one's human rights (United Nations High Commissioner for Refugees, 2012, p. 12)."

The first asylum claims based on sexual orientation or gender identity appear to date from the 1990s, possibly due to certain consolidation of the LGBTQI+ movement and the growing demand for rights. During this period, decisions were made that declared individuals as refugees or granted them asylum in the United States of America, Canada, Belgium, France, Finland, Germany, the Netherlands, and the United Kingdom (LaViolette, 2009; 2010). Since the 1990s, literature has significantly contributed to the development of this theme. Regarding the persecution subject, Goldberg (1993, p. 606) listed possible ways in which LGBTQI+ individuals may be persecuted, such as "harassment and assault, involuntary institutionalization, punishment under laws that impose extreme penalties, including death." The notion of a well-founded fear of persecution is often disputed due to the difficulty of assessing it in real-life events. This is compounded by the lack of comprehensive global information and reports on LGBTQI+ persecution in many countries. In addition, the criminalization of same-gender activity in a given state is also not consistently interpreted as persecution, necessitating the use of data to support such a claim, which, as stated before, is rarely at hand. The idea of continuity or the cumulative suffering that discrimination can cause is reinforced by Shah (2013). Shah also emphasizes that individuals could have been harmed in the future if they had not fled, which aligns with the current understanding of the UNHCR as outlined in the Guidelines on International Protection No. 1: Gender-Related Persecution within the context of Article 1A(2) of the 1951 Convention and/or its 1967 Protocol relating to the Status of Refugees (HCR/GIP/02/01) (United Nations High Commissioner for Refugees, 2002a).

On the issue of credibility, the literature points out that applicants are expected to present evidence and a story that conforms to Western characteristics – usually stereotyped – attributed to LGBTQI+ individuals (Jung, 2015; Millbank, 2004; Murray, 2014). This expectation overlooks the fact that some LGBTQI+ asylum seekers' characteristics and lived experiences may extend beyond the hegemonic frameworks applied to the analysis of LGBTQI+ individuals (Luibhéid, 2008), which are primarily focused on European or North American gay men. Ultimately, they must also satisfy their adjudicator's understanding of LGBTQI+ sexuality and identity, as each application is reviewed by an officer with their own idea of how a lesbian, a trans woman, an intersex person, or a non-binary person, to illustrate, should behave (Millbank, 2009; Tobler, 2014).

> "When testing the credibility of the claimant's story, immigration officials, and judges often assume that all queer people engage in cross-gender identification or that they immediately engage a gay public life on arrival in the new country by frequenting gay establishments. Queer asylum seekers are, thus, assumed to be "out" in a particularly recognizable way associated with white middle-class Western-style commercialism and consumerism, and if they are not, their credibility is deemed severely questionable (Jung, 2015, p. 312)."

In summary, only those who conform to recognized forms of LGBTQI+ identity are declared refugees (Sabsay, 2012), marginalizing those who do not limit themselves to binary self-identification (Bruce-Jones, 2015). Furthermore, these subgroups are rarely explored academically, as a consequence and a symptom of minor to no attention paid in bespoke policymaking. Even some of the recent European legislation on asylum and immigration exhibit bias or shy away from addressing sexual orientation and gender identity issues. They continue to use outdated terms like "sex" instead of "gender" (Council of the European Union, 2013) and overlook specific situations of vulnerability related to sexual orientation and gender identity (Council of the European Union, 2011). This seems to constitute a grave problem in meeting the special reception needs of LGBTQI+ asylum seekers, especially those seeking refugee status based on sexual orientation or gender identity. While there is some bibliographical information available on LGBTQI+ asylum seekers today, institutions like the European Asylum Support Office (EASO), for example, still do not, as per their website, provide training on vulnerable groups other than children. Their focus, to date, remains solely on activities related to children (European Asylum Support Office, 2022). All of these factors corroborate the pressing need to systematically address LGBTQI+ issues in both public discourse and legislative spaces to ensure their rights are acknowledged and carefully considered.

3. UNHCR considerations on LGBTQI+ individuals as a vulnerable social group

While the UNHCR has made progress, there are still inaccuracies in how it addresses LGBTQI+ individuals. Since 2002, at least 51 years after the Refugee Convention and 9 years after the first decision of the Canadian claim to refugee status based on sexual orientation, the UNHCR has directly mentioned the inclusion of LGBTQI+ individuals as part of a particular social group. This recognition has been further legitimized through the publication of several UNHCR documents that suggest guidelines to be followed when dealing with these asylum seekers, namely, the Guidelines on International Protection No. 1: Gender-Related Persecution within the context of Article 1A(2) of the 1951 Convention and/or its 1967 Protocol relating to the Status of Refugees (HCR/GIP/02/01) ("Guidelines No. 1"), the Guidelines on International Protection No. 2: "Membership of a Particular Social group" within the context of Article 1A(2) of the 1951 Convention and/or its 1967 Protocol relating to the Status of Refugees (HCR/GIP/02/02) ("Guidelines No. 2"), the 2008 UNHCR Guidance Note on Refugee Claims Relating to Sexual Orientation and Gender Identity ("2008 Guidance Note") – later updated and substituted by the Guidelines on International Protection No. 9: Claims to Refugee Status based on Sexual Orientation and/or Gender Identity within the context of Article 1A(2) of the 1951 Convention and/or its 1967 Protocol relating to the Status of Refugees ("Guidelines No. 9") – as well as the 2011 Handbook and Guidelines on Procedures and Criteria for Determining Refugee Status under the 1951 Convention and the 1967 Protocol Relating to the Status of Refugees, later updated in 2019 ("Handbook") (United Nations High Commissioner for Refugees, 2002a; 2002b; 2008; 2012; and 2019).

Guidelines No. 1, first mentioned in Items 14 – 17, describe how discrimination could constitute a legitimate reason for fleeing persecution and mention sexual orientation and sexual practices as a reason one is persecuted. It also affirms that "refugee claims based on differing sexual orientation contain a gender element" (United Nations High Commissioner for Refugees, 2002a, p. 4). While this assertion is inaccurate, it delineates the beginning of the stipulations in this sense. On the other hand, Guidelines No. 2 acknowledges that being part of a particular social group was being "invoked with increasing frequency in refugee status determinations, with States having recognized […] homosexuals, as constituting a particular social group for the 1951 Convention" (as it may have implied "LGBTQI+" or "queer individuals") (United Nations High Commissioner for Refugees, 2002b, p. 2) and provides stipulations and guidelines that should be observed for such cases.

The LGBTQI+ asylum scholarship praised the 2008 Guidance Note as it was the first time UNHCR had developed a specific and comprehensive document on LGBTQI+ asylum. The note highlighted that physical and sexual violence, harassment, intimidation, and threats, among other factors, could be considered forms of persecution. These forms of persecution can happen when access to fundamental rights such as education, health, and judiciary is denied. However, it is important to note that the 2008 Guidance Note was considered incomplete and poorly discussed with stakeholders before publication. LaViolette (2010) criticized the 2008 Guidance Note for failing to correctly and thoroughly address the existing correlation between sexual orientation and gender identity for asylum purposes, as it primarily associated gender issues with lesbian women, neglecting the experiences of other LGBTQI+ individuals. The note also failed to emphasize the difference between discrimination and persecution, inadequately addressing intersex and bisexuality and offering limited insights into the protection provided by the state of nationality. Furthermore, the 2008 Guidance Note did not delve deeply into the topic of LGBTQI+ asylum detention, a critical issue as LGBTQI+ individuals are particularly vulnerable within detention centers. Identifying individual members of the LGBTQI+ social group in such environments is challenging, leading to limited international law development and data on LGBTQI+ individuals within detention centers, as some prefer to conceal their identity. Within these detention centers, LGBTQI+ asylum seekers are susceptible to physical and sexual harassment, violence, verbal abuse, threats, social and physical isolation, and lack of access to medical services, hormonal therapy, and mental health care. They may also be subjected to solitary confinement. Alternative measures to detention are recommended to address these challenges. The first international ruling on LGBTQI+ detention in an immigration context was issued in 2012 by the European Court of Human Rights in the case of X v. Turkey, which found that segregating LGBTQI+ detainees violated their human rights and hindered their access to detention center services (Tabak & Levitan, 2014).

It is also relevant to remember that not only LGBTQI+ asylum seekers who are persecuted on the grounds of their sexual orientation or gender identity may face immigration issues. LGBTQI+ asylum seekers who are persecuted on other grounds defined by the Refugee Convention may also encounter immigration challenges. However, merely identifying as LGBTQI+ individuals is sufficient to include them in the LGBTQI+ asylum seekers' social group, which can trigger prejudice and vulnerability, as described above. Guidelines No. 2, with its purpose of discussing

membership of a particular social group, included "homosexuals" in its interpretation of Article 1A(2) of the Refugee Convention. In contrast, the primary purpose of Guideline No. 9 is to discuss and theorize claims to refugee status based on sexual orientation and gender identity. This document places a significant emphasis on the content, definition, and correct use of terms and expressions that characterize the LGBTQI+ community. Published in 2012, it takes a more contemporary approach and complements the 2011 Handbook (United Nations High Commissioner for Refugees, 2012).

The Handbook does not mention LGBTQI+ individuals anywhere in the book, not even in the chapters addressing persecution, discrimination, and membership of a particular social group. In these chapters, the Handbook reinforces examples related to race, religion, and nationality. However, in the 2019 reissue of the Handbook, a specific foreword was added to acknowledge the inclusion of LGBTQI+ issues. The inclusion incorporated Guidelines No. 1, 2, and 9, among other documents, as annexes at the end of the book (United Nations High Commissioner for Refugees, 2019). In Guidelines No. 9, there is a thorough theorization and reporting on the LGBTQI+ community and the claim to refugee status based on sexual orientation and gender identity. Furthermore, it is important and relevant that UNHCR acknowledges the inherent limitation in defining terms and recommends interpreting membership of a particular social group in an evolving manner (United Nations High Commissioner for Refugees, 2002a). This approach can be extended to the terms used in the Refugee Convention as a whole, reinforcing the human rights approach as a cornerstone of International Refugee Law.

4. A systematic literature review on European LGBTQI+ asylum policies

To understand the current discussions on LGBTQI+ asylum policies, particularly whether they have addressed specific subgroups, a systematic literature review was conducted on five large databases, as follows: HeinOnline, DART-Europe Portal, Bielefeld Academic, University of São Paulo Portal, and CAPES Portal. The databases were chosen out of convenience based on their scope, reach, and ease of access. The search aimed to identify original works in the form of articles, theses, books, book chapters, reports, and other documents that discuss or propose LGBTQI+ asylum policies in Europe or European states. A set of keywords, arranged in various combinations, was used to retrieve relevant documents, including "affirmative action," "affirmative policies," "asylum policies," "asylum," "Europe," "LGBT," "queer," "refugee," "refugee policies," and "sexual orientation." Out of 309 documents found, 64 were selected for analysis based on their abstracts, tables of content, introductions, and conclusions. This analysis aimed to determine whether they addressed LGBTQI+ asylum and refugee policies and experiences in Europe or any specific European state at the domestic, regional, or international levels. The selected documents will be further described in terms of their scope and the population they studied.

In addition to articles that addressed the European continent or the European Union (EU) as a whole, the review included articles from 16 other states: Austria, Belgium, Denmark, France, Greece, Germany, Italy, the Netherlands, Norway, Portugal, Serbia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. It is worth noticing that, apart from Turkey, these states are situated in Northern, Southern, and Western Europe. To achieve a more comprehensive understanding, it is essential to locate more studies covering Eastern European countries, which were not found in this systematic review.

This systematic review revealed that the majority of articles (15.7%) concentrated on the presence of stereotypes during the asylum process, particularly related to how LGBTQI+ individuals are expected to express their identity and sexuality. Following this, 11.2% of the articles focused on topics such as training, sensitization, and expert advice related to LGBTQI+ asylum issues. Another 11.2% of the articles discussed the infrastructure provided to LGBTQI+ asylum seekers and refugees, encompassing reception conditions, accommodation center facilities, and the provision of essential services. The fourth category pertained to the vulnerabilities faced by LGBTQI+ individuals during the asylum process and the necessity for specialized procedures to support them (9.1%). Finally, 8.6% of the articles examined the support offered by non-governmental organizations to LGBTQI+ asylum seekers and refugees.

When it comes to addressing stereotypes, which is the most discussed category and, therefore, receives the most attention, one document critiques the fact that many states are looking for a particular LGBTQI+ profile and only desire to welcome those who conform to their westernized criteria: "Norway can be a haven for queer asylum seekers, but merely for those who adhere to Norway's homonormative understanding of sexual identity and gender identity" (Torvik, 2017, p. 84). Gill and Good (2019) highlight a paradox in the acceptance of LGBTQI+ asylum seekers and refugees in European states. While these states portray themselves as representatives of human rights that create communities with shared values, in the end, they retain discretionary rights to decide who enters

their territories. Another issue that falls under the broader category of "stereotypes" is the persistent discrimination against LGBTQI+ individuals in the asylum system and their everyday lives. This fact highlights that many states have not yet extended their LGBTQI+ asylum policies beyond the asylum context. It underscores the importance of developing policies to promote social inclusion, given that social issues, such as homophobia, transphobia, and xenophobia, remain prevalent in many European states and must be therefore combated (Vasiljević, 2015). Long-term solutions, however, can only be found by addressing the root causes of migration in all forms (O'Nions, 2014).

Based on the systematic literature review, it was observed that some LGBTQI+ asylum programs appear to innovate in their approach, and these innovations were not mentioned in the context of other countries in this research. These innovative practices include the following:

(i). Relocating perpetrators of homophobic and transphobic behaviors to other reception facilities (Belgium).
(ii). Using accessories with the rainbow flag and phrases like "queer refugees welcome" to enhance confidence and trust (Germany).
(iii). Allocating a 20% higher renting allowance to asylum seekers and refugees with special protection needs (Germany).
(iv). Offering the option to request a special interviewer trained to conduct LGBTQI+ interviews (Germany).
(v). Allowing LGBTQI+ asylum seekers to collectively self-organize their housing facilities (Greece).
(vi). Accepting self-identification as LGBTQI+ (Portugal).
(vii). Promoting LGBTQI+ awareness among all parties involved in asylum issues (Sweden).
(viii). Employing migrants to work on gender and LGBTQI+ issues with the wider community (Turkey).
(ix). Creating and maintaining a secret shelter for LGBTQI+ asylum seekers and refugees (Turkey).
(x). Discouraging the use of stereotypes in determining credibility in asylum claims (UK).

While the initiatives mentioned above are often attributed to the states directly, some are actually developed in the local and provincial contexts only. For example, the 20% higher rent allowance is specific to Berlin, Germany, and the employment of asylum seekers and refugees, as well as the creation of a secret shelter, is carried out in Şişli, Turkey. Local, municipal, and provincial governments are usually competent to deal with certain aspects of asylum law, as noted by the Program Director of the German program and the literature (Zaun, 2017). As one of the articles mentions, there are advantages in using local government creativity instead of a one-size-fits-all approach to asylum (Lowndes & Polat, 2020).

Furthermore, the literature provides valuable suggestions that programs can adopt to better address the needs of LGBTQI+ asylum seekers and refugees. These suggestions are summarized and compiled below, with similar ideas grouped into unified categories:

(i). Providing basic LGBTQI+ asylum information in multiple languages and channels.
(ii). Offering support to NGOs working with LGBTQI+ asylum, including financial assistance, collaboration, capacity building, and connecting LGBTQI+ asylum seekers with relevant organizations.
(iii). Collecting and publishing data on LGBTQI+ status and including LGBTQI+ status in health surveys to create tailored health services for LGBTQI+ asylum seekers and refugees.
(iv). Being mindful of how Western stereotypes and societal perceptions of sexuality and gender identity affect LGBTQI+ asylum.
(v). Improving specialized legal services.
(vi). Providing asylum seekers with a confidential, private, and appropriate interpretation service, allowing them to appoint their own interpreter paid by the state and allowing the change of such a person when the asylum seeker is not satisfied with them.
(vii). Providing training and sensitization to those who provide services in the asylum system, not only concerning LGBTQI+ experiences with discrimination, differences between gender identity and sexual orientation, history, and terminologies but also LGBTQI+ cross-cultural knowledge.
(viii). Advocating for EASO to promote training, guidelines, and good practices on addressing LGBTQI+ asylum, ensuring domestic authorities follow a consistent LGBTQI+ asylum policy, and recognizing and not reproducing colonial and imperialistic narratives in the asylum system.
(ix). Placing LGBTQI+ asylum seekers in a category with special reception needs, acknowledging the discrimination and violence they may face, and calling on EU member states to include in their domestic legislation the definition of social groups and LGBTQI+ individuals explicitly.
(x). Providing tailored health services for trans individuals, including hormonal therapy; ensuring LGBTQI+ asylum seekers and refugees are

housed with other LGBTQI+ individuals, located closer to potential social support networks, and placed in single rooms when specific LGBTQI+ accommodations are unavailable; creating LGBTQI+-sensitive reception facilities across all EU member states; closely supervising accommodation centers to prevent inappropriate behavior; establishing LGBTQI+ offices to allow for asylum seekers and refugees in filing complaints when facing discrimination and harassment throughout their asylum process.

(xi). Improving the quality of the country of origin information used by asylum officers, rejecting the establishment of EU standard lists of safe countries of origin, and granting international protection to individuals from places where non-cisheteronormative sexual orientation and gender identity are criminalized.

(xii). Providing digital connectivity for asylum seekers by ensuring stable internet connections in accommodation centers; improving access to higher education, the labor market, and training; promoting social support among asylum seekers and collective agency; promoting initiatives that foster their integration into society; and generating a legal and social reform to support this population.

(xiii). Being mindful of intersectionalities in LGBTQI+ asylum claims.

(xiv). Sharing the burden of proof with asylum seekers; ensuring that applications are not fast-tracked, as this may cause more harm than good when asylum seekers are still traumatized by the asylum system, and lawyers have limited time to work on their behalf; urging the EU not to consider a late disclosure of sexual orientation or gender identity as damaging to one's credibility in their asylum application; shifting the focus of credibility assessment to whether the actors of persecution perceive the applicant as an LGBTQI+ individual instead of expecting them to provide elements of their persecution; and replacing the clustering system to a case-by-case analysis that acknowledges individual experiences.

(xv). Naming LGBTQI+ groups separately instead of using a generic term like "gay people" or "homosexuals" and addressing gender identity and sexual orientation as distinct concepts contributes to the recognition of gendered differences in the asylum system, acknowledging that gender, gender identity, and sexuality are different concepts; improving the terminology related to sexual orientation, gender, and gender identity; and being suggested that the recitals explicitly state that the documents also address sexual characteristics and gender expression whenever any of the aforementioned terms are cited.

(xvi). Suggesting that the EU addresses broader issues of discrimination and violence beyond the asylum system, engaging in general awareness activities to combat discrimination.

In relation to the groups addressed in each article, four of them exclusively focused on issues related to lesbian asylum seekers and refugees. One article solely addressed matters concerning bisexual individuals, and two others examined lesbians, gay individuals, and bisexual individuals. The remaining articles focused on addressing LGBTQI+ individuals in general. This data is particularly relevant, considering that the vast majority of studies regarding LGBTQI+ individuals revolve around gay men (Alessi *et al.*, 2020; Jansen, 2013; Wagner, 2016). Therefore, discovering studies that acknowledge the specific struggles experienced by other subgroups within the acronym are not only a welcome development but also essential, despite the confirmed scarcity. Notably, there is an absence of studies exclusively dedicated to trans individuals, whose gender non-conforming characteristics may produce even more marginalization (Bento, 2006). This absence is "a clear indicator of the limited access of transgender people to international protection due to the high degree of stigmatization, pathologization, and persecution that these people suffer in different countries due to their gender identity" (Lafuente, 2014, p. 365). As Butler (1993) points out, the homosexual identity cannot serve as a universal representation of all queer identities. Future research would, therefore, benefit from an increased focus on studies specifically addressing lesbian women, bisexuals, and transgender asylum seekers and refugees. This approach would allow for a more comprehensive analysis of their intersectional, unique experiences and struggles, contributing to policy development and change.

5. Discussion on public policies and societal change

In light of the prevailing marginalization and life-threatening circumstances faced by LGBTQI+ asylum seekers and refugees, the question arises: How can states formulate policies that foster a greater sense of visibility and respect for this vulnerable population? What actions can states take to ensure equal protection for all subgroups within this comprehensive acronym? It is vital to address the difficulty of establishing and promoting services for a population that is still regarded as either ill or dangerous

by some segments of society (Lee, 2013). Furthermore, Donnelly (2013) affirms that states should tailor their actions to address the unique needs of different social groups. However, Donnelly finds it difficult to point out how this could be done when some individuals still perceive LGBTQI+ individuals as less deserving of basic human rights. Other studies focus on the potential of affirmative policies, defined here as initiatives aimed at enhancing the representation of women and marginalized groups in educational, employment, and cultural environments from which these groups have been systematically excluded (Fullinwider, 2018). Bucci (2013) posits that these policies should aim at reforming the structures that perpetuate inequality, protecting individual rights, and reorganizing economic and social spheres. Gomes & Silva (2003) further complement this concept by emphasizing the importance of rendering equality a tangible reality, not merely a legal concept, which is only possible by eliminating all forms of discrimination. The above literature is in line with international law, as international conventions have urged states to adopt affirmative actions, or "special measures," to rectify disparities and inequalities through targeted, temporary, and progressive measures (International Labour Organization, 1958). The literature also advocates for "positive state action," highlighting the responsibility of states to ensure equality among citizens and protect their rights and freedoms, even when these rights are under threat from private parties (Bayefsky, 2016). However, Bell (2003) regrets that state positive action remains a supplementary step, whereas affirmative actions should ideally complement non-discrimination legislation. Piovesan (2008; 2018) reinforces the notion that simply prohibiting certain behaviors is insufficient to guarantee and create absolute equality for marginalized groups. Absolute equality depends on a coordinated effort to introduce such policies while simultaneously prohibiting exclusion.

In terms of LGBTQI+ affirmative actions, Bondarenko (2014) observes that they have not yet reached the level of development seen in ethnicity-based affirmative actions, which have been under discussion for the past 30 years. Reed (2013) states that their aim should be the creation of inclusive non-discrimination legislation. Despite their limited scope and reach, policies aimed at benefiting LGBTQI+ individuals present implementation challenges, primarily due to the fluctuating public opinion toward LGBTQI+ issues. These policies are available only in certain jurisdictions, usually within a broader scope of inclusion policies.

Besides the importance of affirmative action in addressing exclusion and marginalization, the literature also points out other theoretical means to promote societal change. Donnelly (2013) suggests that emphasizing the hardships faced by LGBTQI+ individuals may serve as a catalyst for social change and increased tolerance. This perspective is supported by Borrillo (2010), who argues that the initial steps in promoting change should involve demonstrating how obnoxious it is to discriminate against someone based on their sexual orientation, gender identity, or ethnicity. The pedagogical process should encompass educational institutions, including schools, as well as professionals such as physicians, judges, and police officers, given their close involvement in addressing LGBTQI+ repression. Subsequently, the state should enact specific criminal laws aimed at addressing LGBTQI+ violence and discrimination while discouraging these offenses (Borrillo, 2010). However, the theories developed by both authors seem a distant possibility with the growing far-right movements worldwide (Martel, 2018).

We contend that another way to promote change involves reinterpreting old documents, thereby facilitating social development. Interpreting terms like "sex" in diverse instruments to include "sexual orientation and gender identity," for example, could have a positive effect at the domestic jurisdiction levels. However, this interpretation depends on political will, and it is important to note that most international bodies lack the authority to provide authoritative interpretations (Donnelly, 2013). A similar opinion was given by the Committee on Legal Affairs and Human Rights of the Parliamentary Assembly of the Council of Europe. In document No. 12197, the committee advocated the mainstreaming of the term "gender" as the appropriate terminology for discussing one's identity in official documents (Parliamentary Assembly of the Council of Europe, 2010). When considering the most suitable arena for society's efforts to promote culture change, Beger (2000) believes that the legal sphere offers a more promising prospect than politics. He maintains that politics remains predominantly biased toward heterosexuality. The legal sphere is essential for constituting, regulating, and consolidating matters related to sexuality, thereby influencing matters of equality and social justice, as "a battlefield on which socially intelligible identity spaces and human diversity are fought for, and, thus, also created, cemented, changed and re-institutionalized" (Beger, 2000, p. 265). Last but not least, it is relevant to acknowledge the role that scholars and academia as a whole, as well as movements advocating for sexual freedom, decolonization, queerness, and anti-racism, have played. This is evident in instances like those in the German cities of Berlin, Frankfurt, Hamburg, and Leipzig (Sweetapple, 2018), among other European urban centers, where they have been instrumental in pushing for culture change,

implementing policies, and advancing the development of initiatives for marginalized groups.

6. Conclusion

The worldwide prevalence of violence against LGBTQI+ individuals exceeds what one might find bearable. This heightened level of violence stems from societal perception of this social group, which contributes to a daily escalation in violence rates against them. Moreover, more than 100 million people around the world are displaced from their homes due to conflicts and humanitarian crises occurring across the planet. The LGBTQI+ and refugee agendas interconnect when LGBTQI+ asylum seekers and refugees encounter denials of their rights, mistreatment, and violations of their rights during the asylum process. Since the first LGBTQI+ refugee requests took place in the 1990s, this topic has not yet been satisfactorily debated. Despite states creating norms and programs aimed at this population, some of these initiatives fail to effectively reach the local realities. Persistent gaps continue to hinder the ability of LGBTQI+ asylum seekers and refugees to fully enjoy their rights.

The literature has begun to address several identified issues within the LGBTQI+ asylum process, such as the presence of stereotypes, the need for training, sensitization or expert advice, concerns related to infrastructure and reception conditions, the vulnerability experienced by LGBTQI+ individuals during the asylum process, and the support provided by non-governmental organizations. However, there is a pressing need to shift the focus from general LGBTQI+ policies to tailored policies designed for specific subpopulations within the acronym. Tailoring policies to address and respect the unique needs of; for example, transgender individuals and lesbians would foster a more equitable experience that benefits these specific groups. It is essential not only to acknowledge the different subgroups within the LGBTQI+ social group but also to recognize the unique intersections of their individual characteristics. This aspect is constantly disregarded in the asylum application processes across different locations in the European context. Looking beyond the asylum process, it is evident that states have yet to create policies aimed at promoting the social inclusion of LGBTQI+ asylum seekers and refugees, despite the evident existence of pervasive homophobia, transphobia, and xenophobia in many European states that must be combated.

Finally, in this context of scarce literature on the subject, it is essential to recognize and encourage the role that academia plays in discussing and raising awareness about policies and services provided by states and organizations. Equally important is the role that public policies can play in mitigating the effects of such exclusion and invisibility, especially when analyzing the intersectional discussions raised by the theme. It is within this context that we aim to encourage the exploration of this theme, with the goal of fostering a more refined and innovative perception about the existence of intersectional debates and propositions, as well as a heightened awareness of the vulnerability of LGBTQI+ asylum seekers and refugees – both as a unified group and as an acronym that confines a relatively diverse population. Furthermore, it is essential to emphasize the importance of the role that national states have – or should have – in promoting continuous and daily social inclusion.

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RESEARCH ARTICLE

Understanding relationships between socioeconomic, household crop diversification, and child malnutrition in rural Jhargram, West Bengal, India

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Abstract

In India, child malnutrition remains a huge, persistent challenge to tackle with due to its complex and multidimensional nature. Malnutrition among children under 5 years old can lead to cognitive and physical impediments. Therefore, the objective of this study is to understand the determinants and the linkage of child malnutrition with socioeconomic characteristics and household crop diversification. In this study, the primary data collected from 200 households in the rural area of Jhargram district in West Bengal, India, during April to May 2017 were analyzed. For determining the child nutritional status, the World Health Organization (WHO) growth standard measurement was analyzed using the WHO-anthro software. The transformed Herfindahl index was calculated to illustrate the crop diversification. Statistical methods, such as bivariate analyses and logistic regression models, were used for data analysis. The study found that 36% of the children in the sample had stunted growth, 35.5% were underweight, and 22.5% were identified as wasted. It was found that cropping intensity was very high (183%) in the region, with low crop diversification. Results from logistic regression models found a significant relationship between child malnutrition and birth order, mother's age, caste status, type of house, and farm size of the household. The study also found that low crop diversification of a household was significantly associated with higher malnourishment level among the children. Taken together, these findings indicate the importance of socioeconomic and demographic characteristics as well as crop diversification for improving the nutritional status of children.

Keywords: Agriculture; Cropping pattern; Cropping intensity; Crop diversification; Child malnutrition; Nutrition

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1. Introduction

Globally, 795 million people suffered from chronic undernourishment during 2014 – 2016 period (Food and Agriculture Organization [FAO], 2015). In less developed countries, malnourishment is primarily caused by improper dietary intake or hunger. Despite the rapid economic growth achieved, malnutrition remains a persistent problem in India

(Desai *et al.,* 2016; Chatterjee, 2021). The Global Hunger Index (2022) has ranked India the 107th place out of 121 countries (GHI Report, 2022). To address the challenges in tackling with child malnutrition, the Government of India has taken various initiatives, such as the implementation of Integrated Child Development Services (ICDS) in 1975, the Food Security Act in 2013 and Poshan Abhiyan in 2018. Various agriculture-related programs, such as the Minimum Support Price (MSP), the Pradhan Mantri Krishi Sinchai Yojana (PMKSY), and the National Mission of Sustainable Agriculture (NMSA), were also implemented. Nonetheless, the outcome of these programs and policies implemented by the Indian government to improve of nutrition and agricultural development for the social upliftment of the farmers, yet the problem of nutritional status among children is still prevalent; thus, recent attention has been diverted to focus on agriculture-based approaches for the improvement of nutrition (Levin *et al.,* 2003; Bisai *et al.,* 2016; Gulati & Roy, 2021; E. Duncan *et al.,* 2022). One prominent aspect in understanding the agriculture-nutrition association is the increase in food production, which, in turn, improves dietary intake, thereby fulfilling the essential nutrients necessary for human health. Recently, agricultural diversification has also been recognized as a strategy to reduce undernutrition (Anuja *et al.,* 2022), which acknowledges the importance of agriculture and its connection with nutrition and health status. The previous research found that crop diversification has a significant positive effect on the long-term nutritional status of children, especially girls (Lovo and Veronesi, 2014; Frison *et al.,* 2006). In India, agricultural diversification plays a crucial role in ensuring food security, nutrition, and income generation. In addition, crop diversification has an important impact on the gross domestic product (GDP) (Gopalappa, 1996), as it contributes to employment, increased cropping intensity, reduction in rural-urban migration, and most importantly income generation (Acharya *et al.,* 2011).

Crop diversification augments the production of a variety of food, a strategy that broadens food sources, improves livelihoods, increases job opportunities in the local agro-processing, and revitalizes the rural economy as a whole, thereby improving the problem of micronutrient malnutrition (Thompson & Amoroso, 2014; FAO *et al*., 2021; and Douyon *et al*., 2022). Efficient cropping pattern refers to specialized crop cultivation involving the utmost efficient utilization of land, fertilizer, irrigation system, and other agricultural inputs, which can positively improve land productivity and net farm income of peasants. Hence, diversification of crops is crucial for agricultural sustainability as it removes biotic and abiotic stress to the soil and sustains good productivity of cropland (Kamraju *et al.,* 2017; Das, 2001).

The agriculture in West Bengal used to be characterized by the wide diversification of different crops cultivated in different districts over different periods of time (De, 2000). Evidently, there had been gradual increase of the crop diversification indices, namely, Herfindahl index, Simpson index, entropy index, and modified entropy index, in West Bengal from 1980 – 81 to 2007 – 08 (Majumdar, 2014). However, a spatiotemporal analysis revealed that in Gopiballavpur-II, the crop diversification had gradually decreased from moderate to low level between 2007 – 08 and 2010 – 11 (Bisai *et al.,* 2016).

There is an extensive range of studies regarding child malnutrition focusing on its contextual determinants, including child's demographic characteristics (Talapalliwar & Garg, 2014; Ghimire *et al.,* 2020; Katoch, 2022), household characteristics (Som *et al.,* 2007; Gundersen & Ziliak, 2021; Katoch, 2022), and mother's characteristics (Imai *et al.,* 2014; Vargas & Hernandez, 2020; Katoch, 2022) at community level, and environmental factors (Aneja *et al.,* 2001) both at the regional and national levels (Debnath & Bhattacharjee, 2014; Meshram *et al.,* 2011; Talapalliwar & Garg, 2014). Socioeconomic and demographic factors that are associated with the child malnutrition include mother's nutrition (Adedokun & Yaya, 2021), poverty, hygiene, sanitation, food security, healthcare practices (Islam *et al.,* 1994), birth order, age and duration of breastfeeding, mother's education(Teller & Yimar, 2000; Khan & Raza, 2014; Stiller *et al.,* 2020), birth interval, wealth index, mother's body mass index, and mother's education (Kumar & Singh, 2013; Mandal *et al.,*2014; Dahiya & Viswanathan, 2015; Singh *et al.,* 2020; Biswas *et al*., 2020), which have been extensively investigated. Similar studies have also been conducted in West Bengal (Sarkar, 2016).

The socioeconomic determinants of child malnutrition have been widely studied, yet the studies on the multidimensional aspect of child malnutrition taking into account the household crop diversification remain scarce. Alarminly, in West Bengal, approximately one-third of the children under 5 years old in rural areas are still underweight, measuring at 33.6% (NFHS-4, 2015 – 16) and 33.5% (NFHS-5, 2019 – 20) at different periods. Thus, it is important to determine the fundamental link between nutritional status and agriculture in a region where agriculture is the main source of economy. In view of this, we propose several research questions:

(i). In an area with good agro-climatic conditions, which type of crops is grown and what is the level of cropping intensity?
(ii). Is crop diversification practiced among the rural households?
(iii). Is there a link between household crop diversification and child malnutrition?

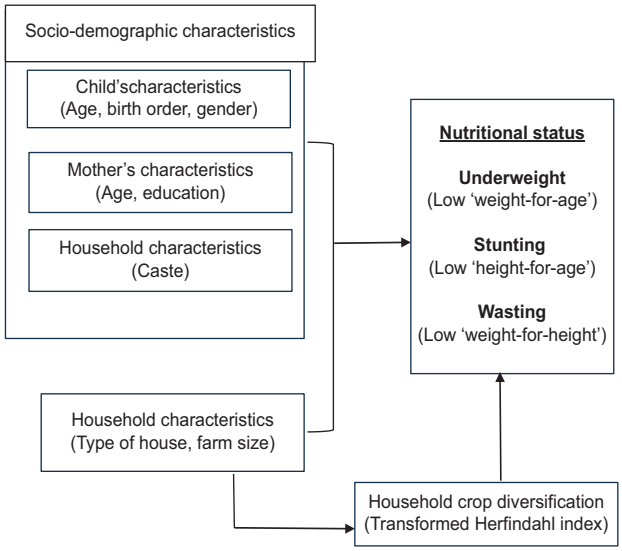

Figure 1. Conceptual framework of the study.

(iv). Based on the above research questions, the key objectives of the study are as follows:

a) To understand the crop diversification and cropping intensity practiced among the rural households;

b) To examine the linkage of socioeconomic characteristics, demographic characteristics, and household crop diversification with child malnutrition.

1.2. An overview of prevalence of child malnutrition in West Bengal

To understand the background of nutritional status among children under 5 years old in West Bengal, this study analyzed the reports of National Family Health Survey (NFHS), using data from NFHS-1 (1992 – 93), NFHS-2 (1998 – 99), NFHS-3 (2005 – 06), NFHS-4 (2015 – 16), and NFHS-5 (2019 – 21). A simple percentage change analysis was carried out for each district in West Bengal to illustrate the difference in the prevalence of underweight, stunting, and wasting, based on data derived from the latest two surveys, that is, NFHS-4 and NFHS-5, which have collected information on child malnutrition at district level (Table 1).

Based on Figure 2, the prevalence of child stunting had decreased over the time, from NFHS-2 (50.4%) to NFHS-4 (32.5%), and slightly increased in NFHS-5 (33.8%). There were not much changes in the prevalence of child wasting even after two decades. The prevalence of child underweight had reduced over the time but remains a matter of great concern as the latest percentage of child underweight recorded in NFHS-5 (2019 – 20) was still above 30% (32.2%).

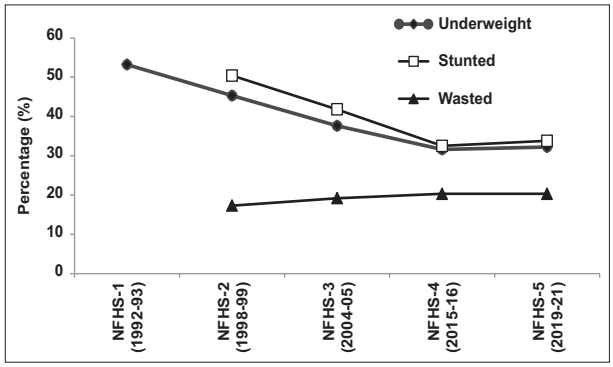

Figure 2. Trend of nutritional status among children in West Bengal.
Note: The data about stunting and wasting for West Bengal are not available in NFHS-1.
Source: NFHS-1, NFHS-2, NFHS-3, NFHS-4, and NFHS-5.

To understand the district-level nutritional status among the children of West Bengal and its change over a period of time, a simple percentage change analysis was performed using data from NFHS-4 and NFHS-5, covering the data in 2015 – 16 and 2019 – 21, respectively. According to Table 1, the prevalence of child underweight and stunting had generally worsened over time (1.9% and 4%, respectively), while there was no improvement in child wasting. Through a district-level analysis, we found that Kolkata is the worst performing district in addressing the escalating prevalence of child underweight, with a staggering 67% increase in underweight prevalence. Nine districts, including Kolkata, manifested a worsening situation in which the number of underweight children kept rising, and ten districts showed improvement in the prevalence of child underweight. Among the districts of West Bengal, Koch Bihar emerged as the best performer in tackling the child underweight conundrum after successfully reducing the prevalence by 23.2%. Regarding the child stunting issue, nine districts showed increasing percentage of stunted children, whereas other ten districts showed decreasing percentage. The district which has performed the worst in controlling the child stunting issue was North 24 Pargana (36%), while the best performer in the district was Haora (–21%). The problem of child wasting had deteriorated in ten districts over the same period, among which Darjeeling was the worst performing district, although Paschim Medinipur remained at the top place for the highest prevalence of child wasting in West Bengal. On the other hand, Purba Medinipur emerged as the clear winner in the rivalry for successfully lowering the child wasting percentage (–36.7%). Overall, it is clear that the nutritional status of children in West Bengal had not improved much, and worse still, the relevant parameters in many districts had deteriorated over the period (NFHS-4 – NFHS-5).

Table 1. Child malnutrition status in West Bengal by districts

Child underweight (%)				Child stunting (%)				Child wasting (%)			
	NFHS-4	NFHS-5	Difference (%)		NFHS-4	NFHS-5	Difference (%)		NFHS-4	NFHS-5	Difference (%)
West Bengal	31.6	32.2	1.9	West Bengal	32.5	33.8	4	West Bengal	20.3	20.3	0.0
Districts				*Districts*				*Districts*			
Kolkata	19.6	32.9	67.9	North24 Paragana	23.8	32.4	36	Darjeeling	10.6	20.6	94.3
Nadia	19.3	25.1	30.1	South24 paragana	27.3	36.7	34	Kolkata	17.4	29.3	68.4
North24 Paragana	18.3	23.6	29.0	Kolkata	24.2	29.6	22	Nadia	10.7	17.6	64.5
Darjeeling	25.3	31.6	24.9	Darjeeling	30	34.3	14	Haora	14.6	21.3	45.9
Hugli	28.7	33.4	16.4	Nadia	23.3	26.1	12	Dakshin Dinajpur	17.1	22.8	33.3
South24 paragana	27.8	32.2	15.8	Bardhaman	32.5	36.2	11	Uttar Dinajpur	14	16	14.3
Bardhaman	33.7	36.3	7.7	Uttar Dinajpur	40.4	44.8	11	Paschim Medinipur	28	30.3	8.2
Dakshin Dinajpur	28.1	30.2	7.5	Malda	37.8	40.5	7	Hugli	18.5	20	8.1
Jalpaiguri	24.6	25.4	3.3	Paschim Medinipur	29.4	31.1	6	South24 paragana	20.1	21.2	5.5
Paschim Medinipur	40.3	40	−0.7	Dakshin Dinajpur	32.9	31.9	−3	Jalpaiguri	17.7	18.3	3.4
Bankura	39.8	38.8	−2.5	Hugli	30.1	28.9	−4	North24 Paragana	13.6	13.3	−2.2
Birbhum	43.1	41.8	−3.0	Murshidabad	41.9	39.8	−5	Bankura	27	26	−3.7
Haora	28.4	27.3	−3.9	Jalpaiguri	31.2	28.9	−7	Murshidabad	17.5	16.3	−6.9
Maldah	37.2	35.3	−5.1	Birbhum	40.5	37	−9	Bardhaman	25.8	23.3	−9.7
Murshidabad	34.6	32.4	−6.4	Bankura	34	30.3	−11	Maldah	22.8	20	−12.3
Purba Medinipur	32.8	30.6	−6.7	Koch Bihar	32.9	28.7	−13	Birbhum	29.5	25.5	−13.6
Uttar Dinajpur	34.7	32	−7.8	Purba Medinipur	29.9	25.8	−14	Purulia	34.6	29.4	−15.0
Purulia	58.2	46.3	−20.4	Puruliya	45.5	36.9	−19	Koch Bihar	20.1	16.8	−16.4
Koch Bihar	29.3	22.5	−23.2	Haora	34.6	27.5	−21	Purba Medinipur	24.5	15.5	-36.7

Source: NFHS-4 and NFHS-5

2. Data and methodology

2.1. Data source

The present study utilized primary data collected from Gopiballavpur-II Community Development block in the Jhargram district of South-Western West Bengal, India, during April to May 2017. Officially carved out from Paschim Medinipur district on April 4, 2017, Jhargram district has since become the 22nd district of West Bengal. Paschim Medinipur is one of the districts in West Bengal with the highest prevalence of underweight children. In both NFHS-4 (2015 – 16) and NFHS-5 (2019 – 21), the prevalence of underweight children in Paschim Medinipur district was 40%, which exceeded the average level of West Bengal. Therefore, the present study selected Jhargram district (once part of the Paschim Medinipur), which has eight Community Development block, from which Gopiballavpur-II block was selected purposely for this study. There were 175 villages in the Gopiballavpur-II block, among which only 20 villages were randomly selected and ten households were purposively chosen from each selected village, yielding a final sample consisting of

200 households. Purposive sampling was applied to select the households based on two criteria: (i) The household was at the time of survey engaged in, at least, small-scale farming, and (ii) the household had children under 5 years of age. If there was more than one child under the age of 5 years old in a household, only the youngest child would be selected or any other child under the age of 5 if the youngest child denied to give measurement.

For anthropometry data, height and weight of the children were collected in the presence of their mothers. For measuring weight of the child, a digital weighing scale was used; three measurements were taken times and the average of the weight was calculated to ensure accuracy of measurements. Stadiometer was used to measure the height of children, but for children aged <12 months, the height was measured while they were lying down. The study used a semi-structured interview schedule for data collection.

2.2. Cropping intensity and crop diversification

To calculate cropping intensity and crop diversification, the following formula was used:

(i) Cropping intensity is defined as the number of crops produced during one agriculture year from a particular cultivated field (Deshmukh and Tanaji, 2017). It is computed by dividing the gross cropped area of a region by the net sown area, that is,

$$\text{Cropping intensity} = \frac{\text{Gross cropped area}}{\text{Net sown area}} \times 100$$

The cropping intensity has been categorized in an earlier research (Iqbal, 2020):

- Low intensity = Below 153%
- Medium intensity = 153 – 159%
- High = Above 159%

(ii) Crop diversification is computed using several indices such as:

(a) Transformed Herfindahl index (THI):

$$1 - \sum_{i=1}^{n} Pi^2$$

THI value ranges between 0 and 1. "1"denotes perfect diversification, while "0" denotes complete specialization (Pal & Kar, 2012).

(b) Modified entropy index (MEI):

$$-\sum_{i=1}^{N} (Pi.lnN.Pi)$$

The value of MEI ranges between 0 and 1. "1" denotes perfect diversification, while "0" denotes total concentration (Shiyani & Pandya, 1998).

(c) Composite entropy index (CEI):

$$-\sum_{i=1}^{N} (Pi.lnN.Pi)$$

The value of CEI ranges between 0 and 1. "1" denotes perfect diversification, while "0" denotes total concentration (Shiyani & Pandya, 1998).

(d) Jasbir Singh's method: Percentage of total crop area under "n" crop divided by number of "n" crop

The value of Jasbir Singh's index lies between 0 and 100. Here, "n" refers to crops whose proportion is 5% or more. Index of crop diversification (ICD) value is inversely proportional to degree of diversification (Bisai *et al.,* 2016).

Note that "N" refers to the total number of crops and "P_i" refers to the proportion of acreage under i-th crop to total cropped area.

2.3. Dependent variables

Child malnutrition, which is the dependent variable, is classified as underweight, stunting, and wasting. The World Health Organization (WHO) defined underweight as a child with low weight-for-age, and an underweight children may be wasted or stunted, or both. Stunting is defined as low height-for-age, and it is the outcome of recurrent or chronic under nutrition connected with poor maternal nutrition and health, poor socioeconomic conditions, frequent illness, and/or inappropriate infant and young child care and feeding in early life. Stunting restrains the children from reaching their cognitive and physical potential. Wasting is known as low weight-for-height, which usually indicates recent and severe weight loss due to insufficient food intake and/or an infectious disease, such as diarrhea.

The corresponding scores, that is, weight-for-age Z-score (WAZ), height-for-age Z-score (HAZ), and weight-for-height Z-score (WHZ), were calculated based on the WHO new growth standard (WHO, 2006) using the WHO-Anthro software. The categorization for underweight (WAZ), stunting (HAZ), and wasting (WHZ) scores was defined by the scores whose Z-score is below minus two standard deviations (–2 SD) from the median of the reference population.

2.4. Independent variables

Key independent variables that influence the child's nutritional outcomes, such as age ("1" <2 years, "2" 2–3 years, "3" 4–5 years), birth order ("1" birth order, "2" birth order),

and gender ("1" male, "2" female) of the children; age ("1" <25 years, "2" >25 years) and education ("1" lower than secondary education, "2" secondary education and above) of mother; and household characteristics such as transformed Herfindahl index ("1" very low, "2" low, "3" moderate), caste ("1" general, "2" scheduled caste, "3" scheduled tribe, "4" OBC), type of house ("1" kaccha, "2" semi-pucca) and farm size ("1" <1 ha, "2" more than 1 ha), were used in this study.

The inclusion of child's characteristics (age, birth order, and gender), mother's characteristics (age and education), and household characteristics (caste, type of house, and farm size) has been approached in the previous studies (Som *et al.,* 2007; Talapalliwar & Garg, 2014; Imai *et al.,* 2014; Khan & Raza, 2014; Kumar & Singh, 2013; Mandal *et al.,* 2014). Age and education of mother were categorized according to the distribution of sample, while the farm size was categorized by considering the distribution and area of landheld by the families.

According to Pal and Kar (2012), Simpson and Herfindahl indices are widely used measure of crop diversification; therefore, the present study selected the transformed Herfindahl index, out of various diversification indices, as the independent variable for three principal reasons. First, the transformed Herfindahl index is the simplified form of Simpson index. Second, it is transformed from Herfindahl index, and third, the value of this index is based on the modified entropy index the value of this index followed the ranges of modified entropy index (Bhat & Salam, 2016).

2.5. Statistical analysis

The entire analysis was carried out using SPSS software version 21.0. Statistical methods, including bivariate analysis, were used to analyze the percentage distribution of child malnutrition parameters, such as underweight, stunting and wasting, and the background characteristics. Logistic regression analysis was performed to investigate the relationship of background characteristics with the outcome variable after controlling for several confounding factors.

3. Results

3.1. Profile of the study population

The socioeconomic and demographic spectrum of the respondents and their households are presented in Table 2. Most of the surveyed households were in the very low category (73%) of the transformed Herfindahl index (THI), and only 18.5% and 8.5% of the households were in low and moderate categories, respectively. About 38.5% of the children aged <2 years, 36.5% aged 2–3years, and the remaining 25% aged 4–5 years. It was found that more than half of the children (52.5%) were male, and a little less than half of them were female (47.5%). The majority (66.5%) of the children were from first birth order and the remaining 33.5% were from second birth order.

More than half (58%) of the mothers were less than 25 years of age and 42% were 25 years old and older. More than three quarters of the mothers (about 79.5%)

Table 2. Percentage distribution of background characteristics in the study population, 2017

Variables	%	n
Transformed Herfindahl index		
Very low	73	146
Low	18.5	37
Moderate	8.5	17
Age of the children		
<2 years	38.5	77
2–3 years	25	50
4–5 years	36.5	73
Gender of the children		
Male	52.5	105
Female	47.5	95
Birth order		
First	66.5	133
Second	33.5	67
Age of mother		
<25 years	58	116
>25 years	42	84
Education of mother		
Lower than secondary education	20.5	41
Secondary education and above	79.5	159
Caste of the household		
General	37	74
Scheduled caste	30	60
Scheduled tribe	15	30
OBC	18	36
Type of house		
Kaccha	61	122
Semi-pucca	39	78
Farm size of households (in ha)		
<1 ha	55	110
More than 1 ha	45	90
Total		200

Abbreviation: OBC: Other backward class.

had completed secondary or higher education. Regarding the household characteristics, the general caste category accounted for 37% of the households, scheduled caste for30%, scheduled tribe for 15%, and other backward class (OBC) for 18%. It is evident that 55% of the households had <1 ha of land and 45% of the households had more than 1 ha of land. The survey also showed that 61% of the households resided in kaccha house and 39% in semi-pucca house.

3.2. Differentials in child malnutrition by background characteristics

Table 3 represents a summary of nutritional outcomes among the studied children (n = 200). It was found that the prevalence of wasting, underweight, and stunting were 36%, 35.5%, and 22.5%, respectively. Among the households with very low crop diversification, nearly three-fourth of those children were found to be underweight, stunted, and

Table 3. Percentage distribution of underweight, stunted, and wasted children categorized by household crop diversification and background characteristics, 2017

Variables	Underweight (<−2 SD)	Stunting (<−2 SD)	Wasting (<−2 SD)
Transformed Herfindahl index			
Very low	71.83	73.61	71.11
Low	21.12	19.44	24.45
Moderate	7.05	6.95	4.44
Age of the children			
<2 years	39.43	37.5	40
2–3 years	26.76	29.16	35.55
4–5 years	33.81	33.34	24.45
Gender of the children			
Male	49.30	52.78	60
Female	50.70	47.22	40
Birth order			
First	60.56	62.5	53.33
Second	39.44	37.5	46.67
Age of mother			
<25 years	70.42	72.22	55.55
>25 years	29.58	27.78	44.45
Education of mother			
Lower than secondary education	16.90	20.83	8.89
Secondary education and above	83.10	79.17	91.11
Caste of the household			
General	32.39	34.73	40
Scheduled caste	40.84	38.89	33.33
Scheduled tribe	12.67	16.67	11.11
OBC	14.09	9.72	15.57
Type of house			
Kaccha	71.84	69.44	77.78
Semi-pucca	28.16	30.56	22.22
Farm size of households (in ha)			
<1 ha	54.92	54.16	44.44
More than one hectare	45.08	45.84	55.56
Total	35.5	36	22.5

Abbreviations: OBC: Other backward class; <−2 SD: Below minus two standard deviations.

wasted. More than one-third of the children under the age of 2 years are found to be malnourished. The study found differentials in gender as boys were found to suffer from wasting at a greater extent compared with girls, whereas for underweight and stunting, their prevalence rates were higher among the girls. Surprisingly, it was found that the majority of children belonging to first birth order were underweight, stunted, and wasted. We also found higher prevalence of underweight, wasting, and stunting among children whose mothers age is <25 years. Besides, the children of higher educated mothers tended to suffer from malnutrition, probably because 78% of the sample were women who had competed secondary education.

The analysis of nutritional parameters revealed that the children belonging to the scheduled caste succumbed to higher risk for underweight and stunting (40.84% and 38.89%, respectively) and wasting was more prevalent among children belonging to general category (40%). The majority of the underweight, stunted, and wasted children resided in kaccha house. More than half of the children from the households owning <1 ha of farm land were underweight (55%) and stunted (54%) compared to households having more than one hectare of land.

Table 4. Types of crops and cropping intensity in the study area, 2017

	Crops	Area in hectares	%
Cereals	Aman (paddy)	135.56	55
	Aus (paddy)	40.2	16.3
	Boro (paddy)	5.59	2.26
	Total	181.35	73.56
Other principal crops	Watermelon	12.08	4.9
	Groundnut	11.98	4.86
	Mung bean	11.58	4.7
	Mustard oil	8.28	3.36
	Potato	7.05	2.86
	Onion	3.89	1.58
	Total	54.86	22.46
Vegetables		10.3	4.18
Total land in operation (gross cropped area)		246.51	100
Net sown area		134.7	/
Cropping intensity		/	183

3.3. Cropping intensity and crop Diversification

From Table 4, it is evident that paddy was mostly cultivated as a Kharif crop that chiefly depends on the seasonal rainfall, and other principal crops such as potato, groundnut, and mustard oil, onion were cultivated as Rabi crops, while watermelon and mung bean were produced as Zaid crops. Seasonal vegetables were usually produced throughout the year but paddy is the principal crop grown by the households. About 73.56% of the gross cropped area were cultivated thrice a year. A man (55%) and aus (16.30%) rices were mainly cultivated in the study area while a man rice was generally produced on a broader scale compared to a us rice. It was found that watermelon was the third most cultivated crop (4.90%), which is mainly cultivated during summer as a Zaid crop. Besides these, groundnut (4.86%), mung bean (4.70%), mustard (3.36%), potato (2.86%), and onion (1.58%) were also grown in a few areas with assured irrigation facilities, a favorable sign of sustainable agricultural expansion in the study area. Vegetables were cultivated only in some parts (4.18%) of the land. Overall, the cropping intensity in the study area is very high (183%).

In Table 5, different indices, such as THI, MEI, CEI, and Jasbir Singh's method, were used to analyze the degree of crop diversification. The result of crop diversification revealed that crop diversification in the study area falls under the Class-I category, indicating low practice of crop diversification. The index value of THI, MEI, and CEI were 0.41, 0.30, and 0.27, respectively. The index value of Jasbir Singh's method of crop diversification (73.56) also revealed very low (Class-V category) diversity level in the

Table 5. Degree of crop diversification in the study area, 2017

	Crop diversification indices	Index value	Categorization of index value in class/level	Degree of diversification
1	Transformed Herfindahl index*	0.41	Class-1 Low (<0.50) Class-II Moderate (0.50 – 0.75) Class-III High (>0.75)	Low
2	Modified entropy index*	0.30		
3	Composite entropy index*	0.27		
4	Jasbir Singh's method#	73.56	Class-1 Very high (<20) Class-II High (20 – 30) Class-III Moderate (30 – 40) Class-IV Low (40 – 50) Class-V Very low (>50)	Very low

Note: *The author categorized the class based on the range of the indices.
#Categorized based on previous research (Bisai *et al.*, 2016).

study region. Two crops, namely, aman and aus had been cultivated on more than 50% of agricultural land. In this case, the compound percentage of two crops (aman paddy and aus paddy) is very high.

3.4. Determinants of child malnutrition

Table 6 lists the determinants of the nutritional status of children, including transformed Herfindahl index and socioeconomic characteristics. In the analysis, model 1 shows the relationship of crop diversification with child malnutrition, while model 2 shows the relationship of crop diversification with child malnutrition after controlling other independent variables.

It is evident from the analysis that children belonging to households practicing low crop diversification were less likely to be underweight (model 2) compared to very low

Table 6. Multivariate logistic regression of crop diversification and background characteristics influencing child malnutrition, 2017

Transformed Herfindahl index	Underweight (<−2 SD)		Stunting (<−2 SD)		Wasting (<−2 SD)	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Exp (B)	Exp (B)	Exp (B)	Exp (B)	Exp (B)	Exp (B)
Very low®						
Low	0.787	0.411*	0.936	0.605	0.663*	0.539
Moderate	1.288	1.500	1.368	2.148	2.105	1.278
Age of the children						
<2 years®						
2–3 years		1.172		0.704		0.844
4–5 years		1.114		0.887		1.458
Gender of the children						
Male®						
Female		1.002		1.305		1.411
Birth order						
First®						
Second		0.073**		0.070**		0.330
Age of mother						
<25 years®						
>25 years		11.058**		12.909**		1.631
Education of mother						
Lower than secondary education®						
Secondary education and above		0.666		1.245		0.200*
Caste of the household						
General®						
Scheduled caste		0.367*		0.390*		0.811
Scheduled tribe		0.830		0.574		0.779
OBC		1.019		1.896		1.214
Type of house						
Kaccha®						
Semi-pucca		2.696*		1.904		4.811**
Farm size of household (in hectare)						
<1 ha®						
More than one hectare		0.576		0.378*		0.607

Note: ®Reference category; **$p < 0.01$, *$p < 0.05$
Abbreviations: OBC: Other backward class; <−2 SD: Below minus two standard deviations.

crop diversification. In model 2, children of the second birth order ($p < 0.01$) and belonging to the scheduled caste category were less likely to be underweight ($p < 0.5$), while children of older mothers ($p < 0.01$) and residing in semi-pucca house ($p < 0.05$) were more likely to be underweight.

Crop diversification did not exhibit significant relationship with child stunting, but model 4 shows that children of the second birth order ($p < 0.01$) and belonging to scheduled caste category were less likely to be stunted ($p < 0.5$). It was also found that households having more than 1 hectare of farm land were less likely to be stunted ($p < 0.05$), while children of older mothers ($p < 0.01$) were found to be significantly stunted.

Model 5 shows significant result of crop diversification with stunting, but, in model 6, it did not find the significant association after controlling the socioeconomic and demographic characteristics. Based on model 6, the children of mothers having completed secondary education and above were less likely to be stunted compared with those of mothers who had achieved education below the secondary level ($p < 0.05$), suggesting that maternal education is an important factor in influencing the nutritional status of the child. The analysis also revealed that children residing in semi-pucca house were more likely to be stunted compared to those residing in kuccha house ($p < 0.01$).

4. Discussion

The present study corroborates previous reports that Jhargram district, West Bengal is facing a high prevalence of underweight, wasting, and stunting among children and found that the crop diversification in the study area was of low level.

The analysis of cropping pattern and crop diversification in the study region revealed that the predominant crop produced in the study region is paddy (mainly aman), which is similar to the cropping practice in the state (West Bengal) as indicated from the paddy outlook report of 2021. The report revealed that West Bengal cultivated 2.52 lakh hectares of paddy and remained as the top producer of paddy. Other high-value crops were cultivated on a very small scale, and in most cases, traditional cropping equipment was adopted. It has been revealed that the favorable condition for intensive cultivation of Aman paddy had garnered interest of the inhabitants, which directly or indirectly affected the crop diversity in the area. In the case of cropping intensity, the results from this study (183%) were found to be pertinent with other studies conducted in West Bengal (Deshmukh and Tanaji, 2017), where the cropping intensity was found to be 186% in 2012 – 13. The crop diversification in West Bengal had been increasing persistently, though not at a faster rate since 1970 (De & Chattopadhyay, 2010; Bisai *et al.,* 2016).

Examining the linkage of socioeconomic characteristics, demographic characteristics and crop diversification with child malnutrition is currently the focus of study in this field because relevant studies at the macro (national) and micro (state) levels are scarce. The association between crop diversification and child malnutrition is a contentious topic as it is often considered as a complex issue. Therefore, microlevel analysis in this respect would provide an insight that could inform policies intended to curb this problem.

This study demonstrated that children of higher birth order were less likely to be underweight and stunted, probably because mothers who already had older children know how to take care of the infant and about the correct feeding practices she had learned from the previous child caring experiences (Khan & Raza, 2014; Sarkar, 2016; Talapalliwar & Garg, 2014). Moreover, children of older mothers were more likely to be underweight and stunted; a justifiable explanation for this is that older mothers who might have children when they were younger are more likely to neglect her health and, thus, become negligent of their newborns' health (Kumar & Singh, 2013; Mandal *et al.,* 2014; Imai *et al.,* 2014; Som *et al.,* 2007; Islam *et al.*, 1994; Ao & Lhungdim, 2014).

Social category is often considered an important determinant of child malnutrition as children belonging to scheduled caste category are considered more disadvantaged and have higher prevalence of malnutrition (Sarkar, 2016), whereas this notion was refuted based on our findings, which showed that children belonging to the scheduled caste category were less likely to be malnourished. On the other hand, children living in semi-pucca houses were associated with higher prevalence of underweight and wasting.

In our study, ownership of farm land is regarded as a 'proxy of wealth index' among the rural households. It was found that children belonging to families owning more than 1 ha of farm land were less likely to be malnourished, probably because these households were more capable of providing sufficient, diverse types of food throughout the year as more farm lands could be used for the cultivation of various crops.

The association between crop diversification and malnutrition was also confirmed in the present study. This is exemplified by the lower probability of underweight and wasting among children from the households practicing moderate crop diversification, as compared with those from the households practicing low crop diversification. Similarly, a past study has found that production of various crop positively impacts nutrition and health (Frison *et al.,* 2006), which is also associated with an increase in household food consumption (Mango *et al.,* 2018). The present study identified that crop diversification is a

suitable way to improve nutrition and health status, which is in line with the strategies of FAO's Plant Production and Protection Division (2012). Thus, an increase in crop diversification among the rural households leads to an increase of food supply and diversity, which is an critical factor in the maintenance of children's nutritional status. Therefore, an improvement in agricultural productivity can help reduce the problem of malnutrition in rural areas where the majority of the population is economically dependent on agriculture (Gulati *et al.,* 2012).

In India, the problem of child malnutrition remains a persistent issue. To tackle this problem, the Indian government has implemented various policies and programs, such as the ICDS, Mid-Day Meals Scheme, and, recently, the Poshan Abhiyaan, which are intended to address the nutritional needs of children and women. Notwithstanding the policies and program, a multi-pronged strategy involving increased agricultural production and diversification of crop cultivation is a tactic that should be attempted to address the malnutrition issues prevalent in the rural regions.

5. Conclusion

The prevalence of child underweight, stunting, and wasting were found to be at 35.5%, 36%, and 22.5%, respectively, in the study area. The study found that household crop diversification is significantly associated with child malnutrition, as children belonging to households which practice higher crop diversification were less likely to be malnourished. Other factors that could significantly influence the nutritional status are birth order, caste, mother's age, type of house, and farm size of households. In India, promoting agriculture-oriented policies that aid in improving the nutritional status of children through the promotion of crop diversification is necessary to improve food security and nutrition since agriculture is the backbone of the Indian economy, providing livelihood, food supply, and income sustenance to the rural population. Promoting crop diversification should be regarded as important as improving reproductive and child health because it ensures the supply of diverse kinds of food items at the household level and ultimately improves the nutritional status of the children. Hence, endorsing agriculture-nutrition-based policies is a win-win tactic beneficial for enhancing the agricultural sector and simultaneously improving the nutritional status of children.

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Author contributions

Conceptualization: All authors
Formal analysis: Kanchan Paira
Investigation: Kanchan Paira
Methodology: All authors
Writing – original draft: Kanchan Paira
Writing – review & editing: Moatula Ao

Ethics approval and consent to participate

The authors declare that the present work was conducted after taking consents and permissions from the study participants. The authors declare that they have informed the study participants during field study about the research work and consent have been taken before the recording of responses and also before the measurement of child anthropometry.

Consent for publication

Consent has been taken from study participants to publish their data.

Availability of data

The authors declare that all the necessary and pertinent data related to the present work will be participants that the information will be used for available as per requests.

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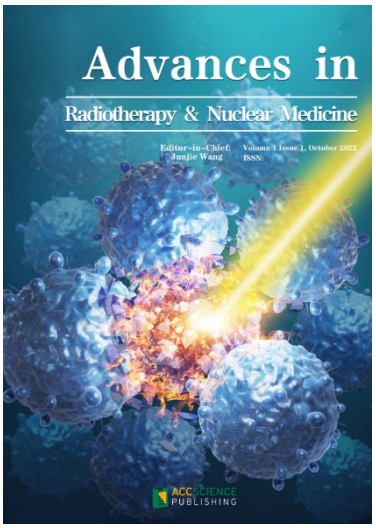

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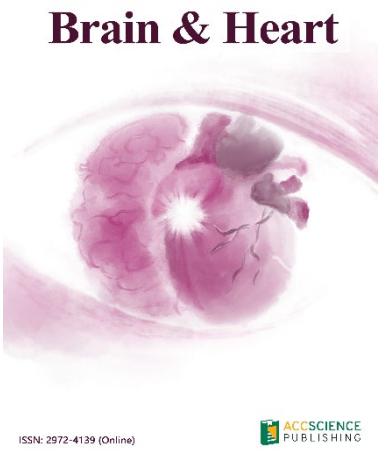
- Brachytherapy (BT)
- Boron Neutron Capture Therapy (BNCT)
- Particle Therapy (proton and heavy ions) (PT)
- Targeted and Immunotherapy (TI)
- Combined Modality Therapy (Heat therapy, electric field therapy, nursing, technology) (CMT)
- Radiation Biology (RB)
- Radiation Physics (RP)
- Innovative Radiation Technology (IRT)
- Positron Emission Tomography (PET)
- Radiopharmaceuticals and Radio-tracer (RR)
- Molecular Imaging and Radionuclide Therapy (MI & RT)
- Single-photon Emission Computed Tomography (SPETCT)

Brain & Heart focuses on neurocardiology, a neurology and cardiology-based interdisciplinary subject that studies the circulatory mechanism of the human body, as well as the mechanisms of the interplay between the cardiovascular system and the nervous system. The journal's scope includes:

Clinical and basic research on diseases related to the circulatory and nervous systems, such as: orthostatic dizziness, orthostatic hypotension, autonomic dysfunction, and the relationship between the autonomic nervous system and the circulatory function in cerebral degeneration;

Heart-brain research on patients with syncope, autonomic dysfunction, cryptogenic stroke, and stroke with atrial fibrillation; research on the relationship between structural heart diseases and nervous system diseases, the correlation between cardiac electrophysiology and abnormal organizational structures and the pathogenesis of stroke, as well as new ways of diagnosis, treatment and prevention of unexplained stroke.



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