ISSN 2729-7640

sciendo

ALFA ARCHITECTURE PAPERS
OF THE FACULTY OF ARCHITECTURE AND DESIGN STU
www.alfa.stuba.sk

1/2025 (Vol. 30)
DOI: 10.2478/alfa-2025-0004

Maternal health and well-being: Behavioural perspective of architectural garden features for sustainable antenatal and postnatal care in Tanzania

Buberwa M. Tibesigwa[1*]

Benson V. Karumuna[2]

[1] *Mbeya University of Science and Technology, Mbeya, Tanzania*

[2] *Mbeya University of Science and Technology, Mbeya, Tanzania and Chongqing University, Chong Qing Shi, China*

***Corresponding author**
E-mail: buberwatibesigwa@gmail.com

Article information
Sent: Jan 6, 2025
Accepted: Feb 24, 2025

Abstract: Maternal health is a significant aspect of global well-being, encompassing social, mental, and physical factors during both antenatal and postnatal periods. The maternal mortality rate in Tanzania has decreased in recent years because of government interventions aimed at enhancing healthcare facilities and the surrounding environment. This study investigates garden features with healing effects to assess users' behavioural perspectives in determining the capacity of garden features for sustainable antenatal and postnatal care. The data were computed and analysed from the MMD of MZRH, Mbeya, Tanzania. The quantitative approach involving a survey questionnaire, multiple regression analysis, and SPSS 25-AMOS were adopted to analyse the data and generate the structural equation model which addresses sustainable maternal health (MH) factors in antenatal and postnatal care (AandPNC). Findings underscored the three most significant indicators found to be related to garden features (βGF = 0.227, p = 0.000), behavioural perspective of mothers (βBP = 0.067, p = 0.001), antenatal and postnatal care (βAandPNC = 0.246, p = 0.002), and social affairs factors (βSA = 0.092, p = 0.003) with an explanatory power of 55.7% (R2 = 0.557). This study advocates for researchers to adopt implementation strategies for effective interventions, while policymakers should establish networks to enhance the application of findings in hospitals, thereby improving garden features for sustainable postnatal and antenatal care.

Keywords: behavioural perspective, garden features, maternal health, sustainability, well-being

INTRODUCTION

One of the main goals of basic development for any nation in the world is lowering the mother mortality rate. Statistics worldwide show that every two minutes a pregnant woman dies. The most likely reasons are usually connected to problems during pregnancy or labour (Do et al., 2019; Mirza et al., 2024; Kurjak et al., 2022). Furthermore, psychological issues have always been a part of daily life since diseases and death can cause overworking, overthinking and disturbances in social events (Thompson, 2011). More importantly than in former times, health issues related to disease disproportionately affect new mothers and their families (Thompson, 2011; Arampatzi et al., 2022). Should this situation continue, it could have significant consequences for the general and emotional growth of associated family members as well as for the infants.

Furthermore, statistics have shown that between 1990 and 2015 the mother death rate per 100,000 live births dropped by 75% for every Millennium Development Goal (MDG) objective 5 of the UN (Lawson and Keirse, 2013; Feyi-Waboso, 2016). While the United Republic of Tanzania has made headway in its campaign of lowering under five mortalities, the USAID report of 2020 shows that moderate progress has been made to lower mother postnatal mortality (USAID, 2020). Studies contend that although considerable progress towards this goal, especially in the past decade, more work is needed to speed the target's achievement (Dutta et al., 2015). Significant issues during pregnancy and postnatal are depression and post-traumatic stress disorder (PTSD). While postnatal rates are 1% to 20% (Geller and Stasko, 2017; Jenkins et al., 2024), prenatal PTSD rates range from 2.3% to 24%.

Despite reduced mortality rates, the situation of maternal mortality remains a neglected disaster, particularly in developing countries, and the SDGs target has yet to be achieved (Callister and Edwards, 2017; Kurjak et al., 2023; Olea- Ramirez, et al., 2024). The focus of the targets under the third goal is to achieve universal health coverage and guarantee access to affordable and safe vaccines and medicines for all individuals. (United Nations, 2023). Statistics highlight the increasing maternal mortality rates linked to emergency obstetric care and postpartum haemorrhage shortly after delivery (Said et al., 2020). Depression and post-traumatic stress syndrome remain significant contributors to

maternal mortality during pregnancy and in the first year postpartum (Pasha and Shepley, 2013; Paraskevopoulou and Kamperi, 2018).

In spite of government initiatives and support from international development aid organisations aimed at enhancing well-being, the outdoor environments of healthcare facilities lack suitable garden features, which are recognised for their benefits in promoting both physical and mental health (Karanikola et al., 2020; Aktan et al., 2024). The rapid urban expansion of sub-Saharan cities results in the degradation of natural ecosystems, significantly affecting features such as green spaces (Puplampu and Boafo, 2021). The current body of work does not establish a connection between exposure to garden features during and after pregnancy for the reduction of antenatal depression; instead, it offers a broad overview of the benefits of outdoor healing environments in healthcare contexts (Lestari and Favurita, 2024).

This investigation explores the impact of architectural garden elements on enhancing maternal well-being and health in Tanzania throughout antenatal and postnatal care. The examination focusses on the healing effects of garden features on mothers' physical, social, and mental well-being, along with behavioural perspectives regarding their utilisation. This investigation explores the influence of garden components, maternal actions, and social factors on sustainable caregiving practices. The study explores the impact of garden elements on reducing maternal stress, sadness, and PTSD during pregnancy and the postpartum period. The results indicate that it is essential for policymakers and medical personnel to integrate garden features into healthcare facilities to decrease maternal mortality rates and promote the achievement of Sustainable Development Goals.

LITERATURE REVIEW

1. Maternal Health (MH)

Maternal health includes pregnancy, childbirth, and the postnatal period, which continues to be a vital global health priority (Souza et al., 2024; Say et al., 2014; Svalastog et al., 2017). Maternal health encompasses multiple stages, each of which ought to be a positive experience. Ensuring that women and their newborns receive comprehensive support, and a conducive environment is crucial for protecting their health and well-being, especially during their hospital stay (Kifle et al., 2017). While there has been notable advancement in lowering maternal mortality rates (MMR) in accordance with the Millennium Development Goals (MDGs), obstacles continue to exist, especially in developing nations (Olea-Ramirez et al., 2024; Kurjak et al., 2023). Globally, a pregnant woman loses her life every two minutes, predominantly in sub-Saharan Africa and South Asia (Aftab et al., 2021). The main factors contributing to maternal mortality encompass postpartum haemorrhage, hypertensive disorders, and infections (Taher, 2024). Additionally, indirect factors like anaemia and malaria further complicate the issue (Kumari et al., 2020).

Tanzania, similar to numerous developing nations, has achieved progress in lowering under-five mortality rates; however, it still faces challenges in tackling maternal psychological health and enhancing emergency obstetric care (Mselle et al., 2023; Shoo et al., 2017). Post-traumatic stress disorder (PTSD) and postpartum depression (PPD) represent critical but often overlooked factors in maternal mortality and morbidity (Liu et al., 2021; Shaik et al., 2023). Although the United Nations Sustainable Development Goals (SDGs) highlight the importance of maternal health, there remains a deficiency in specific interventions that focus on the healing environment within maternal wards, especially in low-resource contexts (Feng et al., 2024; Zuber, et al., 2018; Soman et al., 2024). The existing literature on the impact of healing environments in alleviating maternal psychological distress, especially in developing nations, is quite sparse. Furthermore, there exists a scarcity of empirical evidence regarding the incorporation of outdoor therapeutic areas in maternal wards, underscoring a notable gap in comprehending their possible effects on maternal well-being.

2. Behavioural Perspective (BP)

The behavioural perspective regarding maternal health emphasises the intricate relationships among healthcare-seeking behaviour, cultural beliefs, and environmental influences. Research indicates that inadequate healthcare-seeking behaviour among women in developing nations is shaped by socio-cultural norms, insufficient awareness, and inadequate healthcare infrastructure (Bell et al., 2015; Sharma et al., 2021; Dutta, et al., 2022; Cáceres et al., 2023). The utilisation of maternal healthcare in rural Tanzania as the tradition carried to urban areas is profoundly shaped by cultural beliefs and practices. Even with significant attendance at antenatal care, the rate of skilled birth attendance is still low, largely because indigenous communities prefer home delivery (Felisian et al., 2023). Enhancing maternal health outcomes necessitates tackling these obstacles with culturally aware interventions, acknowledging traditional practices, and engaging men in maternal health choices (Mustafa et al., 2020).

The incorporation of healing gardens within healthcare environments has become increasingly recognised as a supportive strategy alongside contemporary medical practices (Oliveira et al., 2023). Healing gardens are crafted to alleviate stress, support emotional health, and improve recovery by nurturing a bond with nature (Lestari and Favurita, 2024). Essential design principles for effective healing gardens encompass accessibility, sensory stimulation, and restorative elements (Lestari and Favurita, 2024; Zhu and Sarah, 2024). Nonetheless, the influence of these environments on maternal health has not been thoroughly investigated, especially in sub-Saharan Africa. This results in a constrained comprehension of the impact that healing gardens have on maternal healthcare-seeking behaviour. The absence of studies investigating the behavioural effects of green spaces on postnatal recovery and maternal mental health is evident.

3. Garden Features (GF)

Healing gardens are gaining recognition as vital elements within healthcare facilities (Barahona, 2001; Bermudez et al., 2017), providing both physical and psychological advantages for patients and caregivers (Lestari and Favurita, 2024; Oliveira et al., 2023). Essential aspects like greenery, water features, and seating configurations have demonstrated their ability to alleviate stress, boost mood, and promote overall wellness (Barnes et al., 2019; Sullivan and Kaplan, 2016). In maternal wards, these characteristics can create a healing atmosphere that fosters emotional recovery and strengthens the bond between mothers and their infants (Olszewska-Guizzo et al., 2022).

Nonetheless, the design of healing gardens should be in harmony with the needs of users and their cultural contexts. For instance, investigations emphasise the significance of shade, comfortable seating, and accessibility in enhancing user satisfaction (Harries et al., 2023; Eraslan and Ayaz, 2022). Despite the insights presented, there remains a deficiency in empirical evidence regarding the specific garden features that prove most effective in maternal wards, especially in developing countries such as Tanzania. This highlights the lack of investigation into culturally suitable garden designs for healthcare facilities in sub-Saharan Africa.

4. Socio-cultural Aspects (SA)

Social and cultural factors significantly influence maternal health outcomes (Evans, 2013). Historical evidence indicates that gardens have been utilised as therapeutic spaces for centuries, spanning from ancient Persia to mediaeval European monasteries (Sillmann et al., 2024). Nonetheless, the incorporation of healing gardens within contemporary healthcare environments has been uneven, especially in developing nations (Lestari and Favurita, 2024; Lowe et al., 2016). In Tanzania, various socio-cultural beliefs and practices frequently obstruct access to maternal healthcare. In many rural areas, there is a preference for traditional birth attendants rather than skilled healthcare providers (Felisian et al., 2023). Confronting these challenges necessitates interventions that are attuned to cultural sensitivities, honouring local beliefs while advancing practices grounded in evidence.

5. Antenatal and Postnatal Care (AandPNC)

Antenatal and postnatal care (AandPNC) play a vital role in safeguarding the health along with well-being of mothers and infants. Nonetheless, the postnatal period frequently correlates with elevated instances of maternal morbidity, such as postpartum haemorrhage and depression (Sheng et al., 2024; Moyo et al., 2023). Postnatal depression (PND) impacts around 17.22% of mothers worldwide, with elevated rates observed in developing countries (Wang et al., 2021).

Healing environments, such as gardens, can effectively tackle these challenges by offering a restorative space for mothers in the postnatal period. Research indicates that having access to green spaces may lead to decreased stress levels, improved mood, and enhanced emotional well-being (Hall et al., 2023; Lestari and Favurita, 2024; Kotozaki, 2020). Nonetheless, there is a notable gap in the literature regarding the specific advantages of healing gardens for postnatal recovery, especially in sub-Saharan Africa context. This highlights the necessity for additional investigation into the socio-cultural elements that affect the utilisation of healing gardens in AandPNC. Research from multiple studies highlighted that foundational beliefs within multicultural societies are deeply embedded in both the physical and social realms (Hamal et al., 2020). Nevertheless, additional indicators are presented in Tab. 1, offering a summary of maternal health indicators that promote healing for sustainable antenatal and postnatal care).

Existing studies indicate notable advancements in maternal health; however, they also emphasise ongoing difficulties, especially in resource-limited environments. Although healing gardens have demonstrated physical and psychological advantages, empirical evidence regarding their impact in maternal wards, especially in sub-Saharan Africa, remains insufficient. This study seeks to fill these gaps by examining the behavioural, design, and socio-cultural factors that affect the utilisation of healing gardens in maternal wards in Mbeya, Tanzania. This study aims to pinpoint the essential characteristics and obstacles linked to healing environments, ultimately offering data-driven suggestions for enhancing maternal health results and ensuring sustainable antenatal and postnatal care.

Tab. 1. Summarised maternal health indicators. (Source: Authors, 2025)

Construct	Maternal Health Variables	References
BP1	Integration of greeneries based on people's viewpoints	(Do et al., 2019; Reeve et al., 2017; Sullivan et al., 2014)
BP2	Incorporation of garden features based on different user groups	(McCormick, 2017; van der Riet et al., 2017)
BP3	Advice to include religious views during the design of healing gardens	(Cáceres et al., 2023) (Zhao and Mourshed, 2017)
BP4	Female traditional birth attendants during the maternal health care	(Cáceres et al., 2023)
BP5	Consideration of free birthplaces choices	(Kifle et al., 2017)
BP6	Improved infrastructures are perceived to be a factor favouring maternal health	(Feng et al., 2024)
BP7	Involvement of husbands to support their wives when seeking maternal health	(Chayal et al., 2024)
GF1	Recognizing users' requirements	(Zhao and Mourshed, 2017)
GF2	Involve GF that offer positive effect to users	(van der Riet et al., 2017)
GF3	Encourage the use of tangible GF to inspire user's interaction with nature	(Motealleh et al., 2017; Yang et al., 2019; Kalender-Smajlović and Dovjak, 2023)
GF4	Use of variety GF to increase multiple physiotherapies and ecosystem services	(Spring, 2016; Velarde et al., 2007; Harries et al., 2023) (Petros and Georgi, 2011; Rawlings, 2017; Ulrich et al., 2008; Hwang and Park, 2019)
GF5	Consideration of shades and type of seats to provide flexibility to users	
SA1	Courtyard and garden restoration	(Germond and Cochrane, 2010; Glover and Parry, 2009)
SA2	Launching healing initiatives like EPCMD	(United Nations, 2015)
SA3	The emotional support provided before and after delivery	(UNDESA, 2015)
SA4	Technical sustenance establishment to allow safe delivery In-	(Feng et al., 2024)
SA5	troduction of clinical support guidelines	(Marcus, 2016)
SA6	Policy implication to address maternal health	(Novignon et al., 2019)
SA7	Review socio-economic aspects that accelerate maternal health	
SA8	Conduct analysis to maternal health-based frameworks	(Hamal et al., 2020) (Hickman, 2013)
AandPNC1	Develop the maternal self-esteem	(Chen et al., 2020; Glavin and Leahy-Warren, 2013) (Verderber et al., 2014; Cutchin et al., 2010)
AandPNC2	Improved capacity to thrive in a new combined identity	(USAID, 2020) (Glavin and Leahy-Warren, 2013; Redzuan et al., 2020)
AandPNC3	Competence and confidence improvement	(Hamal et al., 2020; Graham et al., 2017; Warren, 2005; Milligan and Bingley, 2007)
AandPNC4	Helpful counselling	(Leahy-Warren and McCarthy, 2007)
AandPNC5	Ensure social support	(Glavin and Leahy-Warren, 2013; Verderber et al., 2014)
AandPNC6	Provision of critical maternal general awareness	
AandPNC7	Adoption of Edinburg Postnatal Depression Scale (EPDS)	
AandPNC8	Receiving care and positive statements for their infant	

MATERIALS AND METHODS

1. Research design

The investigation utilises both qualitative and quantitative methodologies, incorporating statistical analysis, structured questionnaires, and Structural Equation Modelling (SEM) through SPSS-AMOS 25 for data analysis. This method was selected to systematically assess the behavioural viewpoints of mothers and carers, as well as the influence of garden characteristics on maternal health results.

2. Research site

Fig. 1. The existing situation in the study area settings. (Source: Authors, 2024)

The choice of the site was determined by particular criteria, such as its designation as a zonal referral hospital catering to the southern highlands' region of Tanzania and adjacent SADC countries, challenges posed by outdoor environments, and the existence of a substantial maternal health department. Initially, five public hospitals were evaluated, including Muhimbili National Hospital (MNH), Bugando Medical Centre (BMC), Benjamin Mkapa Hospital (BMH), and Kilimanjaro Christian Medical Centre (KCMC). However, MZRH was selected due to its specific characteristics and its potential to enhance garden features for sustainable antenatal and postnatal care.

The study location is the Meta-maternal department (MMD) at Mbeya Zonal Referral Hospital, Mbeya (MZRH), Tanzania. The MMD is situated at GPS coordinates 8.910124, 33.432422, and 8054'33.4''S 33026'00.1''E within the Mbeya CBD area, encompassing a landscape zone of approximately 3800 m2 adjacent to the hospital buildings, as illustrated in Fig. 1. The MMD of MZRH bed capacity is projected to rise from 167 to 390 in-patient beds. The MZRH has a workforce of around 312 individuals, including doctors, nurses, technicians, and administrative personnel, who are distributed across nine distinct departments, one of which is the MMD. The facility is designated as a zonal referral hospital, capable of serving 1.9 million individuals annually. The facility provides a comprehensive array of medical services, encompassing inpatient and outpatient clinical care, maternal health support, emergency department services, surgical procedures, and paediatric care. The MMD encompasses the most extensive landscape area, characterised predominantly by bare land, with only a limited section featuring lawns. The MZRH management intends to enhance the existing outdoor healing environment of the MMD and support various user groups within and around the hospital premises.

3. Survey method

The study was conducted in Mbeya, Tanzania, from May 2021 to November 2021. It adopted a questionnaire tool and an interview as a survey method to collect and examine the behavioural perspective of hospital garden features that mainly targeted the caregivers and hospital visitors of a large population based on a small collected sample of respondents within the case study area. The two groups are targeted due to their direct involvement in maternal health and well-being experts or relatives to provide first-hand insights respectively.

A total of 5 public hospitals recognised by the Ministry of Health (MoH) were identified based on excellent performance criteria. These included public hospitals with maternal wards, population pressure, inadequate infrastructures, garden features, and availability of key informants. Since the study aimed to analyse the MoH indicators during the AandPNC, only a hospital with the highest scores based on the challenges associated with infrastructures and human resources speeds up maternal healing. On the other hand, 20 doctors and nurses registered by their respective boards were purposively selected from different public hospitals for a pre-qualification interview of the systematic process. However, the pre-qualification of a systematic approach enabled identifying one public hospital with the capacities for MoH as mentioned earlier with a total population of 555.

However, Taro Yamane's formula was applied in the equation below to compute the study's minimum sample size, resulting 233 respondents (Adam, 2020; Kothari and Garg, 2014).

Equation 1: Taro Yamane's Formula of the Sample Size

$$(n) = \frac{N}{(1+Ne^2)} = 233 \quad (1)$$

In this context, "n" denotes the minimum number of respondents required, referred to as the minimum sample size, while "N" indicates the size of the study population. Additionally, "e" signifies a level of precision, representing an acceptable margin of error, which is assumed to be at a 95% confidence level for this study (Taherdoost, 2017). This approach aims to ensure a high degree of reliability in the results, effectively minimising the margin of error and adhering to established practices in the fields of social science and health research. The determined sample size of 233 was verified through an online priori sample size calculator for SEM, affirming its suitability for the analytical needs of the study. Furthermore, conducting Structural Equation Models necessitates an evaluation of sample adequacy. This study utilised an online priori sample size calculator for SEM to determine the minimum sample size (Soper, 2020). Nonetheless, the expected effect size (Cohen's d) was 0.3, the target statistical power level was 0.8, the study included 4 latent variables, and there were 14 observed variables at a probability level of 0.05. The findings indicate that a minimum sample size of 138 is recommended for SEM, demonstrating that the calculated sample size of 233 is appropriate for the analysis and study conducted.

4. Questionnaire design

The structured questionnaire, organised into four main sections, was distributed to participants to gather insights for the study. Initially, the focus was to investigate crucial garden elements that significantly contribute to maternal health. Then it anticipated to gather insights on social issues from the research and behavioural viewpoints of various group requirements. Ultimately, the goal was to gain a deeper understanding of antenatal and postnatal care.

The five-point binary Likert scale (ranging from 1 = Strongly Disagree/Not Important/Not Influential to 5 = Strongly Agree/Very Important/Very Influential) was utilised with the objective of indicating numerical ranks exclusively. Nonetheless, this binary Likert scale design did not account for absolute quantities or equal intervals between them. In the meantime, a consistent average rating with suggested ordinal values facilitated the interpretation of respondents' perspectives. Conversely, we implemented the formula: (Highest Point minus Lowest Point in the Likert scale) to determine the level of each item, divided by the corresponding level numbers. In this study, the group Likert scale points were defined as follows: (1 to ≤ 1.8 indicated Strongly Disagree); (1.81 to ≤ 2.6 indicated Disagree); (2.61 to ≤ 3.4 indicated Moderate); (3.41 to ≤ 4.2 indicated Agree); and (4.21 to ≤ 5 indicated Strongly Agree).

20 doctors and nurses, previously identified, were randomly selected based on their experience in maternal health and enrolled in a pilot study. The aim was to pinpoint additional inaccuracies, eliminate unnecessary words, and clarify terms in the questionnaire. Moreover, the pilot study facilitated the identification and assessment of key issues within the questionnaire survey, aiming to create optimal and comprehensible questionnaires. A total of 233 questionnaires, both in English and translated into Swahili, were utilised for the survey. Ethical considerations were taken into account during the questionnaire survey, including participants' willingness to engage in the study and the signing of the consent letter; respondents completed the questionnaire anonymously.

Nevertheless, in the case of difficulties during the face-to-face interview, the individual elaborated the questionnaires to ensure respondents understood the study objective and their views and perspectives. However, fifteen participants were unable to attend the in-person interview. Consequently, communication was established via emails and social media platforms like WhatsApp, WeChat, and phone calls to facilitate the completion of the questionnaire survey. A total of 197 questionnaires, representing 84.6%, were deemed appropriately administered and utilised for data analysis.

5. Analysis methods

The gathered sample data underwent coding, editing, descriptive analysis, and was assessed for reliability and construct validity using the SPSS Amos 25 software program. We assessed construct validity to evaluate the degree to which all items on a scale assess the same construct. The internal reliability of the 5-point Likert scale was assessed through an examination of data reliability. The study aimed to determine whether the questionnaire survey tool yields consistent results across various test sets. In the meantime, the application of SPSS-AMOS 25 facilitated the execution of confirmatory factor analysis (CFA) and the development of a structural equation model (SEM) for mental health. Furthermore, we calculated the reliability estimate linked to the composite scores for the 11 observed variables or items by employing the standardised Cronbach's formula.

Equation 2: Standardised Cronbach's formula

$$a = \frac{\mathrm{kr}}{(1+(\mathrm{k}-1)\mathrm{r})} \quad (2)$$

Where, a= Reliability Estimate, k= Number of Items (14), and r= Average Correlation (0.652).

$$a = \frac{14(0.652)}{(1 + (14-1)0.652)}$$

$$= \frac{9.128}{9.476} = 0.96$$

Thus, after computing data from the standardised Cronbach's formula, the reliability was 0.96; therefore, this signifies that 96% of the variance in the composite score related to the fourteen items is a reliable variance.

RESULTS

1. Demographic information

The investigation involved a varied cohort of participants, comprising diploma graduates (15.2%), degree holders (54.3%), master's graduates (19.8%), and PhD holders (10.7%). Furthermore, representatives from various government sectors were involved, with hospital directors making up 42.1%, managerial roles at 21.8%, and Heads of Departments (HoD) at 36.1%. The demographic characteristics underscored the active participation of specialists from the Ministry of Health (MoH), as outlined in Tab. 2. The targeted demographic groups were selected to guarantee a thorough representation of stakeholders engaged in maternal health services. Hospital directors and heads of departments were involved because of their critical roles in decision-making for healthcare delivery, while government officials from MoH contributed valuable insights at the policy level. The inclusion of respondents with varied educational backgrounds ensured a broad spectrum of perspectives, spanning from operational to strategic levels, thereby enhancing the validity and applicability of the findings.

Tab. 2. Socio-demographic information of respondents. (Source: Authors, 2024)

Respondent Category	Class	Frequency	Percentage Sample (%)
Age (Years)	18–30	40	20.3
	31–43	94	47.7
	44–56	45	22.8
	Above 56	18	9.2
Hospital Visitors	Male	29	14.7
	Female	168	85.3
Education Level	Diploma	30	15.2
	Degree	107	54.3
	Masters	39	19.8
	PhD	21	10.7
Caregivers	Doctors	94	47.7
	Nurses	103	52.3
Leadership	Others	43	21.8
	HoD	71	36.1
	Hospital Director	83	42.1

2. Maternal health influencing factors

This study analysed the impact of garden features on maternal health by gathering data via surveys, discussions in focus groups, and interviews. The Relative Importance Index (RII) was employed to measure the influence of each garden feature.

$$RII = \sum(\frac{W}{AN})$$

Where W represents the Likert scale weight (1–5), A denotes the highest weight (5), and N indicates the total number of respondents (197). The findings presented in Tab. 3 demonstrate that user needs are prioritised above all else, highlighting the therapeutic and healing advantages linked to outdoor settings. The second-highest ranked factor was the need for technical support to ensure safe delivery, indicating a deficiency in the existing healthcare infrastructure.

Tab. 3. Maternal health influences. (Source: Authors, 2024)

Influence Category	Influences	Respondent's Frequency (N)					Total N		RII	Ranking
	Likert Scale Weight	5	4	3	2	1		ΣW	ΣW/AN	
Environmental Issues (EI)	EI1	49	40	49	28	27	197	635	0.645	18
	EI2	48	39	37	39	34	197	619	0.628	20
	EI3	23	19	44	57	53	197	490	0.498	26
	EI4	21	17	49	63	39	197	485	0.492	27
Behavioural Perspective (BP)	BP1	69	55	25	21	26	197	708	0.719	14
	BP2	80	81	21	7	9	197	810	0.822	5
	BP3	31	48	59	39	19	197	621	0.630	19
	BP4	59	55	49	18	15	197	663	0.673	17
	BP5	61	84	37	9	6	197	756	0.768	10
	BP6	64	60	48	12	11	197	739	0.750	12
	BP7	49	40	49	28	27	197	635	0.645	18
Garden Features (GF)	GF1	91	82	23	1	2	197	856	0.869	1
	GF2	20	48	61	40	27	197	609	0.618	22
	GF3	69	64	52	10	0	197	777	0.789	8
	GF4	75	59	44	13	6	197	775	0.787	9
	GF5	31	48	59	39	19	197	621	0.630	19
	GF6	49	40	49	28	27	197	635	0.645	18
Social Affairs (SA)	SA1	83	90	9	4	13	197	823	0.836	4
	SA2	23	19	44	57	53	197	490	0.498	26
	SA3	83	89	18	5	9	197	844	0.857	3
	SA4	95	79	18	3	0	197	851	0.864	2
	SA5	82	68	37	5	4	197	807	0.819	6
	SA6	24	39	38	31	62	197	514	0.521	25
	SA7	31	48	59	39	19	197	621	0.630	19
	SA8	20	48	61	40	27	197	609	0.618	22
Antenatal and postnatal care (AandPNC)	AandPNC1	19	39	73	48	17	197	583	0.592	24
	AandPNC2	83	68	29	8	9	197	799	0.811	7
	AandPNC3	49	51	55	25	15	197	679	0.689	15
	AandPNC4	59	73	38	15	12	197	743	0.754	11
	AandPNC5	53	69	43	15	14	197	728	0.739	13
	AandPNC6	19	39	73	48	17	197	583	0.592	24

	AandPNC7	20	48	61	40	27	197	609	0.618	22
	AandPNC8	57	49	47	24	19	197	670	0.680	16
	GP1	19	48	84	29	13	197	610	0.619	21
Government policy on healing gardens (GP)	GP2	44	42	40	29	38	197	604	0.613	23
	GP3	24	39	38	31	62	197	514	0.521	25
	GP4	21	17	49	63	39	197	485	0.492	27

Findings indicated notable challenges, including insufficient emotional support surrounding childbirth and inadequate restoration efforts for courtyards and gardens. The lack of explicit guidelines from MoH concerning healing environments in hospital designs has been recognised as a significant concern. Numerous hospital designs prioritise functional medical guidelines while overlooking principles of healing architecture. The absence of organised outdoor activities leads to social isolation and heightened stress levels among hospital users. Principal Component Analysis (PCA) further refined these findings by reducing the number of influencing factors while preserving those with the highest explanatory power (Tab. 4). The Scree Plot (Fig. 2) demonstrates that only factors with eigenvalues exceeding 1 were retained, thereby enhancing the analysis's robustness.

However, findings showed that lack of emotional support provided before and after delivery, courtyard, and garden restoration were among the challenges faced by the hospitals outdoors. The Ministry of Health, Community Development, Gender, Elderly and Children (MHCGEC) has not established and emphasised strategies and approaches that can facilitate hospitals' design by considering an outdoor healing environment. Most hospital designs have assessed the available ministry guidelines while leaving aside basic healing architecture principles to support and accelerate the healing process to different hospital users.

In addition, other challenges include the unavailability of garden features based on different group users and the lack of clinical support guidelines. The unavailability of some organised outdoor activities leads to idleness, thus hindering social engagement among other user groups. Most garden users miss special treatment hence failing to reduce stress and work tension. In the same vein, most respondents cautioned the lack of improved capacity to thrive in a new combined identity and less encouragement to use tangible garden features to inspire users' interaction with nature.

Meanwhile, to quickly analyse the extensive data of available samples in our study, we computed the PCA to summarize the statistical contents through a smaller data set. On the other hand, the goal of calculating a PCA was to ease our set of variables to the manageable one and not all the fourteen factors could be retained. Finally, only four eigenvalues, more than 1, were used in the factor analysis. Similarly, the four factors clarify 71.444% variance, which shows the 71.444% variance is sorted out over four elements, while ten factors explain 78.103% variance, as illustrated in Tab. 4. Furthermore, only those factors appearing to have eigenvalue higher than 1 were retained (Guttman-Kaiser rule) as well as factors which, in total, account for about 70–80% of the variance. However, we see in the scree-plot Fig. 2, all the factors before the breaking point were kept. In this case, all the remaining factors (from the fifth factor onwards) which seem not to fall within the recommended factors were dropped within the set of variables (Rietvield, van Hout, 1993).

Tab. 4. Total variance explained. (Source: Authors, 2025)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.113	29.376	29.376	4.113	29.376	29.376	2.679	19.137	19.137
2	2.175	15.533	44.909	2.175	15.533	44.909	2.674	19.097	38.234
3	1.957	13.979	58.888	1.957	13.979	58.888	2.339	16.706	54.940
4	1.758	12.556	71.444	1.758	12.556	71.444	2.311	16.504	71.444
5	.932	6.659	78.103						
6	.764	5.457	83.560						
7	.613	4.380	87.939						
8	.485	3.461	91.401						
9	.337	2.407	93.808						
10	.254	1.818	95.626						
11	.198	1.412	97.038						
12	.164	1.174	98.211						
13	.135	.963	99.174						
14	.116	.826	100.000						

Extraction Method: Principal Component Analysis

Also, this can be demonstrated by the Scree Plot, which plots the eigenvalue (total variance explained) against the factor numbers or components. From the fifth factor onwards, the line is almost flat, illustrating every successful aspect is accounting for a minor quantity of the total variance, as shown in Fig. 2.

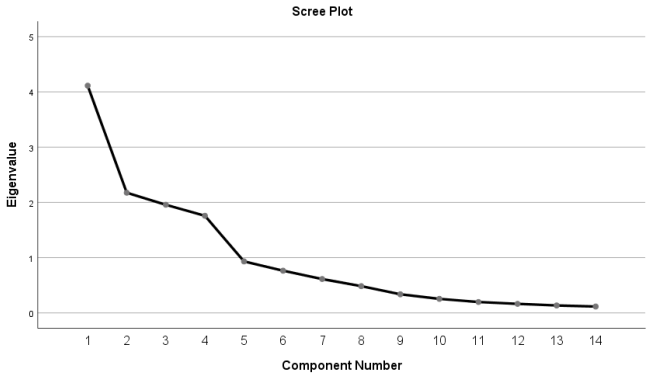


Fig. 2. Scree Plot. (Source: Authors, 2025)

To understand the power of individual garden features for maternal health during the postnatal period, we computed the most top-ten garden features (GF) influences from the RII in Tab. 3. Identifying the GF intended for maternal health was vital for this research. However, a discriminant analysis was employed to understand how GF differs from the influencing category, hence predicting how GF variables connected with maternal health are healing power using interval predictor variables of 1 to 5. The data in Tab. 5 show that the eigenvalue value is 3.127a, signifying the extent of discriminating ability. The canonical correlation of 0.835 is relatively high to calculate the adequate size, and it can be squared. Also, the cumulative proportion value of the discriminating ability is 100% indicating the computation of an analysis involving two groups.

Tab. 5. Eigenvalues. (Source: Authors, 2025)

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	3.127a	100.0	100.0	.835

a. First, one canonical discriminant function was used in the analysis.

Tab. 6. Wilks' Lambda. (Source: Authors, 2025)

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.888	17.728	6	.000

Since our discriminants analysis involved two groups, there is only one function value. The Wilks' Lambda analysis in Tab. 6 shows how the prediction model fits and is statistically significant by (df = 6, p-value = 0.000, Chi-square = 17.728), which means that the computed p-value is smaller than 0.05. So, we reject the null hypothesis at a 5% significant level and conclude that the function possesses discriminating ability.

3. Garden Features (GF)

Understanding the power of GF is significant to improving the MH. The pinpointing of the vital garden features was the essential step of the research. The average mean for GF indicators was computed with descriptive analysis, as illustrated in Tab. 9. Only those constructs that reached figures above the specified five Likert scales range (3.41—agree or effective to 5—strongly agree/effective) were considered the prospective indicators for MH during AandPNC. However, the results recognised three (3) out of five indicators with mean scores greater than or equal to 3.41. Identifying users' requirements (M = 3.80; SD = 1.18; CI = 3.62–3.98) was first ranked to support maternal health. The use of variety GF to increase multiple physiotherapies and ecosystem services (M = 3.79; SD = 1.20 CI = 3.61–3.97) was categorised under this category. However, encouraging tangible GF to inspire users' interaction with nature (M = 3.72; SD = 1.27; CI = 3.53–3.92; P < 0.01) was invented to facilitate the feeling and involvement of public authorities and other relevant institutions to discover the influence of GF in maternal health.

4. Behavioural Perspective

Behavioural perceptions of garden features were assessed using a Likert scale. Findings (Tab. 9) reveal that the integration of greenery based on users' perspectives (M = 3.81, SD = 1.18) was the most influential factor. The inclusion of garden features catering to different user groups (M = 3.80, SD = 1.14) ranked second, followed by the need for free birthplace choices (M = 3.79, SD = 1.13). Infrastructure improvements (M = 3.73, SD = 1.20) were also crucial for maternal transportation and accessibility. Pearson's correlation test confirmed a statistically significant relationship ($p < 0.01$), validating the positive impact of these factors on maternal health outcomes (Tab. 11).

5. Social Affairs

Four social factors influencing maternal health were analysed (Tab. 9). Findings indicate that courtyard integration and garden restoration (M = 3.74, SD = 1.18) had the highest impact, followed by the need for emotional support before and after delivery (M = 3.60, SD = 1.15). The introduction of clinical support guidelines (M = 3.59, SD = 1.17) and technical sustenance for safe delivery (M = 3.46, SD = 1.10) were also significant. These results suggest that beyond physical infrastructure, emotional and social support systems are vital for improving maternal healthcare experience.

6. Antenatal and Postnatal Care

The research identified significant factors affecting postnatal and antenatal care as illustrated in Tab. 9. Counselling services (M = 3.79, SD = 1.20) were identified as the most essential, followed by the necessity for enhanced capacity to adapt to new maternal identities (M = 3.70, SD = 1.16). During this period, social support (M = 3.67, SD = 1.24) was crucial. Pearson's correlation test indicated a robust positive association between these factors, underscoring their significance in maternal healthcare, as shown in Tab. 11.

7. Indicator identification and ranking

Maternal health parameters were evaluated and ranked utilising SPSS-25. Cronbach's alpha coefficients for various constructs fell within the acceptable range as depicted in Tab. 7, thereby affirming the reliability of the measurement instruments. The Kaiser-Meyer-Olkin (KMO) test results (χ^2 = 385.795, df = 136, KMO = 0.674, p = 0.000) confirmed the adequacy of the sample for factor analysis. Descriptive analysis and a one-sample t-test confirmed the significance of these indicators as shown in Tab. 9.

Tab. 7. Cronbach's Alpha Coefficient. (Source: Authors, 2025)

Item	Latent Variables			
Manifested Variables	**Behavioural Perspective**	**Garden Features**	**Social Affairs**	**Antenatal and Postnatal Care**
No. of Observed Variables	4	3	4	3
Cronbach's Alpha Coefficient	0.829	0.824	0.748	0.912
Cronbach's Alpha Based on Standardised Items			0.809	

Tab. 8. KMO and Bartlett's Test. (Source: Authors, 2025)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.674
Bartlett's Test of Sphericity	Approx. Chi-Square	1327.841
	df	610
	Sig.	.000

Tab. 9. Ranking of indicators for maternal health by users. (Source: Authors, 2025)

Rank	Cluster	Indicators	Mean	Std. Dev	95% CI	
					Lower	Upper
01	BP1	Integration of greeneries according to user's viewpoint	3.8107	1.18004	3.6314	3.9899
02	BP2	Incorporation of garden features based on different user groups	3.8047	1.14058	3.6315	3.9779
03	BP5	Birthplace choice consideration	3.7988	1.12641	3.6278	3.9699
08	BP6	Encourage the availability of infrastructures that support maternal health	3.7278	1.20386	3.5450	3.9106
04	GF1	Recognising users' requirements	3.7988	1.17807	3.6199	3.9777
09	GF3	Encourage the use of tangible GF to inspire users' interaction with nature	3.7219	1.27225	3.5287	3.9151
05	GF4	Use a variety of GF to increase multiple physiotherapies and ecosystem services	3.7870	1.20102	3.6046	3.9694
07	SA1	Courtyard and garden restoration	3.7396	1.18157	3.5602	3.9191
12	SA3	Emotional support was provided before and after delivery	3.6036	1.15067	3.4288	3.7783
14	SA4	Technical sustenance establishment to allow safe delivery	3.4556	1.09631	3.2891	3.6221
13	SA5	Introduction of clinical support guidelines	3.5976	1.17169	3.4197	3.7756
10	AandPNC2	Capacity improvement to thrive in a new combined identity	3.6982	1.15884	3.5222	3.8742
06	AandPNC4	Helpful counselling	3.7870	1.19605	3.6053	3.9686
11	AandPNC5	Ensure social support	3.6686	1.24270	3.4799	3.8574

8. Maternal health indicators

Factor analysis (Tab. 10) revealed 14 essential maternal health indicators, categorised into four groups: garden features, social affairs, behavioural perspectives, and antenatal (postnatal) care. The findings are consistent with current literature, affirming the significance of these indicators. The composite reliability (CR) and average variance extracted (AVE) met the acceptable thresholds (CR > 0.7, AVE > 0.5), thereby confirming construct validity.

9. Structural Equation Modelling (SEM)

Structural Equation Modelling (SEM) was utilised to evaluate the relationships among the identified variables. The model fit indices presented in Tab. 12 indicate a satisfactory fit, with χ^2 = 81.346, RMSEA = 0.029, TLI = 0.948, CFI = 0.965, and AGFI = 0.923. The findings suggest that garden features, social interactions, and behavioural perspectives have a significant impact on maternal health outcomes. Multiple regression analysis (Tab. 13) corroborates this finding, demonstrating a R^2 value of 0.557, which signifies that these factors account for 55.7% of the variance in maternal health.

Tab. 10. A Rotated Component Matrix of Maternal Health. (Source: Authors, 2025)

Code	Indicators	Clusters				CR	AVE
		1	2	3	4		
BP1	Integration of greeneries based on people's viewpoints		.813				
BP2	Incorporation of garden features based on different user groups		.845			0.730	0.872
BP5	Consideration of free birthplace choices		.768				
BP6	Encourage the availability of infrastructures that support maternal health.		.744				
GF1	Recognizing users' requirements				.911		
GF3	Encourage the use of tangible GF to inspire users' interaction with nature				.765	0.700	0.874
GF4	Use a variety of GF to increase multiple physiotherapies and ecosystem services				.826		
SA1	Courtyard and garden restoration			.618			
SA3	The emotional support provided before and after delivery			.869		0.760	0.832
SA4	Technical sustenance establishment to allow safe delivery			.611			
SA5	Introduction of clinical support guidelines			.852			
AandP NC2	Improved capacity to thrive in a new combined identity	.918					
AandP NC4	Helpful counselling	.924				0.804	0.925
AandP NC5	Ensure social support	.845					

Extraction Method: Principal Component Analysis
Rotation Method: Varimax Rotation

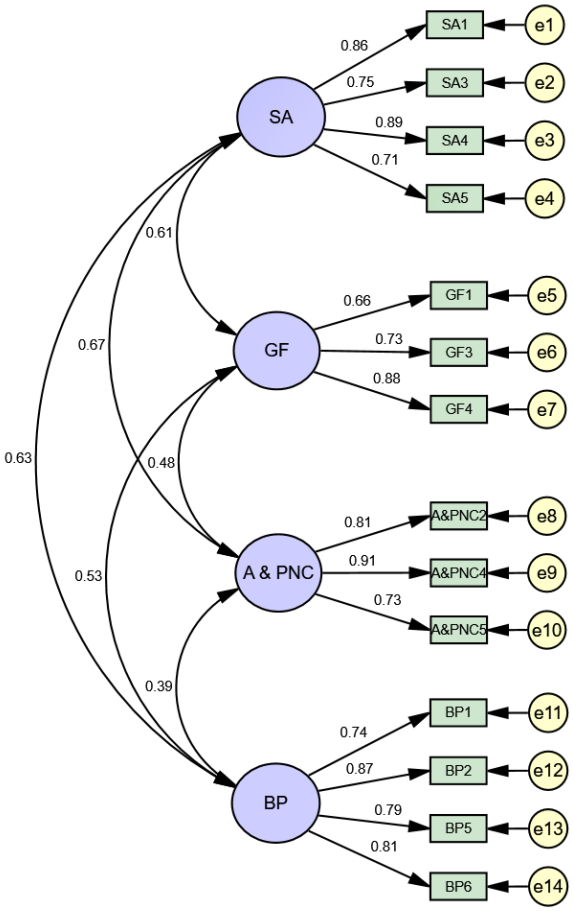
Tab. 11. Correlation Coefficients and Significance Levels Existing between Variables for Garden Features (GF), Social Affairs (SA), Behavioural Perception (BP), and Antenatal and Postnatal Care (AandPNC). (Source: Authors, 2025)

Variables		BP1	BP2	BP5	BP6	GF1	GF3	GF4	SA1	SA3	SA4	SA5	Aand PNC2	Aand PNC4	Aand PNC5
BP1	Pearson Correlation	1													
	Sig. (2-tailed)														
BP2	Pearson Correlation	.668**	1												
	Sig. (2-tailed)	0													
BP5	Pearson Correlation	.470**	.650**	1											
	Sig. (2-tailed)	0	0												
BP6	Pearson Correlation	.464**	.476**	.551**	1										
	Sig. (2-tailed)	0	0	0											
GF1	Pearson Correlation	.215**	.274**	0.113	0.086	1									
	Sig. (2-tailed)	0.005	0	0.144	0.266										
GF3	Pearson Correlation	.244**	.292**	0.132	0.132	.665**	1								
	Sig. (2-tailed)	0.001	0	0.087	0.088	0									
GF4	Pearson Correlation	0.054	0.131	0.024	-0.01	.722**	.439**	1							
	Sig. (2-tailed)	0.484	0.09	0.753	0.952	0	0								
SA1	Pearson Correlation	0.119	0.072	0.077	0.078	0.044	0.078	.304**	1						
	Sig. (2-tailed)	0.122	0.35	0.318	0.315	0.57	0.315	0							
SA3	Pearson Correlation	0.133	0.099	.290**	0.039	0.035	0.055	0.021	.389**	1					
	Sig. (2-tailed)	0.085	0.199	0	0.613	0.655	0.479	0.79	0						
SA4	Pearson Correlation	.286**	.264**	0.043	0.094	.218**	.227**	0.111	.326**	.347**	1				
	Sig. (2-tailed)	0	0.001	0.577	0.227	0.004	0.003	0.149	0	0					
SA5	Pearson Correlation	.175*	0.132	.284**	0.137	.163*	.401**	-0.01	.322**	.730**	.424**	1			
	Sig. (2-tailed)	0.023	0.087	0	0.076	0.035	0	0.871	0	0	0				
AandPNC2	Pearson Correlation	0.02	.231**	.336**	.209**	.194*	.161*	.222**	0.133	0.026	0.031	0.138	1		
	Sig. (2-tailed)	0.795	0.002	0	0.006	0.011	0.037	0.004	0.084	0.737	0.691	0.073			
AandPNC4	Pearson Correlation	-0.02	.233**	.349**	.202**	0.15	0.11	.240**	0.13	0.04	0.045	0.127	.855**	1	
	Sig. (2-tailed)	0.832	0.002	0	0.009	0.051	0.156	0.002	0.091	0.604	0.561	0.099	0		
AandPNC5	Pearson Correlation	0.076	.220**	.335**	.257**	.211**	.324**	.249**	.177*	0.009	0.071	.264**	.741**	.727**	1
	Sig. (2-tailed)	0.328	0.004	0	0.001	0.006	0	0.001	0.021	0.908	0.358	0.001	0	0	

**. The Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Fig. 3. The Path Diagram Relationship between Variables. (Source: Authors, 2025)



Tab. 12. Model Fit Indices (MI). (Source: Authors, 2025)

S/N	Model Fit Indices (MFI)	Acceptable MI Limit	Computed Result Indices (CRI)
1	Absolute Model Fit Chi-square Indices($\chi 2$) Degree of Freedom (df) Parsimonious Fit Minimum Discrepancy($\chi 2$/df)	< 3 Better	81.346 71 1.146
2	RMSEA	< 0.07 Good	0.029
3	Incremental Fit Tucker Lewis Index (TLI) Comparative Fit Index (CFI) Adjusted Goodness of Fit Index (AGFI)	> 0.9 Good > 0.9 Better > 0.9 Better	0.948 0.965 0.923

A new variable, sustainable maternal health (MH), was constructed using a regression model: MH = β0 + (βGF × GF) + (βSA × SA) + (βAandPNC × AandPNC) + (βBP × BP) + ε where βGF = 0.227 (p = 0.000), βSA=0.092 (p = 0.003), βAandPNC = 0.246 (p = 0.002), and βBP = 0.067 (p = 0.001). This formula demonstrates how each factor contributes to sustainable maternal health (Fig. 4).

Tab. 13. Unstandardised Regression Weight. (Source: Authors, 2025)

Coefficients							
Decision	Path	Strategic Model Process	Unstandardised Coefficients		Standardised Coefficients	T-Value	Sig.
			B	Std. Error (SE.)	Beta		
Intension	<---	Garden Features	0.227	0.061	0.351	13.971	0.000
Intension	<---	Social Affairs	0.092	0.084	0.095	11.075	0.003
Intension	<---	Antenatal and Postnatal Care	0.246	0.080	0.298	13.058	0.002
Intension	<---	Behavioural Perspective	0.067	0.074	0.078	11.944	0.001

DISCUSSION

This study emphasises the substantial influence of architectural garden features, social factors, and behavioural perspectives on maternal health in antenatal and postnatal care contexts. The results indicate that 85.3% of women utilised healthcare facilities for antenatal and postnatal care, whereas only 14.7% of men sought services to support maternal health. The study revealed that carers comprised 52.3% nurses and 47.7% doctors, indicating an imbalance in maternal healthcare provision. The findings are consistent with earlier research conducted in Cambodia (Hwang and Park, 2019), Malawi (Thorsen et al., 2014), Ghana (Craymah et al., 2017), Kenya (Ongolly and Bukachi, 2019) and sub-Saharan Africa (Esopo et al., 2020), underscoring the necessity for enhanced outdoor healing environments. This study has a significant limitation due to potential selection bias, as the sample predominantly consisted of individuals already involved in maternal healthcare, potentially failing to capture the viewpoints of underserved populations. Response bias may have affected the results, as participants might have offered socially desirable responses instead of their genuine experiences (van de Mortel, 2008). The research utilised self-reported data, which may lead to recall bias, especially concerning perceptions of outdoor healing environments. Future research ought to integrate observational methods and physiological measures to corroborate self-reported outcomes.

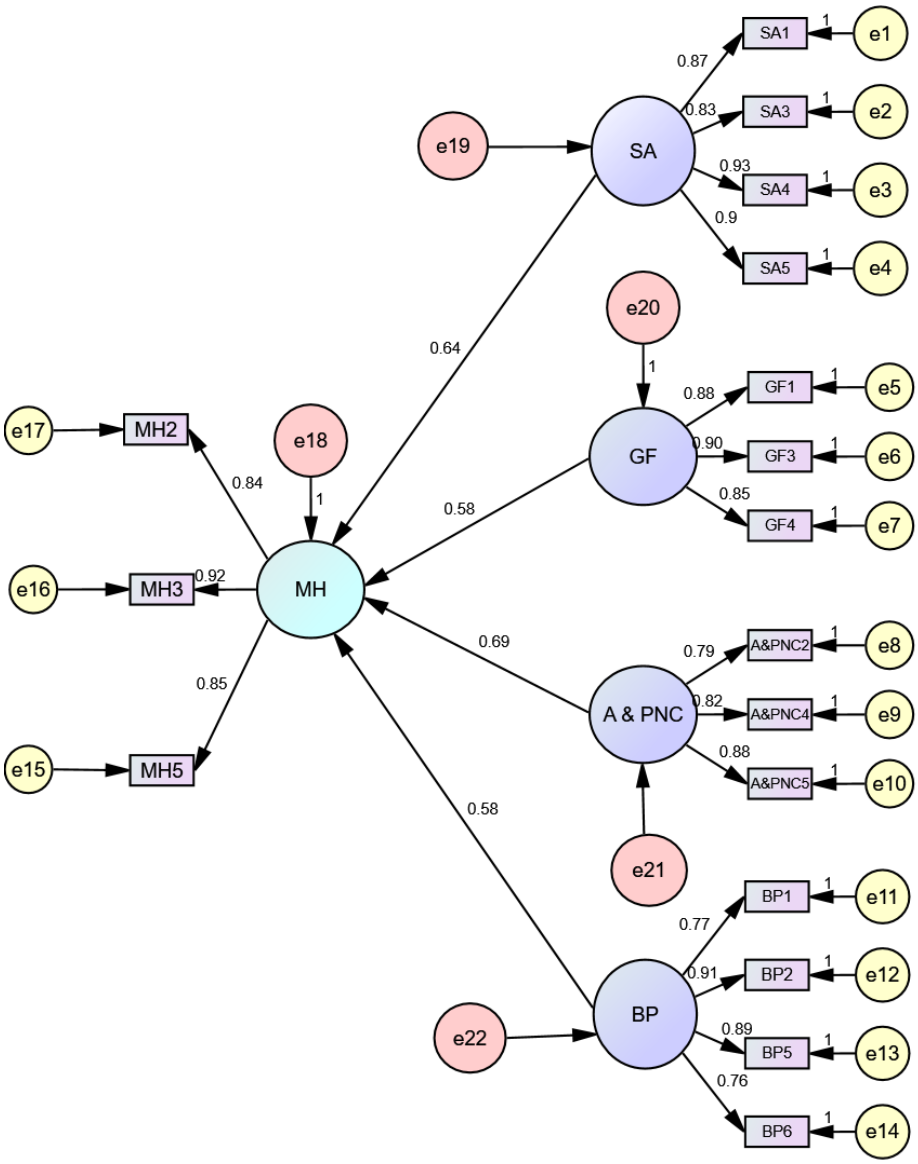


Fig. 4. A Structural Equation Model of Standardised Estimates. (Source: Authors, 2025)

A further methodological limitation relates to the design and accessibility of outdoor spaces. The study found that paved walkway features frequently lacked accessibility and safety, as their widths were inadequate for the simultaneous passage of two wheelchairs. This aligns with prior research highlighting the significance of well-designed pedestrian pathways (Chang and Chien, 2017; Pasha and Shepley, 2013); however, the study fails to consider the variability in hospital infrastructure across various regions. Subsequent research should investigate the impact of geographical and economic factors on the viability of implementing these design recommendations. The research identified deficiencies in security features within outdoor maternal ward areas, including insufficient IT facilities and inadequate shelter.

This deficiency adversely impacts the comfort and emotional well-being of users. The findings align with prior research, emphasising the necessity of integrating educational, reflective, and sustainable elements in hospital gardens to improve patient satisfaction and engagement (Lestari and Favurita, 2024; Chang and Chien, 2017). Budgetary constraints and institutional policies may restrict the implementation of these recommendations, a factor that requires future investigation.

These findings highlight the necessity for evidence-based design of healthcare facilities that incorporates green spaces to enhance maternal health. Designers must prioritise environments that facilitate various physical activities and support mental health (Soman et al., 2024). Private seating areas encircled by vegetation may provide solitude for individuals, whereas open communal spaces can promote social interaction and peer support among mothers. The research reveals literature differences in ethnic and social-cultural factors integration such as traditional games, including Mdako and Bao (Swahili), to improve cultural significance and foster community involvement. The recommendations correspond with behavioural health perspectives identified in earlier studies (Zhao and Mourshed, 2017; Perriam, 2014).

The study emphasises the necessity of organised outdoor activities that promote relaxation and social interaction, including gardening, communal cleaning, and designated reading areas. The feasibility of these interventions is contingent upon factors including hospital policies, climate conditions, and available funding. Future research should evaluate the effectiveness of various hospital settings in implementing and sustaining outdoor features. The study highlights the insufficient selection of garden features that optimally support maternal health. Although previous studies have highlighted the advantages of healing gardens

(Lestari and Favurita, 2024; Hastuti and Lorica, 2020; Kalender-Smajlović and Dovjak, 2023), a gap persists in comprehending the role of specific design elements in psychological recovery. The findings necessitate additional interdisciplinary research among healthcare providers, landscape architects, and behavioural scientists to create holistic healing environments that integrate aesthetic appeal, functionality, and maternal health advantages. This study offers important insights into the influence of garden features on maternal healthcare. Healthcare facility design should incorporate user-centred and culturally relevant outdoor spaces to enhance the well-being of mothers, carers, and visitors.

CONCLUSION

Establishing a healing and supportive maternal environment is crucial for enhancing the well-being of new mothers. This study emphasises the importance of incorporating outdoor healing settings into maternal healthcare facilities to improve psychological well-being and facilitate recovery. Engaging natural therapeutic spaces in healthcare facilities can enhance perceptions of maternal health and childbirth, thereby improving the overall experience for mothers. The findings highlight the significant correlation between emotions and place, illustrating the essential function of healing environments in maternal recovery. The insights obtained from various user groups, such as mothers and carers, offer significant direction for the design of outdoor spaces in maternal hospitals. This study emphasises the necessity of integrating social and public spaces, pathways, individual private spaces, water features, and digital connectivity zones to facilitate emotional and physical healing. User-driven recommendations provide a basis for healthcare researchers informing designers and planners to develop environments that meet the needs of maternal hospital users.

This research advances the establishment of benchmarking design guidelines for outdoor healing environments within maternal healthcare contexts. The findings advocate for a proactive strategy among healthcare facility designers, carers, and decision-makers as informers of policy makers to emphasise healing garden elements that may alleviate postpartum depression and anxiety. Integrating user-centred outdoor spaces in healthcare facilities enhances the supportive and holistic environment for maternal well-being.

Acknowledgements

The authors are deeply grateful to funders including "National Natural Science Foundation of China (NSFC), grant number (NSFC-52078072)."

References

Adam, A. M. (2020) 'Sample Size Determination in Survey Research', Journal of Scientific Research and Reports, 26(5), pp. 90–97. https://doi.org/10.9734/jsrr/2020/v26i530263

Aftab, F., et al. (2021) 'Direct maternal morbidity and the risk of pregnancy-related deaths, stillbirths, and neonatal deaths in South Asia and sub-Saharan Africa: A population-based prospective cohort study in 8 countries', PLoS Med, 18(6), e1003644. https://doi.org/10.1371/journal.pmed.1003644

Aktan, N., et al. (2024) 'Urban Green Space and Perinatal Health Inequities in the United States: A Literature Review', The Journal of Perinatal Education, 33(2), pp. 88–99. https://doi.org/10.1891/jpe-2023-0008

Arampatzi, C., et al. (2022) 'The effect of postpartum psychosis on partner's and infant's life', World Journal of Advanced Research and Reviews, 15(1), pp. 122–127. https://doi.org/10.30574/wjarr.2022.15.1.0676

Barahona, L. F. (2001) 'New trends in health architecture for children and the effects of the built environment on young patients', Master thesis, Florida International University, Florida, USA. https://dx.doi.org/10.25148/etd.FI14050424

Barnes, M. R., et al. (2019) 'Characterizing Nature and Participant Experience in Studies of Nature Exposure for Positive Mental Health: An Integrative Review', Frontiers in Psychology, Vol. 9, 2617. https://doi.org/10.3389/fpsyg.2018.02617

Bell, S. L., et al. (2015) 'Seeking everyday well-being: The coast as a therapeutic landscape', Social science and medicine, Vol. 142, pp. 56–67. https://doi.org/10.1016/j.socscimed.2015.08.011

Bermudez, J., et al. (2017) 'Externally-induced meditative states: an exploratory fMRI study of architects' responses to contemplative architecture', Frontiers of Architectural Research, 6(2), pp. 123–136. https://doi.org/10.1016/j.foar.2017.02.002

Cáceres, Á. L., et al. (2023) 'Perceptions, health seeking behavior and utilization of maternal and newborn health services among an indigenous tribal community in Northeast India – a community-based mixed methods study', Frontiers in Public Health, 6(11), 1139334. https://doi.org/10.3389/fpubh.2023.1139334

Callister, L. C., Edwards, J. E. (2017) 'Sustainable Development Goals and the Ongoing Process of Reducing Maternal Mortality', Journal of obstetric, gynecologic, and neonatal nursing, 46(3), pp. 56–64. https://doi.org/10.1016/j.jogn.2016.10.009

Chang, K. G., Chien, H. (2017) 'The Influences of Landscape Features on Visitation of Hospital Green Spaces—A Choice Experiment Approach', International Journal of Environmental Research and Public Health, 14(7), 724. https://doi.org/10.3390/ijerph14070724

Chayal, V., et al. (2024) 'Husband's involvement in utilization of maternal health services by their spouse in district Rohtak, Haryana', Journal of Family Medicine and Primary Care, 13(6), pp. 2272–2277. https://doi.org/10.4103/jfmpc.jfmpc_1153_23

Chen, Y., et al. (2020) 'Maternal health care management during the outbreak of coronavirus disease 2019', Journal of medical virology, 92(7), pp. 731–739. https://doi.org/10.1002/jmv.25787

Craymah, J. P., et al. (2017) 'Male Involvement in Maternal Health Care at Anomabo, Central Region, Ghana', International Journal of Reproductive Medicine, Vol. 2017, 929013. https://doi.org/10.1155/2017/2929013

Cutchin, M. P., et al. (2010) 'Moving to a Continuing Care Retirement Community: Occupations in the Therapeutic Landscape Process', Journal of Cross-Cultural Gerontology, Vol. 25, pp. 117–132. https://doi.org/10.1007/s10823-010-9113-y

Do, D. T., et al. (2019) 'Public Park behaviour in Da Nang: An investigation into how open space is used', Frontiers of Architectural Research, 8(4), pp. 454–470. https://doi.org/10.1016/j.foar.2019.05.006

Dutta, A., et al. (2015) 'Maternal, Newborn, and Child Health in Tanzania: Costs and Impacts of the One Plan II', Healthy Policy Project, USAID, Washington, DC, USA. [online] Available at: https://www.healthpolicyproject.com/pubs/666_HPPBriefTanzaniaOnePlanR.pdf

Dutta, G. K., et al. (2022) 'Mental healthcare-seeking behavior during the perinatal period among women in rural Bangladesh', BMC Health Services Research, Vol. 22, 310. https://doi.org/10.1186/s12913-022-07678-z

Eraslan, Ş., Ayaz, A. (2022) 'Outdoor heals: An example of a healing garden in a rehabilitation centre', A|Z ITU Journal of the Faculty of Architecture, 19(3), pp. 585–597. https://doi.org/10.5505/itujfa.2022.68878

Esopo, K., et al. (2020) 'Interventions to improve adherence to antenatal and postnatal care regimens among pregnant women in sub-Saharan Africa: a systematic review', BMC Pregnancy and Childbirth, Vol. 20, 316. https://doi.org/10.1186/s12884-020-02992-y

Evans, E. C. (2013) 'A review of cultural influence on maternal mortality in the developing world', Midwifery, 29(5), pp. 490–496. https://doi.org/10.1016/j.midw.2012.04.002

Felisian, S., et al. (2023) 'Sociocultural practices and beliefs during pregnancy, childbirth, and postpartum among indigenous pastoralist women of reproductive age in Manyara, Tanzania: a descriptive qualitative study', BMC Women's Health, Vol. 23, 123. https://doi.org/10.1186/s12905-023-02277-4

Feng, H., et al. (2024) 'Sustainable Healing and Therapeutic Design Driven Well-Being in Hospital Environment', Buildings, 14(9), 2731. https://doi.org/10.3390/buildings14092731

Feyi-Waboso, P. (2016) 'SDGs: The Need for Vital Registration and Accurate Record Keeping', African Journal of Reproductive Health, 20(3), pp. 39–44.

Geller, P. A., Stasko, E. C. (2017) 'Effect of Previous Posttraumatic Stress in the Perinatal Period', Journal of obstetric, gynecologic, and neonatal nursing, 46(6), pp. 912–922. https://doi.org/10.1016/j.jogn.2017.04.136

Germond, P., Cochrane, J. R. (2010) 'Healthworlds: Conceptualizing Landscapes of Health and Healing', Sociology, 44(2), pp. 307–324. https://doi.org/10.1177/0038038509357202

Glavin, K., Leahy-Warren, P. (2013) 'Postnatal Depression Is a Public Health Nursing Issue: Perspectives from Norway and Ireland', Nursing Research and Practice, Vol. 2013, 7. https://doi.org/10.1155/2013/813409

Glover, T. D., Parry, D. C. (2009) 'A third place in the everyday lives of people living with cancer: functions of Gilda's Club of Greater Toronto', Health Place, 15(1), pp. 97–106. https://doi.org/10.1016/j.healthplace.2008.02.007

Graham, D. A., et al. (2017) 'Modeling the Effects of Urban Design on Emergency Medical Response Calls during Extreme Heat Events in Toronto, Canada', Int J Environ Res Public Health, 14(7), 778. https://doi.org/10.3390/ijerph14070778

Hall, K., et al. (2023) 'Mothers' accounts of the impact of being in nature on postnatal wellbeing: a focus group study', BMC Women's Health, Vol. 23, 32. https://doi.org/10.1186/s12905-023-02165-x

Hamal, M., et al. (2020) 'Social determinants of maternal health: a scoping review of factors influencing maternal mortality and ma-ternal health service use in India', Public health reviews, 41(13). https://doi.org/10.1186/s40985-020-00125-6

Harries, B., et al. (2023) 'Designing a wellbeing garden' a systematic review of design recommendations', Design for Health, 7(2), pp. 180–201. https://doi.org/10.1080/24735132.2023.2215915

Hastuti, A. S. O., Lorica, J. D. (2020) 'The Effect of Healing Garden to Improve the Patients Healing: An Integrative Literature Review', Journal of Health and Caring Sciences, 2(1), pp. 34–47. https://doi.org/10.37719/jhcs.2020.v2i1.ra001

Hickman, C. (2013) 'To brighten the aspect of our streets and increase the health and enjoyment of our city: The National Health Society and urban green space in late-nineteenth century London', Landscape and Urban Planning, Vol. 118, pp. 112–119. https://doi.org/10.1016/j.landurbplan.2012.09.007

Hwang, W. J., Park, Y. M. (2019) 'Factors Influencing the Accessibility of Maternal Health Service in Cambodia', International Journal of Environmental Research and Public Health, 16(16), 2909. https://doi.org/10.3390/ijerph16162909

Jenkins, H., et al. (2024) 'Prevalence of perinatal post-traumatic stress disorder (PTSD) in low- income and middle-income countries: a systematic review and meta-analysis', BMJ Public Health, 2(1), e000215. https://doi.org/10.1136/bmjph-2023-000215

Kalender-Smajlović, S., Dovjak, M. (2023) 'Advantages of greenery in hospital environment - a literature review', International Journal of Sanitary Engineering Research, 16(1), pp. 4–13. https://doi.org/10.2478/ijser-2023-0002

Karanikola, P., et al. (2020) 'Indoor and Outdoor Design in Healthcare Environments: The Employees' Views in the General University Hospital of Alexandroupolis, Greece', Environments, 7(8), 61. https://doi.org/10.3390/environments7080061

Kifle, D., et al. (2017) 'Maternal health care service seeking behaviors and associated factors among women in rural Haramaya District, Eastern Ethiopia: a triangulated community-based cross-sectional study', Reproductive Health, Vol. 14, 6. https://doi.org/10.1186/s12978-016-0270-5

Kothari, C. R., Garg, G. (2014) 'Research Methodology: Methods and Techniques', 3rd ed. New Age International Publishers, New Delhi, India.

Kotozaki, Y. (2020) 'Horticultural activity improves postpartum women's cognitive function: Preliminary evidence from an exploratory pilot study', Cogent Psychology, 7(1), 1851003. https://doi.org/10.1080/23311908.2020.1851003

Kumari, R., et al. (2020) 'Evaluate the Direct and indirect Etiologies of Material Mortality: A Retrospective Analysis', International Journal of Medical and Biomedical Studies, 4(7), pp. 210–212. https://doi.org/10.32553/ijmbs.v4i7.1384

Kurjak, A., et al. (2022) 'Why maternal mortality in the world remains tragedy in low-income countries and shame for high-income ones: will sustainable development goals (SDG) help?', Journal of Perinatal Medicine, 51(2), pp. 170–181. https://doi.org/10.1515/jpm-2022-0061

Lawson, G. W., Keirse, M. J. N. C. (2013) 'Reflections on the maternal mortality millennium goal', Birth, 40(2), pp. 96–102. https://doi.org/10.1111/birt.12041

Leahy-Warren, P., McCarthy, G. (2007) 'Postnatal depression: prevalence, mothers' perspectives, and treatments', Archives of Psychiatric Nursing, 21(2), pp. 91–100. https://doi.org/10.1016/j.apnu.2006.10.006

Lestari, M. W., Favurita, A. L. (2024) 'Healing Garden as a Green Open Space in Hospital', International Islamic Medical Journal, 6(1), pp. 25–35. https://www.doi.org/10.33086/iimj.v6i1.6054

Liu, Y., et al. (2021) 'Postpartum depression and postpartum post- traumatic stress disorder: prevalence and associated factors', BMC Psychiatry, 21(1), 487. https://doi.org/10.1186/s12888-021-03432-7

Lowe, M., et al. (2016) 'Social and Cultural Factors Affecting Maternal Health in Rural Gambia: An Exploratory Qualitative Study', PLoS ONE, 11(9), e0163653. https://doi.org/10.1371/journal.pone.0163653

Marcus, C. C. (2016) 'The Future of Healing Gardens', HERD: Health Environments Research and Design Journal, 9(2), pp. 172–174. https://doi.org/10.1177/1937586715606926

McCormick, R. (2017) 'Does Access to Green Space Impact the Mental Well-being of Children: A Systematic Review', Journal of paediatric nursing, Vol. 37, pp. 3-7. https://doi.org/10.1016/j.pedn.2017.08.027

Milligan, C., Bingley, A. (2007) 'Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults', Health and Place, 13(4), pp. 799–811. https://doi.org/10.1016/j.healthplace.2007.01.005

Mirza, M. S., et al. (2024) 'Analysis of Strategies for Reducing Maternal Mortality Rates (MMR) in Developing Countries: A Meta-Analysis', Sriwijaya Journal of Obstetrics and Gynecology, 2(1), pp. 127–136. https://doi.org/10.59345/sjog.v2i1.140

Motealleh, P., et al. (2017) 'Investigating the significance of landscape in designing library by emphasizing the enhancement of learning', HBRC Journal, 13(2), pp. 217–222. https://doi.org/10.1016/j.hbrcj.2014.12.007

Moyo, E., et al. (2023) 'Postpartum Women's Experiences of Postnatal Care in Sub-Saharan Africa: A Qualitative Evidence Synthesis', Wiley, Vol. 52(1), pp. 5–15. https://doi.org/10.1111/birt.12872

Mselle, L., et al. (2023) 'Improving comprehensive emergency obstetric and newborn care in Tanzania: A qualitative study', Midwifery, Issue 123, 103698. https://doi.org/10.1016/j.midw.2023.103698

Mustafa, M., et al. (2020) 'Patriarchy, Maternal Health and Spiritual Healing: Designing Maternal Health Interventions in Pakistan', CHI '20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems, Honolulu, USA, pp. 1–13. https://doi.org/10.1145/3313831.3376294

Novignon, J., et al. (2019) 'Socio-economic inequalities in maternal health care utilization in Ghana', International Journal for Equity in Health, 18, 141. https://doi.org/10.1186/s12939-019-1043-x

Olea-Ramirez, L. M., et al. (2024) 'Intervention Strategies to Reduce Maternal Mortality in the Context of the Sustainable Development Goals: A Scoping Review', Women, 4(4), pp. 387–405. https://doi.org/10.3390/women4040030

Oliveira, M. Y., et al. (2023) 'A Literature Review on the Benefits of Healing Gardens', 18th International Conference on Environmental Science and Technology, Athens, Greece. [online] Available at: https://cms.gnest.org/sites/default/files/Proceedings/cest2023_00401/cest2023_00401.pdf

Olszewska-Guizzo, A., et al. (2022) 'Features of urban green spaces associated with positive emotions, mindfulness and relaxation', Scientific Reports, 12, 20695. https://doi.org/10.1038/s41598-022-24637-0

Ongolly, F. K., Bukachi, S. A. (2019) 'Barriers to men's involvement in antenatal and postnatal care in Butula, western Kenya', African Journal of Primary Health Care and Family Medicine, 11(1), pp. 2071–2928. https://doi.org/10.4102/phcfm.v11i1.1911

Paraskevopoulou, A. T., Kamperi, E. (2018) 'Design of hospital healing gardens linked to pre-or post-occupancy research findings', Frontiers of Architectural Research, 7(3), pp. 395–414. https://doi.org/10.1016/j.foar.2018.05.004

Pasha, S., Shepley, M. M. (2013) 'Research note: Physical activity in pediatric healing gardens', Landscape and Urban Planning, Vol. 118, pp. 53–58. https://doi.org/10.1016/j.landurbplan.2013.05.005

Perriam, G. (2015) 'Sacred spaces, healing places: therapeutic landscapes of spiritual significance', The Journal of medical humanities, 36(1), pp. 19–33. https://doi.org/10.1007/s10912-014-9318-0

Petros, A. K., Georgi, J. N. (2011) 'Landscape Preference Evaluation for Hospital Environmental Design', Journal of Environmental Protection, 2(5), pp. 639–647. http://dx.doi.org/10.4236/jep.2011.25073

Puplampu, D. A., Boafo, Y. A. (2021) 'Exploring the impacts of urban expansion on green spaces availability and delivery of ecosystem services in the Accra metropolis', Environmental Challenges, Vol. 5, 100283. https://doi.org/10.1016/j.envc.2021.100283

Rawlings, T. S. (2017) 'Beyond landscape: development of a major healing garden', Cardiovascular diagnosis and therapy, 7(3), pp. 325–330. https://www.doi.org/10.21037/cdt.2017.01.02

Redzuan, S. A. M., et al. (2020) 'Prevalence and risk factors of postpartum depression, general depressive symptoms, anxiety and stress (PODSAS) among mothers during their 4-week postnatal follow-up in five public health clinics in Perak: A study protocol for a cross-sectional study', British Medical Journal, 10(6), 034458. https://doi.org/10.1136/bmjopen-2019-034458

Reeve, A., et al. (2017) 'Healing gardens in children's hospitals: Reflections on benefits, preferences, and design from visitors' books', Urban Forestry

and Urban Greening, Vol. 26, pp. 48–56. https://doi.org/10.1016/j.ufug.2017.05.013
Rietvield, T., van Hout, R. (1993) 'Statistical Techniques for the Study of Language and Language Behaviour', De Gruyter Mouton, Berlin, Germany, Boston, USA. https://doi.org/10.1515/9783110871609
Said, A., et al. (2020) 'Causes of maternal deaths and delays in care: comparison between routine maternal death surveillance and response system and an obstetrician expert panel in Tanzania', BMC Health Services Research, 20, 614. https://doi.org/10.1186/s12913-020-05460-7
Say, L., et al. (2014) 'Global causes of maternal death: a WHO systematic analysis', Lancet Glob Health, 2(6), pp. 323–333. https://doi.org/10.1016/s2214-109x(14)70227-x
Shaik, A. B., et al. (2023) 'A systematic review of the relationship between severe maternal morbidity and post-traumatic stress disorder', The Journal of Medical Research, 9(3), pp. 63–71. https://www.doi.org/10.31254/jmr.2023.9307
Sharma, M. K., et al. (2021) 'Maternal health care services in Nepal: A qualitative perspective based on the socio-ecological model', Journal of Health Promotion, 9(1), pp. 42–54. https://doi.org/10.3126/jhp.v9i01.40961
Sheng, B., et al. (2024) 'Association between postpartum depression and postpartum hemorrhage: A systematic review and meta-analysis', Acta Obstetricia et Gynecologica Scandinavica, 103(7), pp. 1263–1270. https://doi.org/10.1111/aogs.14795
Shoo, R. S., et al. (2017) 'Stagnating maternal mortality in Tanzania: what went wrong and what can be done', Tanzania Journal of Health Research, 19(2). https://doi.org/10.4314/thrb.v19i2.6
Sillmann, T. A., et al. (2024) 'Therapeutic gardens: historical context, foundations, and landscaping', Ornamental Horticulture, Vol. 30, e242740. https://doi.org/10.1590/2447-536X.v30.e242740
Soman, D. A., et al. (2024) 'Influence of the Physical Environment on Maternal Care for Culturally Diverse Women: A Narrative Review', HERD, 17(3), pp. 306–328. https://doi.org/10.1177/19375867241227601
Soper, D. (2020) 'A-Priori Sample Size Calculator for Structural Equation Models' [Software], Scientific Research, Free Statistics Calculators, version 4.0. [online] Available at: https://www.danielsoper.com/statcalc/calculator.aspx?id=89
Souza, J. P., et al. (2024) 'A global analysis of the determinants of maternal health and transitions in maternal mortality', The Lancet Global Health, 12(2), pp. 306–316. https://doi.org/10.1016/S2214-109X(23)00468-0
Spring, J. A. (2016) 'Design of evidence-based gardens and garden therapy for neurodisability in Scandinavia: data from 14 sites', Neurodegenerative disease management, 6(2), pp. 87–98. https://doi.org/10.2217/nmt.16.2
Sullivan, W. C., et al. (2014) 'Gaia meets Asclepius: Creating healthy places', Landscape and Urban Planning, 127, pp. 182–184. https://doi.org/10.1016/j.landurbplan.2014.03.005
Sullivan, W. C., Kaplan, R. (2016) 'Nature! Small steps that can make a big difference', Health Environments Research and Design Journal, 9(2), pp. 6-10. https://doi.org/10.1177/1937586715623664
Svalastog, A. L., et al. (2017) 'Concepts and definitions of health and health related values in the knowledge landscapes of the digital society', Croatian Medical Journal, 58(6), pp. 431–435. https://doi.org/10.3325/cmj.2017.58.431
Taher, T. M. J. (2024) 'Maternal Mortality: What is The Situation and The Determinants?', Maaen Journal for Medical Sciences, 3(1), 7, pp. 40–44. https://doi.org/10.55810/2789-9136.1041
Taherdoost, H. (2017) 'Determining Sample Size: How to Calculate Survey Sample Size', International Journal of Economics and Management Systems, Vol. 2, pp. 237–239. [online] Available at: https://www.iaras.org/iaras/filedownloads/ijems/2017/007-0032(2017).pdf
Thompson, C. W. (2011) 'Linking landscape and health: The recurring theme', Landscape and Urban Planning, 99(3-4), pp. 187–195. https://doi.org/10.1016/j.landurbplan.2010.10.006
Thorsen, V. C., et al. (2014) 'Components of Maternal Healthcare Delivery System Contributing to Maternal Deaths in Malawi: A Descriptive Cross–Sectional Study', African Journal of Reproductive Health, 18(1), PMID: 24796165, pp. 16–26.
Ulrich, R. S., et al. (2008) 'A Review of the Research Literature on Evidence-Based Healthcare Design', HERD: Health Environments Research and Design Journal, 1(3), pp. 61–125. https://doi.org/10.1177/193758670800100306
UNDESA (2015) 'MDG Gap Task Force Report', United Nations Development Programme, New York, USA. [online] Available at: https://www.undp.org/publications/mdg-gap-task-force-report
United Nations (2015) 'The Millennium Development Goals Report', United Nations, New York, USA. [online] Available at: https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf
United Nations (2023) 'Goal 3: Ensure healthy lives and promote well-being for all at all ages', Sustainable Development Goals. [online] Available at: https://www.un.org/sustainabledevelopment/health/ [Accessed 18 Febr 2024]
USAID (2020) 'Ending Preventable Maternal Mortality', U.S. Agency for International Development (.gov). [online] Available at: https://2017-2020.usaid.gov/sites/default/files/documents/1864/MH%20Strategy_web_red.pdf
van de Mortel, T. (2008) 'Faking it: Social desirability response bias in self-report research', Australian Journal of Advanced Nursing, 25(4), pp. 40–48. [online] Available at: https://www.ajan.com.au/archive/Vol25/Vol_25-4_vandeMortel.pdf
van der Riet, P., et al. (2017) 'Family members' experiences of a "Fairy Garden" healing haven garden for sick children', Collegian, 24(2), pp. 165–173. https://doi.org/10.1016/j.colegn.2015.11.006
Velarde, M. D., et al. (2007) 'Health effects of viewing landscapes – Landscape types in environmental psychology', Urban Forestry and Urban Greening, 6(4), pp. 199–212. https://doi.org/10.1016/j.ufug.2007.07.001
Verderber, S., et al. (2014) 'The evolving role of evidence-based research in healthcare facility design competitions', Frontiers of Architectural Research, 3(3), pp. 238–249. https://doi.org/10.1016/j.foar.2013.12.001
Wang, Z., et al. (2021) 'Mapping global prevalence of depression among postpartum women', Translational Psychiatry, 11, 543. https://doi.org/10.1038/s41398-021-01663-6
Warren, P. L. (2005) 'First-time mothers: social support and confidence in infant care', Journal of Advanced Nursing, 50(5), pp. 479–488. https://doi.org/10.1111/j.1365-2648.2005.03425.x
Yang, L., et al. (2019) 'Integrated design of transport infrastructure and public spaces considering human behaviour: A review of state-of-the-art methods and tools', Frontiers of Architectural Research, 8(4), pp. 429–453. https://doi.org/10.1016/j.foar.2019.08.003
Zhao, Y., Mourshed, M. (2017) 'Patients' Perspectives on the Design of Hospital Outpatient Areas', Buildings, 7(4), 117. https://doi.org/10.3390/buildings7040117
Zhu, L., Sarah, J. S. (2024) 'History and Evolution of the Healing Gardens: Investigating the Building-Nature Relationship in the Healthcare Setting', SSM - Qualitative Research in Health, Vol. 6, 100450. https://doi.org/10.1016/j.ssmqr.2024.100450
Zuber, P. L. F., et al. (2018) 'Mapping the landscape of global programmes to evaluate health interventions in pregnancy: the need for harmonised approaches, standards and tools', BMJ Global Health, 3(5), e001053. https://doi.org/10.1136/bmjgh-2018-001053