How do women prepare for pregnancy in a low-income setting? Prevalence and associated factors

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Abstract

Background
Despite growing evidence of pregnancy preparation benefits, there is little knowledge on how women in developing countries prepare for pregnancy and factors influencing their preparedness. Here, we determine how women in Malawi prepare for pregnancy and factors associated with pregnancy preparation.

Methods
We used data from a previous cohort study comprising 4,244 pregnant mothers, recruited between March and December 2013 in Mchinji district, Malawi. Associations of pregnancy preparation with socio-demographic and obstetric factors were tested for using mixed effects ordinal regression, with the likelihood ratio and Wald’s tests used for variable selection and independently testing the associations.

Results
Most mothers (63.9%) did not take any action to prepare for their pregnancies. For those who did (36.1%), eating more healthily (71.9%) and saving money (42.8%) were the most common forms of preparation. Mothers who were married (adjusted odds-ratio (AOR 7.77 (95% CI [5.31, 11.25]) or with no or fewer living children were more likely to prepare for pregnancy (AOR 4.71, 95% CI [2.89, 7.61]). Mothers with a period of two to three years (AOR 2.51, 95% CI [1.47, 4.22]) or at least three years (AOR 3.67, 95% CI [2.18, 6.23]) between pregnancies were more likely to prepare for pregnancy than women with first pregnancy or shorter intervals. On the other hand, teenage and older (> 35 years old) mothers were less likely to prepare for pregnancy (AOR 0.61, 95% CI [0.47, 0.80]) and AOR 0.49 95% CI [0.33, 0.73], respectively).

Conclusion
While preconception care may not be formally available in Malawi, our study has revealed that over a third of mothers took some action to prepare for pregnancy before conception. Although this leaves around two thirds of women who did not make any form of pregnancy...
preparation, our findings form a basis for future research and development of a preconception care package that suits the Malawian context.

Introduction

Preconception health conditions and behaviours contribute to pregnancy outcomes. Pregnancy preparation or preconception care allows women or couples to seek or undertake interventions including biomedical, behavioural and social health before conception occurs to identify and deal with any risk factors [1]. There is growing evidence that such preconception interventions significantly improve pregnancy outcomes [2,3].

Sub-Saharan Africa (SSA) suffers the highest burden of maternal and child mortality in the world and rates remain very high despite global efforts targeting major reductions [4,5]. In low and middle-income settings such as these, preconception care programmes are either weak or non-existent due to lack of resources, policy guidelines and knowledge of the need for preconception care among couples [6]. While the content of a preconception care package may be clear in high income countries, in low- and middle-income countries there is no consensus as to what such a package should entail [7,8], leading to challenges in implementation, monitoring and evaluation of pregnancy preparation initiatives in these settings. It is unsurprising therefore, that there is limited knowledge on how women in low- and middle-income settings, SSA in particular, prepare for pregnancy and the factors that influence pregnancy preparation. The limited available evidence shows that most pregnancies in SSA are not prepared for and preconception care is almost non-existent [9,10]. This is despite the numerous underlying health problems such as high prevalence of HIV, adolescent pregnancies, undernutrition and intimate partner violence, putting women at an increased risk of poor pregnancy outcomes [11–14]. A study in Southern Malawi by Yeatman et al. found that most men (60%) and women (73%) did not prepare for pregnancy; only 12% of men and 7% of women were found to have sufficiently prepared for pregnancy, but the preparatory steps taken remain unknown [15]. Lack of pregnancy preparation was prevalent even when the pregnancy was intentional, with 50% of women who had planned to get pregnant reporting to have made no preparations for the pregnancy [16]. A study on folic acid supplementation in Uganda found no woman who had been taking folic acid supplementation at preconception [17]. Furthermore, there is no evidence on whether women in Africa receive preconception counselling prior to getting pregnant [9].

Malawi is a low-income country where maternal mortality rates remain high, estimated at 219.7 per 100,000 livebirths in 2015 [18,19]. Recent studies have shown that more than half of pregnancies in Malawi are unintended suggesting that these pregnancies, and possibly more, are not prepared for [16]. This widespread lack of pregnancy preparation may be contributing to delays in accessing antenatal care in addition to limiting access to interventions dealing with preconception risk factors for adverse pregnancy outcomes. This study aims to understand how women in Malawi prepare for pregnancy and the socio-demographic and obstetric factors that influence pregnancy preparation. This can inform the development and implementation of an effective preconception care strategy that formally includes pregnancy preparation in Malawi’s health care system and is accessible to all women.

Methods

Study design and data collection

We used data from a previous prospective cohort study of pregnant mothers in Mchinji, a rural district in central Malawi. The initial study aimed to explore relationships between
pregnancy intention and key maternal and neonatal outcomes [16]. Full details of the initial cohort study design and setting are published elsewhere [16]. Briefly, pregnant women were recruited over a period of nine months between March and December 2013 from 25 randomly selected area blocks (out of 49 area blocks of approximately equal population size) of Mchinji district. The twenty-five blocks, which covered about half of the district, were randomly selected and grouped into three zones based on location. Pregnant mothers were identified through key informants, who had village registers and enumerated every household and its members for an ongoing district-wide pneumococcal vaccine surveillance programme. All pregnant mothers from the selected 25 areas were eligible to participate in the study if they were aged 15 years or older and provided informed consent.

The degree of pregnancy intention was measured using the validated Chichewa (Malawi’s local language) version of the London Measure of Unplanned Pregnancy (LMUP) [20,21]. The LMUP is a psychometrically validated measure of the degree of intention of a current or recent pregnancy, consisting of six questions covering contraception use, timing of pregnancy, intention, desire for a baby, discussion with a partner and pre-conception preparation. Responses to each question are scored as zero, one or two. The overall degree of pregnancy intention is measured on a scale of zero to 12 in order of increasing degree of pregnancy intention [22].

Participating mothers were asked all six questions on the LMUP and a further set of demographic and obstetric history questions during pregnancy. The focus of the present study was to carry out a detailed analysis of the participants’ responses to question six of the LMUP, which asks about the mothers’ preconception actions in preparation for their pregnancy, in relation to their demographic and obstetric characteristics (http://www.lmup.com) [20].

Study variables

Dependent and independent variables. The dependent variable was mothers’ preparation for pregnancy. It was measured by the participants’ responses to question six of LMUP. Responses to LMUP question six were summarised into three categories: “No preparation” (if participants did not do any of the actions), “some preparation” (if the participant did any one action) and “prepared” (if they took any two or more actions). The independent variables considered were socio-demographic and obstetric characteristics and previous history of depression (Table 1). In this study, possible episodes of depression before pregnancy were screened

| Independent variable                  | Response Categories                  |
|--------------------------------------|--------------------------------------|
| Maternal age at last birthday        | ≤18; 19–29; 30–34; ≥35               |
| (years)                              |                                       |
| Maternal level of education          | None; primary; secondary; tertiary    |
| Marital status                       | Married; not married                  |
| Number of live children              | 0, 1–3, ≥4                           |
| Father’s age at last birthday (years)| ≤18; 19–29; 30–40; ≥41               |
| Partner’s level of education         | None; primary; secondary, tertiary    |
| Socio-economic status                | Poorest quantile; next poor quantile; middle quintile; next rich quintile; richest quantile |
| Distance to closest health facility  | <2.5; 2.5–4.99; 5–7.5; ≥7.5           |
| (km)                                 |                                       |
| Religion                             | Christian-Other; Christian-Catholic; Muslim; other religion |
| Tribe                                | Chewa; Ngoni; Senga; Yao; other tribe |
| Birth interval                       | First birth; within 24 months; 2–3 years; ≥3 years |
| Depression before pregnancy**       | 1 or 2, <2 weeks; (2)1, >2 weeks; (3) both |

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by asking pregnant women whether (a) they felt down, depressed or hopeless (low mood) or (b) if they had felt no interest or having little pleasure in doing things (anhedonia) in the year before pregnancy [16]. Affirmative responses to at least one of the questions were put in three categories including: (1) yes to either one or both questions, but episodes only lasted for less than two weeks; (2) yes to either question with episodes lasting for more than two weeks; and (3) yes to both questions and episodes lasting for over two weeks (Table 1).

Mothers’ socio-economic status was determined by an asset-based approach whereby data was collected on variables that reflected the mothers’ living standards, including characteristics of their houses, access to utilities and durable assets, such as bicycle or radio owned by their households. These variables were then converted into a single variable of socio-economic status by principal component analysis, which was then divided to group women into the socio-economic quintiles”.

Data management and statistical analysis
We performed exploratory and descriptive analyses to identify frequencies of respondents, preparedness categories, variable correlations and other background characteristics in relation to the outcome of pregnancy preparation. As the dependent variable was ordinal, we fitted an ordinal regression model for univariate analysis of the association between the dependent variable and each of the independent variables. Likelihood ratio and Wald’s tests were then used to identify independent variables to adjust for and test for their association with pregnancy preparation. We selected all variables that were significant at a 20% significance level for inclusion in the multivariable ordinal model. The final multivariable model included the following socio-demographic and obstetric factors: mother’s age at last birthday, marital status, mother’s education, wealth status, distance to closest health facility, time interval between pregnancies number of live children and history of depression prior to the pregnancy. Both the univariate and multivariable ordinal regressions were run as mixed effects models with geographical cluster included as a random effect. We reported crude and adjusted odds ratios, with their 95% confidence intervals (CI) as measure of uncertainty.

Ethics approval and consent to participate
Ethical approval, including the approach to include pregnant women aged 15 and over, was provided by the University College London Research Ethics Committee and the College of Medicine Research Ethics Committee at the University of Malawi (approval numbers 3974/001 and P.03/12/1273 respectively).

Results
All 4,244 mothers who participated in the original cohort study were included in the analysis. The mean age of the mothers was 25 years (range: 15–49). Of the total, 3,905 (92%) of the women were married. A majority 85.7% (n = 3,637) of the 4,244 women, and 71.0% (n = 3,012) of their partners, had not been educated beyond primary level. About 30% (n = 1,235) of the women travelled more than 7.5 kilometres to get to the nearest health facility to access health services. Of the 4,244 women interviewed, 49.3% (n = 2,091) were Christian, followed by 46.8% (n = 1,985) who were Catholics (Table 2). The Chewa tribe was the predominant among the respondents (84.8%; n = 3,587). Close to a third of the women (29.2%; n = 1,240) had not given birth before, while most of them (70.6%; n = 2,980) did not report indications of previous episodes of depression (Table 2). Based on women’s self-reported last menstrual period, pregnancy gestational age at the time of interview ranged from two to nine months (median = 6 months).
Table 2. Summary of socio-demographic and obstetric characteristics by level of pregnancy preparation by women in Mchinji.

|                               | Total     | Unprepared | Some preparation | Prepared |
|--------------------------------|-----------|------------|------------------|----------|
|                                | N = 4244  | n = 2710   | n = 1055         | n = 469  |
| **Mother’s age**               |           |            |                  |          |
| < = 18                         | 649 (15.3%)| 422 (15.5%)| 174 (16.5%)      | 53 (11.3%)|
| 19–29                          | 2546 (60%) | 1538 (56.5%)| 674 (63.9%)      | 334 (71.2%)|
| 30–34                          | 618 (14.6%)| 419 (15.4%)| 139 (13.2%)      | 60 (12.8%)|
| > = 35                         | 431 (10.2%)| 341 (12.5%)| 68 (6.4%)        | 22 (4.7%)|
| **Father’s age**               |           |            |                  |          |
| < = 18                         | 62 (1.5%)  | 48 (1.8%)  | 12 (1.1%)        | 2 (0.4%)  |
| 19–29                          | 2209 (52%) | 1326 (48.8%)| 609 (57.7%)      | 274 (58.4%)|
| 30–40                          | 1435 (33.8%)| 900 (33.1%)| 362 (34.3%)      | 173 (36.9%)|
| > = 41                         | 365 (8.6%) | 292 (10.7%)| 56 (5.3%)        | 17 (3.6%)  |
| **Marital status**             |           |            |                  |          |
| Unmarried                      | 339 (8%)   | 293 (10.8%)| 35 (3.3%)        | 11 (2.3%)  |
| Married                        | 3905 (92%) | 2427 (89.2%)| 1020 (96.7%)     | 458 (97.7%)|
| **Mother’s education**         |           |            |                  |          |
| None                           | 422 (9.9%) | 317 (11.7%)| 72 (6.8%)        | 33 (7%)   |
| Primary                        | 3215 (75.8%)| 2081 (76.5%)| 814 (77.2%)      | 320 (68.2%)|
| Secondary                      | 597 (14.1%)| 318 (11.7%)| 166 (15.7%)      | 113 (24.1%)|
| Tertiary                       | 10 (0.2%)  | 4 (0.1%)   | 3 (0.3%)         | 3 (0.6%)  |
| **Father’s education**         |           |            |                  |          |
| None                           | 334 (7.9%) | 236 (8.7%) | 77 (7.3%)        | 21 (4.5%)  |
| Primary                        | 2678 (63.1%)| 1725 (63.4%)| 675 (64%)       | 278 (59.3%)|
| Secondary                      | 1144 (27%) | 699 (25.7%)| 289 (27.4%)      | 156 (33.3%)|
| Tertiary                       | 18 (0.4%)  | 6 (0.2%)   | 4 (0.4%)         | 8 (1.7%)   |
| **Wealth status**              |           |            |                  |          |
| Poorest                        | 839 (19.8%)| 603 (22.2%)| 180 (17.1%)      | 56 (11.9%) |
| Second                         | 839 (19.8%)| 576 (21.2%)| 184 (17.4%)      | 79 (16.8%) |
| Middle                         | 838 (19.7%)| 547 (20.1%)| 224 (21.2%)      | 67 (14.3%) |
| Next-rich                      | 839 (19.8%)| 503 (18.5%)| 229 (21.7%)      | 107 (22.8%)|
| Rich                           | 835 (19.7%)| 453 (16.7%)| 232 (22%)        | 150 (32%)  |
| **Distance**                   |           |            |                  |          |
| <2.5km                         | 576 (13.6%)| 356 (13.1%)| 119 (11.3%)      | 101 (21.5%)|
| 2.5–4.99km                     | 994 (23.4%)| 637 (23.4%)| 247 (23.4%)      | 110 (23.5%)|
| 5–7.49km                       | 1434 (33.8%)| 922 (33.9%)| 359 (34%)        | 153 (32.6%)|
| >7.5km                         | 1235 (29.1%)| 802 (29.5%)| 328 (31.1%)      | 105 (22.4%)|
| **Religion**                   |           |            |                  |          |
| Christian                      | 2091 (49.3%)| 1379 (50.7%)| 510 (48.3%)      | 202 (43.1%)|
| Catholic                       | 1985 (46.8%)| 1233 (45.3%)| 504 (47.8%)      | 248 (52.9%)|
| Muslim                         | 94 (2.2%)  | 50 (1.8%)  | 29 (2.7%)        | 15 (3.2%)  |
| Other                          | 74 (1.7%)  | 58 (2.1%)  | 12 (1.1%)        | 4 (0.9%)   |
| **Tribe**                      |           |            |                  |          |
| Chewa                          | 3597 (84.8%)| 2386 (87.7%)| 841 (79.7%)      | 370 (78.9%)|
| Senga                          | 207 (4.9%) | 57 (2.1%)  | 115 (10.9%)      | 35 (7.5%)  |
| Yao                            | 92 (2.2%)  | 55 (2%)    | 24 (2.3%)        | 13 (2.8%)  |
| Ngoni                          | 281 (6.6%) | 184 (6.8%) | 60 (5.7%)        | 37 (7.9%)  |
| Other                          | 67 (1.6%)  | 38 (1.4%)  | 15 (1.4%)        | 14 (3%)    |

Birth interval

(Continued)
Most women (63.9%; n = 2,710) did not take any action to prepare for pregnancy (Fig 1). The most common action taken among those that took some action was healthy eating (n = 1,095) followed by saving money (13.2%; n = 562), taking iron tablets (6.5%; n = 277) and seeking advice (3.4%; n = 145) (Fig 1). A few women (11.1%; n = 469) took a combination of at least two actions (e.g. healthy eating, saving money and taking iron tablets). The most common combination of actions consisted of saving money and eating healthily, which was reported by 8.6% (n = 367) of the women.

After adjustment, pregnancy preparedness was associated with several factors (Table 3). The adjusted odds of preparing for pregnancy were 7.77 (95% CI [5.31, 11.25]) times higher among married women relative to unmarried women. The odds of pregnancy preparation also increased with increasing birth interval. Mothers with a period of two to three years (AOR 2.51, 95% CI [1.47, 4.22]) or more than three years (AOR 3.67, 95% CI [2.18, 6.23]) between current and previous pregnancies were more likely to take preparatory actions for pregnancy as compared to mothers with first pregnancy or with shorter period between pregnancies (Table 3). On the other hand, teenage mothers (AOR 0.61, 95% CI [0.47, 0.80]) and mothers aged above 35 years (AOR 0.49, 95% CI [0.33, 0.73]) were less likely to prepare pregnancy as compared to mothers aged between 19–29 years (Table 3). Women with no live children were also more likely to have prepared for pregnancy (AOR 4.71, 95% CI [2.89, 7.61]) than women with 1–3 live children, while mothers with four or more live children were less likely to prepare pregnancy (AOR 0.70, 95% CI [0.53, 0.92]). There was no clear evidence on the role of depression on pregnancy preparation. While mothers who had indicated having low mood or anhedonia for less than two weeks (AOR 0.66, 95% CI [0.53, 0.82]) or just low mood but for more than two weeks (AOR 0.55, 95% CI [0.43, 0.70]) were less likely to prepare for pregnancy as compared to women with no experience of depression, we found no evidence of significant association between pregnancy preparation and episodes of both low mood and anhedonia for more than two weeks (AOR 0.59, [0.28, 1.25]; Table 3), though this analysis is limited by the small number of women who reported this level of depression (n = 53) hence the confidence intervals are wide.

**Discussion**

This study has shown that although pregnancy preparation before conception is not common in Malawi, a sizeable proportion of mothers (just over a third) do take some actions to prepare...
for pregnancy. This is despite preconception care not being a key component of maternal and child health within Malawi’s health care system, as evidenced by its absence in key Government policy documents such as the 2012 Ministry of Health Road Map for Accelerating Reduction of Maternal and Neonatal Morbidity and Mortality and the 2011–2016 Health Sector Strategic Plan (HSSP). These policy documents largely focus on antenatal care, labour and delivery and the postpartum period [23–25]. The study also revealed that pregnancy preparation is associated with several socio-demographic including age and marital status, and obstetric factors including time interval between pregnancies and number of live children.

Amongst the mothers who had prepared for their pregnancy, the most common ways of pregnancy preparation were eating healthily and saving money, while fewer mothers sought medical attention or took iron. When considered in the global context of how mothers prepare for pregnancy, our findings suggest both similarities and differences in ways of preparing for

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**Fig 1.** Frequency distribution of actions which pregnant women in Mchinji District, Malawi, took at preconception in preparation for their pregnancy.

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Pregnancy between mothers in high-income countries and mothers in low-income settings. In high-income settings, pregnancy preparation hinges mostly on folic acid intake, changing behaviours or habits such as smoking, alcohol consumption and doing physical exercise and changes in diet to achieve a healthy weight [26]. While the mothers participating in this study also reported diet improvement (eating healthily) as an action they took to prepare for their pregnancy, women in Malawi are generally non-smokers, with less than 1% female smokers, and very few take alcohol especially in rural areas and hence stopping smoking or drinking alcohol is unlikely to be reported among the actions taken to prepare for pregnancy [18]. However, with very high poverty levels, people have irregular income hence the importance of saving money to cover for the financial needs arising from the pregnancy. Also, Malawi has some of the highest anaemia prevalence rates among pregnant women in SSA and indeed globally, ranging between 32.8% and 72.0% [27]. Thus, increasing iron intake from preconception,
would help to reduce risks of women developing anaemia during pregnancy [28]. Furthermore, prevalence of HIV and other infectious diseases in Malawi is very high and seeking medical services at preconception would help mothers to test for HIV and other infectious diseases that have potential to bring poor pregnancy outcomes. However, the low proportion of women seeking medical advice at preconception suggests that most mothers may not be aware of their infection status and other non-communicable diseases at conception [18]. This may increase the risk of mother to child transmissions of infections or pregnancy related complications, which may lead to child or maternal morbidity and mortality. The key implication here is that any intervention to improve pregnancy preparation should be in context of the local setting while drawing lessons from the global research and implementation.

Some of the factors identified in this study in association with pregnancy preparation, such as no previous pregnancy or living child or long interval since last pregnancy, imply that pregnancy preparation is linked to a positive intention or desire to be pregnant. Factors such as young age (≤ 18 years) or older age (≥ 35 years) have been associated with poor pregnancy outcomes in other studies [29]. In this study, we have also found that mothers in this age groups were less likely to prepare for pregnancy. The underlying factors for unintended pregnancies included unmet need for, or failure of contraceptives [30]. Considering that these age groups also have some of the highest rates of poor pregnancy outcomes, our findings indicate that interventions to avoid unintended pregnancy through improving access to and uptake of contraception, or to improve pregnancy planning and preparation where pregnancy is wanted in these age groups could be a key to reducing poor pregnancy outcomes.

A limitation of this study is that the data on preconception preparations was collected retrospectively. Interviewing mothers when they were already pregnant on what they did before conception may have introduced recall bias and it is possible some mothers would have been stating what they were doing during pregnancy rather than what they did at preconception. However, the question used to assess preconception preparation was part of a tool that had undergone local translation and validation, suggesting that most women were able to report on actions the took prior to conception [20].

Conclusion

Although preconception care is lacking in the Malawi health care system, some women are already taking actions to improve their health before conception—principally by eating a healthier diet or saving money. Further research should acknowledge these women’s desire to improve health before pregnancy, and so take a new women-led approach to developing women-led or couple-led interventions to preconception health. Lack of pregnancy preparation is associated with a wide range of socio-demographic and obstetric factors. This suggests a need for multi-faceted interventions, including meeting the contraception needs of those with no intention of getting pregnant.

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References

1. WHO. Meeting to develop a global consensus on preconception care to reduce maternal and childhood mortality and morbidity. WHO Headquarters, Geneva Meeting report Geneva. 2012;78.

2. Denktaş S, Poeran J, van Voorst SF, Vos AA, de Jong-Potjer LC, Waelpotten AJM, et al. Design and outline of the Healthy Pregnancy 4 All study. BMC pregnancy and childbirth. 2014 Jul; 14:253. https://doi.org/10.1186/1471-2393-14-253 PMID: 25080942

3. Asiki G, Baisley K, Newton R, Marions L, Seeley J, Kamali A, et al. Adverse pregnancy outcomes in rural Uganda (1996–2013): Trends and associated factors from serial cross sectional surveys. BMC Pregnancy and Childbirth. 2015; 15(1):1–12. https://doi.org/10.1186/s12884-015-0708-8 PMID: 26515763

4. Alkema L, Chou D, Hogan D, Zhang S, Moller AB, Gemmill A, et al. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: A systematic analysis by the un Maternal Mortality Estimation Inter-Agency Group. The Lancet. 2016; 387 (10017):462–74.

5. Liu L, Oza S, Hogan D, Chu Y, Perin J, Zhu J, et al. Global, regional, and national causes of under-5 mortality in 2000–15: an updated systematic analysis with implications for the Sustainable Development Goals. The Lancet. 2016; 388(10063):3027–35.

6. Dean S, Rudan I, Althabe F, Webb Girard A, Howson C, Langer A, et al. Setting Research Priorities for Preconception Care in Low- and Middle-Income Countries: Aiming to Reduce Maternal and Child Mortality and Morbidity. PLoS Medicine. 2013; 10(9). https://doi.org/10.1371/journal.pmed.1001508 PMID: 24019762

7. Dean S V, Lassi ZS, Imam AM, Bhutta ZA. Preconception care: promoting reproductive planning. Reproductive health. 2014 Sep; 11 Suppl 3(Suppl 3):S2. https://doi.org/10.1186/1742-4755-11-S3-S2 PMID: 25412559

8. Hemsing N, Greaves L, Poole N. Preconception health care interventions: A scoping review. Sexual and Reproductive Healthcare. 2017; 14:24–32. https://doi.org/10.1016/j.srhc.2017.08.004 PMID: 29186631

9. Zühlke L, Acquah L. Pre-conception counselling for key cardiovascular conditions in Africa: optimising pregnancy outcomes. Cardiovascular Journal of Africa. 2016; 27(2):79–83. https://doi.org/10.5830/ CVJA-2016-017 PMID: 27213854

10. Stephenson J, Patel D, Barrett G, Howden B, Copas A, Ojukwu O, et al. How do women prepare for pregnancy? Preconception experiences of women attending antenatal services and views of health professionals. PLoS ONE. 2014; 9(7). https://doi.org/10.1371/journal.pone.0109086 PMID: 25068333

11. Dwyer-Lindgren L, Cork MA, Sligar A, Steuben KM, Wilson KF, Provost NR, et al. Mapping HIV prevalence in sub-Saharan Africa between 2000 and 2017. Nature. 2019; 570(7760):189–93. https://doi.org/10.1038/s41586-019-1200-9 PMID: 31092927

12. World Health Organization. Global and regional estimates of violence against women WHO. WHO Press., 2012.

13. Akombi BJ, Agbo KE, Merom D, Renzaho AM, Hall JJ. Child malnutrition in sub-Saharan Africa: A meta-analysis of demographic and health surveys (2006–2016). PLoS ONE. 2017. https://doi.org/10.1371/journal.pone.0177336 PMID: 28494007

14. Wado YD, Sully EA, Murnah JN. Pregnancy and early motherhood among adolescents in five East African countries: A multi-level analysis of risk and protective factors. BMC Pregnancy and Childbirth. 2019. https://doi.org/10.1186/s12884-019-2204-z PMID: 30727995
15. Yeatman S, Smith-Greenaway E. Birth Planning and Women’s and Men’s Health in Malawi. Studies in Family Planning. 2018. https://doi.org/10.1111/sifp.12060 PMID: 29998555

16. Hall J.A., Barrett G., Phiri T., Copas A., Malata A., Stephenson J. Prevalence and determinants of unintended pregnancy in Mchinji district, Malawi; using a conceptual hierarchy to inform analysis. 2016;1–22. https://doi.org/10.1371/journal.pone.0165621 PMID: 27798710

17. Bannink F, Larok R, Kirabira P, Bauwens L, Hove G van. Prevention of spina bilida: folic acid intake during pregnancy in Gulu district, northern Uganda. Pan African Medical Journal. 2015; 20:1–9.

18. National Statistical Office (NSO), ICT. Malawi Demographic and Health Survey 2015–16. National Statistics Office The DHS Program [Internet]. 2017;1–658. Available from: http://dhsprogram.com/pubs/pdf/FR319/FR319.pdf.

19. Kassebaum NJ, Bertozzi-Villa A, Coggeshall MS, Shackelford KA, Steiner C, Heuton KR, et al. Global, regional, and national levels and causes of maternal mortality during 1990–2013: A systematic analysis for the Global Burden of Disease Study 2013. The Lancet. 2014; 384(9947):980–1004.

20. Hall J, Barrett G, Mbwana N, Copas A, Malata A, Stephenson J. Understanding pregnancy planning in a low-income country setting: Validation of the London measure of unplanned pregnancy in Malawi. BMC Pregnancy and Childbirth. 2013.

21. Hall JA, Stephenson J, Barrett G. Evaluating the Chichewa version of the London Measure of Unplanned Pregnancy in Malawi: a validation update. BMC Research Notes. 2021; 14(1):1–5.

22. Barrett G, Smith SC, Wellings K. Conceptualisation, development, and evaluation of a measure of unplanned pregnancy. Journal of Epidemiology and Community Health. 2004; 58(5):426–33. https://doi.org/10.1136/jech.2003.014787 PMID: 15082745

23. UNICEF. Malawi Maternal and Newborn Health Disparities. 2017.

24. Toivonen KI, Oinonen KA, Duchene KM. Preconception health behaviours: A scoping review. Preventive Medicine. 2017 Mar; 96:1–15. https://doi.org/10.1016/j.ypmed.2016.11.022 PMID: 27939264

25. Malawi Ministry of Health. Health Sector Strategic plan II. 2017; 2.

26. Ignaszak-Kaus N, Ozegowska K, Piekarski P, Pawelczyk P, Jędrzejczak P. Planning and preparation for pregnancy among women with and without a history of infertility. Ginekologia polska. 2018; 89 (2):74–9. https://doi.org/10.5603/GP.a2018.0013 PMID: 29512811

27. Broek SM and N van de. Anaemia in pregnancy in Malawi.pdf. Malawi Medical Journal. 2006; 18 (4):160–75. PMID: 27529009

28. van den Broek NR, Rogerson SJ, Mhango CG, Kambala B, White SA, Molyneux ME. Anaemia in pregnancy in southern Malawi: Prevalence and risk factors. BJOG: An International Journal of Obstetrics and Gynaecology. 2000. https://doi.org/10.1111/j.1471-0528.2000.tb13260.x PMID: 10759260

29. Londero AP, Rossetti E, Pittini C, Cagnacci A, Driul L. Maternal age and the risk of adverse pregnancy outcomes: A retrospective cohort study. BMC Pregnancy and Childbirth. 2019. https://doi.org/10.1186/s12884-019-2400-x PMID: 31337350

30. Thindwa D, Landes M, Van Lettow M, Kanyemba A, Nkhoma E, Phiri H, et al. Pregnancy intention and contraceptive use among HIV-positive Malawian women at 4–26 weeks post-partum: A nested cross-sectional study. PLoS ONE. 2019.