International Journal of Public Health (2019) 64:743–754
https://doi.org/10.1007/s00038-019-01238-9

REVIEW

Effects of unintended pregnancy on maternal healthcare services utilization in low- and lower-middle-income countries: systematic review and meta-analysis

Md Nuruzzaman Khan[1,2] · Melissa L. Harris[1] · Desalegn Markos Shifti[1] · Alexander Suuk Laar[1] · Deborah Loxton[1]

Received: 11 February 2019 / Revised: 20 March 2019 / Accepted: 23 March 2019 / Published online: 30 April 2019

Abstract

Objectives To examine the association between unintended pregnancy and maternal healthcare services utilization in low- and lower-middle-income countries.

Methods A systematic literature search of Medline, Cinahl, Embase, PsycINFO, Cochrane Library, Popline, Maternity and Infant Care, and Scopus databases published since the beginning of the Millennium Development Goals (i.e. January 2000) to June 2018 was performed. We estimated the pooled odds ratios using random effect models and performed subgroup analysis by participants and study characteristics.

Results A total of 38 studies were included in the meta-analysis. Our study found the occurrence of unintended pregnancy was associated with a 25–39% reduction in the use of antenatal, delivery, and postnatal healthcare services. Stratified analysis found the differences of healthcare services utilization across types of pregnancy unintendedness (e.g. mistimed, unwanted).

Conclusions Integrating family planning and maternal healthcare services should be considered to encourage women with unintended pregnancies to access maternal healthcare services.

Keywords Unintended pregnancy · Maternal healthcare services use · Low- and lower-middle-income countries · Systematic review and meta-analysis

Introduction

The reduction in maternal and early child mortality has long been on the global development policy agenda and is a target in the United Nations' Sustainable Development Goals (SDGs) 3, which focuses on health and well-being at all ages. In order to reach this target, the global maternal mortality rate is required to be reduced to fewer than 70 per 100,000 births by 2030 (UN 2015). The target for early child mortality (0–28 days of life) is to be reduced to as low as 12 per 1000 live births (UN 2015). Although successful implementation of the United Nations' Millennium Development Goals (MDGs) has resulted in remarkable progress in reducing maternal and early child mortality in

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00038-019-01238-9) contains supplementary material, which is available to authorized users.

✉ Md Nuruzzaman Khan
mdnuruzzaman.khan@uon.edu.au

Melissa L. Harris
Melissa.Harris@newcastle.edu.au

Desalegn Markos Shifti
desalegnmarkos.shifti@uon.edu.au

Alexander Suuk Laar
alexander.laar@uon.edu.au

Deborah Loxton
deborah.loxton@newcastle.edu.au

[1] Priority Research Centre for Generational Health and Ageing, School of Medicine and Public Health, Faculty of Health and Medicine, Hunter Medical Research Institute, University of Newcastle, West Wing, Level 4, Lot 1 Kookaburra Circuit, New Lambton Heights, NSW 2305, Australia

[2] Department of Population Sciences, Jatiya Kabi Kazi Nazrul Islam University, Mymensingh, Bangladesh

low- and lower-middle-income countries (LLMC), a lot of work remains in order to achieve the SDGs (Chao et al. 2018; WHO 2018b). Currently, around 239 mothers per 100,000 live births in LLMC die compared to 12 mothers per 100,000 live births in developed countries (WHO 2018a). These deaths are associated with complications during childbirth (11–17%) and in the postpartum period (50–71%) (Islam 2007). Moreover, obstetric complications, particularly complications during labour, are responsible for 58% of the total 3.2 million stillbirths, the majority of which occur in LLMC (Chao et al. 2018). Early child mortality rates are also substantially higher in LLMC, with 2.5 million deaths representing 47% of all under-five deaths (WHO 2018b). Around 80% of these deaths occur in the first 7 days of life due to preterm birth, intrapartum-related complications, infections, and birth defects (WHO 2018b). Maternal and early child mortality in LLMC have been associated with lack of access to interventions for preventing pregnancy (e.g. family planning services and contraception methods), as well as lack of skilled care during pregnancy (e.g. antenatal and delivery care) and in the weeks after childbirth (e.g. postnatal care) (WHO 2018a). Therefore, it is vital that governments increase the provision of high-quality services, including antenatal, delivery, and postnatal healthcare services (Hunt and Bueno de Mesquita 2007) to prevent poor maternal and infant outcomes. However, this remains a challenge despite the fact that commitments have been encapsulated in the MDGs (UN 2018), the World Health Organization's (WHO) Safe Motherhood Initiative (Mahler 1987), and country-level policies (Herrera et al. 2017; Pantoja et al. 2017). Although these initiatives are designed to increase uptake of services, around half of total pregnancies still end without any form of skilled care during and after pregnancy (UN 2018). To meet this challenge, achieving universal health coverage at affordable prices as recommended in the SDGs, along with other international recommendations, a comprehensive assessment of the factors that prevent women from utilizing healthcare services is important (Tafere et al. 2018).

Unintended pregnancy, a pregnancy which occurs when a woman desires no children or no more children (unwanted pregnancy), or which occurs earlier than desired (mistimed pregnancy), is a serious public health challenge in LLMC. Around 88 million unintended pregnancies occur each year in LLMC, representing around 43% of total pregnancies, and 89% of total unintended pregnancies (99 million) that occur worldwide (Bearak et al. 2018; Sedgh and Hussain 2014). Most importantly, the number of unintended pregnancies is increasing in LLMC and is expected to continue over the next few decades, despite contraception use increasing substantially due to efforts made in the MDGs and country-level policies (Bearak et al. 2018). The increasing number of women of reproductive age in the population and socio-economic inequality in contraception use are likely to contribute to this increase (Sedgh and Hussain 2014). Women who have experienced unintended pregnancy are more likely to have experienced abuse by a partner and family members (Pallitto et al. 2005), to be socio-economically disadvantaged (Feyisso et al. 2017), and more likely to be unaware of their pregnancy (Achyut et al. 2015). These might prevent the uptake of healthcare services for these women. These factors were highlighted in a number of studies conducted in different settings in which it was found that the occurrence of unintended pregnancy was associated with lower use of maternal healthcare services (Abosse et al. 2010; Amo-Adjei and Tuoyire 2016; Guliani et al. 2013; Ochako and Gichuhi 2016). However, this association is equivocal (Dahiru and Oche 2015; Wado et al. 2014; Zegeye et al. 2014), with our understanding of the relationship between unintended pregnancy and maternal healthcare services utilization limited, and, at best, fragmented. This limited understanding might arise due to different between country context regarding the perception of pregnancy and birth (Cripe et al. 2008), the availability of healthcare services (Bitew et al. 2017), and the complexity of measuring unintended pregnancy (Barrett and Wellings 2002). Given our limited understanding and higher prevalence of unintended pregnancy in LLMC, a complete perspective of the association between maternal healthcare services utilization and unintended pregnancy at the population level is important to fully comprehend the issue and aid the designing of public health policies. Therefore, the present study has been conducted to provide a comprehensive assessment of the association between unintended pregnancies that end in a live birth and antenatal, delivery, and postnatal healthcare services utilization in LLMC.

Methods

A systematic review and meta-analysis following the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) consensus statement on the conduct of meta-analysis of observational studies was conducted (Moher et al. 2009). Relevant and available studies related to pregnancy intention and antenatal, delivery, and postnatal healthcare services utilization were included.

Search strategy

Systematic computerized literature searches of Medline, Cinahl, Embase, PsycINFO, Cochrane Library, Popline,

Maternity and Infant Care, and Scopus databases were conducted in June 2018. Studies published since the establishment of the MDGs (January, 2000) were included. Searches were conducted on the basis of individual comprehensive search strategies for each database. We developed search strategies consisting of a combination of free text words, words in titles/abstracts, and medical subject heading (MeSH) terms for exposure [(pregnancy, planned), (pregnancy, unwanted), (intention or unintended or unwanted or mistimed or accident* or unplanned) adj3 pregnan*)], outcomes (antenatal care, prenatal care, perinatal care, preconception care, delivery care etc.), and settings (countries name). The exposure, outcomes, and settings were then combined using Boolean operators (AND, OR). The full search strategy and search results for each database are presented in supplementary Tables 1 to 7. Further searches for eligible studies were conducted by reviewing the references within the identified articles. We included articles published in the English language, and LLMC were selected based on the 2017 World Bank classification (World Bank 2017).

Study eligibility criteria

Inclusion criteria

To be included, articles had to meet the following criteria: (1) maternal pregnancy intention was considered as an exposure variable, (2) either antenatal, delivery, or postnatal healthcare services utilization were considered as outcome variables, (3) the articles were quantitative research studies, and (4) they were published in peer-reviewed journals. Another inclusion criterion was the availability of odds ratios (ORs) with 95% confidence interval (CI) data or the raw data that allowed the calculation of ORs and 95% CIs for at least one of the outcome variables. In case of duplicate publications using the same data, we included the most recent and robust study and excluded the other(s).

Exclusion criteria

We excluded studies carried out on women with suppressible condition including human immunodeficiency virus infection and Acquired Immune Deficiency Syndrome (HIV/AIDS), sexually transmitted infections, or chronic diseases due to different patterns of healthcare service utilization, and different services available for these women. Systematic review and meta-analysis papers, opinion pieces, studies published only as abstracts, and studies published before January 2000 were also excluded.

Data collection process and data items

Prior to tabulating the final data, a data extraction form was designed, trialled, and modified by following the "Strengthening the Reporting of Observational Studies in Epidemiology" guidelines (Von Elm et al. 2007). Three reviewers (MNK, DMS, and ASL) independently extracted the following data from the full-text articles: country of origin, year of study, study design, number of participants, exposure variables, and when exposure variables were assessed, outcomes, confounders, and measures of association based on information available from the publications. The information extracted by the reviewers were compared and selected if consistently reported by all reviewers. Inconsistencies were identified in two studies and resolved by the senior authors (MLH and DL).When any information was unclear, the authors of the original articles were contacted for further details and updated accordingly.

Quality assessment in included studies

A modified Newcastle–Ottawa scale for quality assessment of the included studies was utilized (Modesti et al. 2016). Three reviewers independently assessed the study quality and assigned a value ranging from 1 to 7 for cross-sectional and 1 to 8 for case–control and cohort studies. Studies were defined as high quality if they scored ≥ 6, moderate quality if they scored 4–5, or low quality if they scored 1–3.

Statistical analysis

ORs as the effect measure were extracted from each study. If ORs were unavailable, unadjusted ORs with 95% CI was estimated using raw data. We used a fixed-effects or random-effects model to calculate the summary estimates for the overall effect of pregnancy intention on antenatal, delivery, or postnatal healthcare services utilization. The model was selected on the basis of the heterogeneity assessment. An I^2 statistics with p value were estimated for each meta-analysis to describe the extent of heterogeneity. When the test for heterogeneity was moderate (50%) or high (75%), the pooled estimates of ORs were computed by using the random-effects model (Higgins et al. 2003).

Sources of heterogeneity in the subgroup and meta-regression analysis (Thompson and Higgins 2002) were explored using the pre-specified subgroups (sample size, confounding factors, study design, and study setup). In the summary estimate, we merged mistimed and unwanted pregnancy together as unintended pregnancy. However, previous research has found different effects associated with having a mistimed or unwanted pregnancy on

healthcare services utilization (Singh et al. 2013). To capture these differences, we added the types of pregnancy unintendedness as another subgroup. Publication bias was assessed by visual inspection of Funnel plot asymmetry and Egger's regression test (Egger et al. 1997). The trim-and-fill method was used when the evidence of publication bias was found, to estimate and adjust for potentially missing studies and the effect size recalculated accordingly (Duval and Tweedie 2000). All analyses were performed using Stata software version 15.1 (Stata Corp, College Station, Texas, USA).

Results

A total of 1072 articles dating from the inception of the MDGs were identified (Fig. 1).

On the basis of the title, abstract, and relevance to the research questions, 79 articles were selected for full-text review for possible inclusion in the study. Of these, 32 articles were excluded, leaving 47 articles. Thirty-eight of these articles were included in the meta-analysis, and the remaining nine articles were synthesized narratively.

Study characteristics

A summary of the 38 articles included in the meta-analysis is presented in supplementary Table 8. Studies included were based on data from 53 countries. About 40% of the total included studies were conducted in Ethiopia (15). Selected study data were collected from either health facilities (4), communities (20), or the whole country (14) through face-to-face interviews. Only two studies used computer-assisted personal interviewing software (Dansereau et al. 2016), and an interview administrative questionnaire (Nair et al. 2012) to collect data. The majority of the studies were cross-sectional (34) followed by prospective cohort (3) and case–control studies (1). The sample size of the included studies ranged from 307 to 200,417, with a total of 474,901 women. In the majority of articles, pregnancy intention was assessed retrospectively by using standard questionnaires (33) followed by prospective assessment (3) and assessment during pregnancy (2). Of the 33 articles that assessed pregnancy intention retrospectively, 19 articles used the Demography and Health Survey standard questionnaires that referred to women's feelings regarding pregnancy when conception occurred within 5 years prior to the survey date (Kaufmann et al. 1997). The remaining 14 articles used the same questionnaires to assess pregnancy intention when pregnancy occurred either 1 year (5), 2 years (7), or 3 years (2) prior to the survey date. Of the 38 articles selected, 12 articles reported at least one antenatal care visit, nine articles reported four or more antenatal care visits, seven articles reported institutional delivery, three articles reported skilled delivery care, and three articles reported

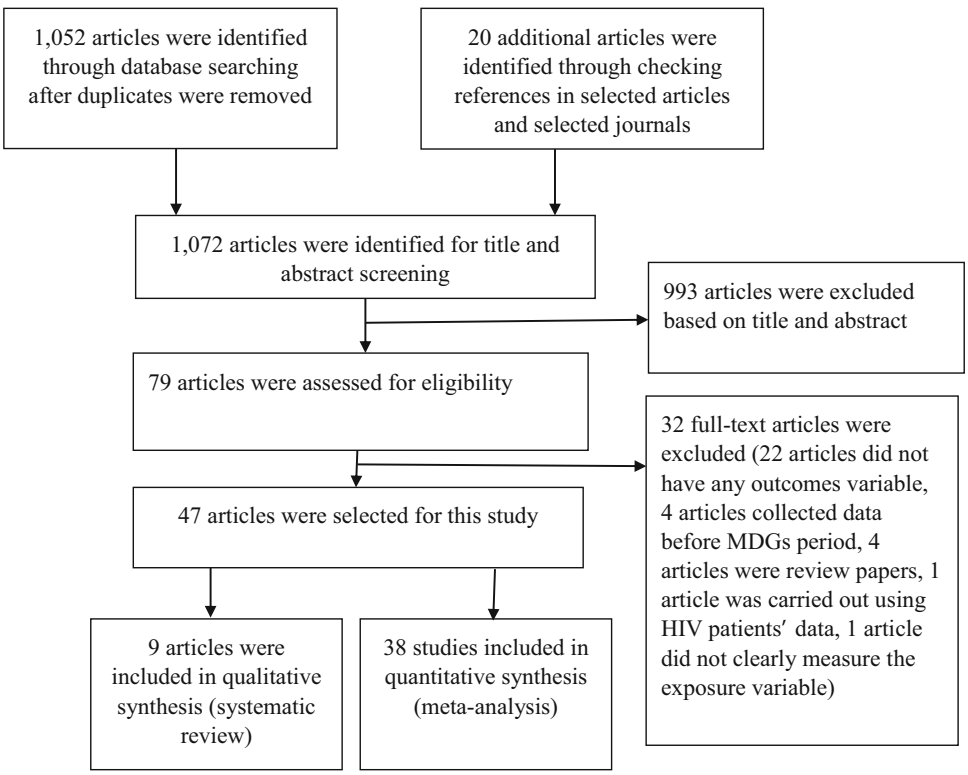

Fig. 1 Schematic representation of the included studies examining unintended pregnancy and maternal healthcare service utilisation in low- and middle-income countries published between 2000 and 2018 using the PRISMA checklist and flow diagram

postnatal healthcare services utilization. The remaining four articles reported multiple healthcare services utilization as outcomes. All studies were of moderate (2) and high quality (36) (Supplementary Tables 10–12).

Pool and sensitivity analysis

The pooled ORs for each outcome, publication bias, and trim-and-fill estimates are presented in Table 1. Women reporting unintended pregnancy were around 25% less likely to use at least one antenatal care visit (OR, 0.75, 95% CI, 0.68–0.82, I^2 = 86.7%, 16 studies) than women reporting an intended pregnancy. The odds of using four or more antenatal care visits was also found to be 39% lower (OR, 0.61, 95% CI, 0.68–0.84, I^2 = 94.1%, 12 studies) among women reporting an unintended pregnancy compared to women reporting an intended pregnancy. We also found that the occurrence of unintended pregnancy was associated with lower use of delivery healthcare services. Women reporting an unintended pregnancy were 25% (OR, 0.75, 95% CI, 0.66–0.85, I^2 = 89.0%, 7 studies) less likely to use skilled delivery care services compared to women reporting an intended pregnancy. The percentage was even lower for use of institutional delivery care services. Women reporting an unintended pregnancy were around 36% (OR, 0.64, 95% CI, 0.53–0.78, I^2 = 79.0%, 11 studies) less likely to give birth in any form of healthcare institution (both public and private) than women reporting an intended pregnancy. The odds of using postnatal healthcare services utilization were also found to be lower (OR, 0.65, 95% CI, 0.47–0.91, I^2 = 92.1%, 6 studies) among women reporting an unintended pregnancy compared to an intended pregnancy.

The p value of Egger's test provided no evidence of publication bias for use of each of the healthcare services. However, visual inspection of the funnel plots indicated asymmetry in studies related to four or more antenatal care visits and institutional delivery (Supplementary Figure 2A and 4A). Studies related to at least one antenatal care, skilled delivery care, or postnatal care showed symmetric patterns. We then use the trim-and-fill methods to impute the number missing studies. Two studies for four or more antenatal care visits, and one study for institutional delivery were hypothetically imputed. The pooled analysis including these unpublished papers showed that women reporting an unintended pregnancy were around 44% less likely to use four or more antenatal care visits (OR, 0.56, 95% CI, 0.44–0.70) than women reporting an intended pregnancy. Similarly, the summary ORs remained at 38% (OR, 0.62, 95% CI, 0.52–0.75) lower for institutional delivery care among women reporting an unintended pregnancy than women reporting an intended pregnancy after adjustment of publication bias.

The negative effect of the occurrence of unintended pregnancy on healthcare services utilization was also demonstrated in the narrative review (Supplementary Table 9). In 7 of the 9 articles reviewed, researchers reported that the occurrence of unintended pregnancy contributed up to 490% and 200% of inadequate and non-utilization of antenatal healthcare services, respectively

Table 1 Summary effect of unintended pregnancy on antenatal, delivery and postnatal healthcare services utilization in low- and lower-middle-income countries (2000–2018), publication bias, and trim-and-fill estimates

Characteristics	Number of studies	Summary estimates[b]		Egger bias test p value	Trim-and-fill estimates[a]	
		OR (95% CI)	Heterogeneity Index		Missing studies no.	OR (95% CI)
Antenatal care						
At least one antenatal care visit[c]	16	0.75 (0.68–0.82)	86.7%	0.832	0	0.76 (0.69–0.84)
Four or more antenatal visits[c]	12	0.61 (0.50–0.74)	94.1%	0.309	2	0.56 (0.44–0.70)
Delivery health care						
Skilled delivery care[c]	7	0.75 (0.66–0.85)	89.0%	0.717	0	0.75 (0.66–0.85)
Institutional delivery[c]	11	0.64 (0.53–0.78)	79.5%	0.186	1	0.62 (0.52–0.75)
Postnatal care[c]	6	0.65 (0.47–0.91)	92.1%	0.525	0	0.65 (0.47–0.91)

CI confidence interval, *OR* odds ratio

[a]The trim-and-fill method simulates studies that are likely to be missing from the literature due to publication or other forms of bias. The trim-and-fill OR estimates what the pooled OR would be whether these missing studies were included in the analysis

[b]Summary estimates were based on random-effects methods

[c]Intended pregnancy is considered as reference category

(Amo-Adjei and Tuoyire 2016; Bassani et al. 2009; Chompikul and Isaranurug 2008; Ochako and Gichuhi 2016; Paredes et al. 2005; Regassa 2011; Titaley et al. 2009). The authors of one article calculated ORs of home and institution delivery separately for the majority of socio-demographic and pregnancy intention variables (Tebekaw et al. 2015). They found women experiencing an unintended pregnancy were 211% more likely to prefer home delivery than women experiencing an intended pregnancy. In contrast, nearly 43% higher odds of using private facility-based delivery services were reported among women experiencing an intended pregnancy than those experiencing an unintended pregnancy. An approximately similar lower risk of postnatal healthcare services utilization was found in another study conducted in Tanzania among women reporting an unintended pregnancy compared to women reporting an intended pregnancy (Kanté et al. 2015).

Stratified analysis

The study showed high heterogeneity ($I^2 > 75\%$) among studies and subgroups for each of the types of healthcare service utilization. To examine the sources of heterogeneity, we conducted stratified analysis across types of pregnancy unintendedness (unwanted, mistimed), sample size (divided based on mean sample size of the included studies and classified as ≤ 9644, > 9644), confounding factors (adjusted, unadjusted), study design (cross-sectional, case–control, prospective cohort), and study setup (national, regional) (Tables 2, 3, 4). Our stratified analysis found that *unwanted pregnancy* was significantly associated with lower use of each form of healthcare services. However, *mistimed pregnancy* showed an insignificant effect for utilizing four or more antenatal healthcare services visits (OR, 0.71, 95% CI, 0.47–1.07), and skilled delivery care (OR, 1.02, 95% CI, 0.93–1.12). The odds were also significant for at least one antenatal care visit (OR, 0.73, 95% CI, 0.55–0.95), institutional delivery (OR, 0.66, 95% CI, 0.53–0.83), and postnatal healthcare services utilization (OR, 0.59, 0.43–0.82). Heterogeneity of the reported ORs for healthcare service utilization were also found across sample size, confounding factors, study design, and study setup.

Discussion

This manuscript provides a detailed and comprehensive assessment of the effect of unintended pregnancy on antenatal, delivery, and postnatal healthcare services utilization in LLMC. A total of 38 studies were included that were conducted based on data from 53 countries. We found unintended pregnancy had a significant effect on lower utilization of each form of healthcare service. Our subgroup analysis across types of pregnancy unintendedness found unwanted pregnancy was associated with lower use of each form of healthcare services, while mistimed pregnancy was associated with lower use of at least one antenatal care visit, institutional delivery, and postnatal healthcare services.

Assessing the opportunities and challenges relating to maternal healthcare services utilization is important for addressing the SDG of achieving universal access to healthcare services (Kuuire et al. 2017). In order to achieve this, it is crucial to monitor where improvements in healthcare access have occurred, and areas where progress must be accelerated (Fullman et al. 2018). This is particularly important for LLMC where healthcare services utilization is still very low, and influenced by many factors. Some of these are dysfunctional and underperforming healthcare systems (Abosse et al. 2010), community norms (Kuzara et al. 2018), roads and transportation (Tegegne et al. 2018), and key socio-demographic factors such as lower-socio-economic condition, lack of education, and not being engaged in employment (Gupta et al. 2014; WHO 2015). Given the higher prevalence of unintended pregnancy in LLMC, in this study we found that ensuring maternal healthcare services utilization among women experiencing an unintended pregnancy is another important challenge. It is therefore a need to properly address this challenge to facilitate gains in health-related SDGs. This requires integrating family planning and maternal healthcare services in order to not only prevent women experiencing an unintended pregnancy but also provide earlier detection and facilitate an increase in women's knowledge regarding the importance of attending maternal and family planning services and the availability of such services.

Two previous meta-analyses conducted using worldwide (Dibaba et al. 2013) and Ethiopian (Tesfaye et al. 2017) data provided evidence of delayed antenatal healthcare services utilization among women experiencing an unintended pregnancy. In our comprehensive meta-analysis, we have added to the body of knowledge which suggests that the occurrence of unintended pregnancy also reduces the number of antenatal care services visits as well as reducing the odds of using skilled delivery care, institutional delivery, and postnatal healthcare services. Factors related to either women, their partners or family members, and healthcare sectors, or more likely some combination of the three might be linked with such low utilization of these services. There is extensive evidence that women experiencing an unintended pregnancy are more likely to be socio-economically disadvantaged, have no formal schooling and enjoy lower autonomy which limits their capability to utilize recommended services because of

Table 2 Stratified analysis of pooled ORs of unintended pregnancy and at least one antenatal care visit and four or more antenatal care visits in low- and lower-middle-income countries (2000–2018)

Characteristics	Pooled OR (95% CI)	*P*	
		Heterogeneity	Meta-regression
At least one antenatal care visit			
Type of unintendedness			
Unwanted	0.73 (0.64–0.82)	< 0.001	0.964
Mistimed	0.73 (0.55–0.95)	< 0.001	
Sample size			
≤ 9644	0.74 (0.66–0.83)	< 0.001	0.943
> 9644	0.74 (0.60–0.90)	< 0.001	
Confounding factors			
Adjusted	0.76 (0.69–0.84)	0.002	0.901
Unadjusted	0.73 (0.62–0.88)	< 0.001	
Study design			
Cross-sectional study	0.75 (0.68–0.82)	< 0.001	NA
Case–control study	0	0	
Prospective cohort	0	0	
Study setup			
National	0.79 (0.72–0.87)	< 0.001	0.01
Regional	0.56 (0.43–0.73)	0.010	
Four or more antenatal care visits			
Type of unintendedness			
Unwanted	0.58 (0.43–0.79)	< 0.001	0.207
Mistimed	0.71 (0.47–1.07)	< 0.001	
Sample size			
≤ 9644	0.57 (0.44–0.74)	< 0.001	0.348
> 9644	0.71 (0.49–1.05)	< 0.001	
Confounding factors			
Adjusted	0.77 (0.67–0.88)	0.005	0.034
Unadjusted	0.50 (0.36–0.70)	< 0.001	
Study design			
Cross-sectional study	0.60 (0.49–0.75)	< 0.001	0.780
Case–control study	0	0	
Prospective cohort	0.67 (0.51–0.88)[a]	NA	
Study setup			
National	0.61 (0.48–0.79)	< 0.001	0.847
Regional	0.61 (0.45–0.83)	0.061	

[a]Odds ratio for single study, meta-regression *P* values represent a test of the entire characteristic, NA: not available, pooled ORs were based on random-effects methods separately for each characteristic

either financial difficulties or poor knowledge regarding the importance of services use during pregnancy (Ali et al. 2016). Women's negative feelings towards pregnancy because of either the number of children or unexpected breaks to education, career or other life aspirations might also lead to lower utilization of services (Achyut et al. 2015; Wado et al. 2014). Moreover, the risk of lower utilization of maternal healthcare services increases greatly if the unintended pregnancy occurred in the second or consecutive birth orders, as in this case women having an unintended pregnancy are more likely to rely on their prior experience of pregnancy (Titaley et al. 2009). Negative feelings might also arise among partners and other family members; therefore, they remain unaware of the pregnancy, which could increase the susceptibility of women having an unintended pregnancy being less likely to utilize appropriate services (Guliani et al. 2013). This risk increases greatly if women have experienced an unwanted pregnancy rather than a mistimed pregnancy, the pregnancy occurred as a result of sexual assault, rape, or coercive sex outside the marital relationship, and the outcomes of pregnancy (the child's sex) is opposite to the

Table 3 Stratified analysis of pooled ORs of unintended pregnancy and skilled delivery care and institutional delivery care services utilization in low- and lower-middle-income countries (2000–2018)

Characteristics	Pooled OR (95% CI)	*P*	
		Heterogeneity	Meta-regression
Skilled delivery care			
Type of unintendedness			
Unwanted	0.61 (0.47–0.78)	< 0.001	< 0.001
Mistimed	1.02 (0.93–1.12)	0.006	
Sample size			
≤ 9644	0.76 (0.68–0.85)	0.004	0.712
> 9644	0.74 (0.50–1.10)	< 0.001	
Confounding factors			
Adjusted	0.62 (0.46–0.84)	0.884	0.095
Unadjusted	0.78 (0.68–0.90)	< 0.001	
Study design			
Cross-sectional study	0.74 (0.65–0.85)	< 0.001	NA
Case–control study	0	0	
Prospective cohort	0	0	
Study setup			
National	0.78 (0.68–0.90)	< 0.001	0.09
Regional	0.52 (0.38–0.71)	0.884	
Institutional delivery			
Type of unintendedness			
Unwanted	0.71 (0.61–0.84)	0.265	0.490
Mistimed	0.66 (0.53–0.83)	0.124	
Sample size			
≤ 9644	0.64 (0.52–0.80)	< 0.001	0.873
> 9644	0.61 (0.50–0.74)[a]	NA	
Confounding factors			
Adjusted	0.79 (0.69–0.89)	0.799	0.084
Unadjusted	0.54 (0.40–0.74)	< 0.001	
Study design			
Cross-sectional study	0.61 (0.50–0.76)	< 0.001	0.557
Case–control study	0.71 (0.40–1.25)[a]	NA	
Prospective cohort	0.88 (0.62–1.27)[a]	NA	
Study setup			
National	0.71 (0.62–0.82)	0.150	0.472
Regional	0.59 (0.42–0.83)	< 0.001	

[a]Odds ratio for single study, meta-regression *p* values represent a test of the entire characteristic, NA: not available, pooled ORs were based on random-effects methods separately for each characteristic

usual preference of the partner and other family members (Rahman et al. 2016). The results of our subgroup analysis across type of pregnancy unintendedness were also supportive of this statement.

Our analysis found the odds of using four or more antenatal care visits among women having an unintended pregnancy were lower than the odds of using at least one antenatal care visit. The odds were even lower for institutional delivery than the odds of skilled delivery care. This implies that many women having an unintended pregnancy who start service use drop out before receiving the four or more antenatal care services visits, or found out they were pregnant late, and therefore receive fewer antenatal care services and prefer home delivery rather than institutional delivery. These factors contributed to the increase in the number of women experiencing unintended pregnancy who did not receive four or more antenatal care visits as recommended by the WHO before 2016 (as opposed to current recommendations of eight visits), when data for most of the studies we included in this study were collected (WHO 2016). Therefore, such discontinuity of care as well as women's late pregnant detection constitutes missed

Table 4 Stratified analysis of pooled OR of unintended pregnancy and postnatal care services utilization in low- and lower-middle-income countries (2000–2018)

Characteristics	Pooled OR (95% CI)	*P*	
		Heterogeneity	Meta-regression
Postnatal care			
Type of unintendedness			
Unwanted	0.56 (0.38–0.84)	< 0.001	0.820
Mistimed	0.59 (0.43–0.82)	< 0.001	
Sample size			
≤ 9644	0.83 (0.61–1.13)	0.019	< 0.001
> 9644	0.48 (0.38–0.61)	0.026	
Confounding factors			
Adjusted	0.87 (0.65–1.16)	0.253	0.365
Unadjusted	0.59 (0.40–0.88)	< 0.001	
Study design			
Cross-sectional study	0.94 (0.75–1.19)[a]	NA	0.291
Case–control study	0.60 (0.42–0.86)	< 0.001	
Prospective cohort	0	0	
Study setup			
National	0.59 (0.40–0.88)	< 0.001	0.365
Regional	0.87 (0.65–1.16)	0.253	

[a]Odds ratio for single study, meta-regression *p* values represent a test of the entire characteristic, NA: not available, pooled ORs were based on random-effects methods separately for each characteristic

opportunities and can be considered as another important challenge. In LLMC, this can be considered as a failure in public healthcare systems, as people tend to have more dependence on it, than in wealthier countries, and within countries, poor and other deprived groups usually depend heavily on public healthcare systems (Peters et al. 2008). Such higher dependency on public health systems might arise because of geographic accessibility, the availability of the right types of services with minimal cost, and matching with the social and cultural expectations of individual users (Peters et al. 2008). Lack of services therefore can have serious consequences, especially for women having an unintended pregnancy, as they have less autonomy to travel far, or are unwilling to pay for healthcare services (Ali et al. 2016; Sedgh et al. 2006). Moreover, the relationship between publicly funded healthcare systems, unintended pregnancy, and access to healthcare services might also have other dimensions. Less availability of healthcare services could reduce the chances of family planning services use, leading to the occurrence of unintended pregnancy; this then could lead to lower utilization of subsequent antenatal, delivery, and postnatal healthcare services (Mohan et al. 2015). This linkage might be associated either with characteristics associated with women having unintended pregnancy, or reducing the opportunities for healthcare providers to educate women about the importance of utilizing the next level of services (Dahiru and Oche 2015). It is also possible that depending upon their financial capacity, one group of women could use each form of healthcare service consistently, while other groups would not use any services (Guliani et al. 2013). Programmes which target the early detection of unintended pregnancy and continuity of care are therefore important. More focus on women's reasons for dropping out of care, such as geographical accessibility, quality of care, and cost of care that prevents women from either use or continuity of services may achieve better results (Ali et al. 2016; Sedgh et al. 2006).

One strength of our study is that it is based on all studies published in LLMC since the year 2000, when MDGs were established targeting to ensure services use for all pregnancies. We used comprehensive search techniques and validated systematic review methods such as "Strengthening the Reporting of Observational Studies in Epidemiology" (Von Elm et al. 2007), and PRISMA guidelines (Moher et al. 2009) for database searches, data extraction and selection of the studies to be included in the meta-analysis. These strengthened the quality of our review and conclusions. However, despite these strengths some limitations of this systematic review and meta-analysis must be considered. First, measurement of pregnancy intention varied between studies, which makes classification of pregnancy intention as simply *intended* vs *unintended* extremely difficult. However, in this study, we merged

mistimed and *unwanted* pregnancy into the *unintended pregnancy* category for an overall estimate, and a performed subgroup analysis across types of pregnancy unintendedness (mistimed, unwanted). A similar predictive odds for overall estimate and subgroup estimates reveals reclassification did not affect our results. Secondly, most of the studies included in the meta-analysis were cross-sectional, and they might reflect recall bias of reporting outcomes variables. In addition, this could lead to the high possibility of ambivalent responses in reporting pregnancy status. Thirdly, there were significant heterogeneities across included studies that might result in differences in participants and study characteristics. However, our stratified analysis consistently revealed similar association with summary ORs, suggesting the validity of the summary results. Fourth, we did not search unpublished papers and grey literature, which might lead to exclusion of papers which could contribute on arising publication bias. However, Egger's test showed no evidence of significant publication bias although funnel plots showed little evidence of publication bias (i.e. asymmetry) for four or more antenatal care visits and institutional delivery. This slight asymmetry may arise because of the inclusion of a small number of studies for particular healthcare event, substantial between study heterogeneity, or because all studies were similar sizes (Green and Higgins 2005). However, we found a similar trend in results of summarized ORs when we captured publication bias by using the trim-and-fill method, thus suggesting that our findings are reliable.

Conclusion

The experience of unintended pregnancy was found to be significantly associated with lower use of antenatal, delivery, and postnatal healthcare services. Consistent lower utilization of services among women having an unwanted pregnancy was also identified. However, having a mistimed pregnancy was found to be significantly associated with lower use of at least one antenatal care, institutional delivery, and postnatal healthcare service. These findings greatly strengthen the evidence regarding the association between the occurrence of unintended pregnancy and reduced services use, and provide an additional rationale for integrating family planning and maternal healthcare services for early detection of women having an unintended pregnancy. It would be helpful for healthcare providers to add women having an unintended pregnancy to mainstream healthcare services by encouraging them as well as increasing their knowledge regarding the importance of attending such services. This would increase service use among women having an unintended pregnancy, which could contribute to reducing associated adverse consequences.

Acknowledgements We acknowledge the support of the Priority Research Centre for Generational Health and Aging, a member of the Hunter Medical Research Institute, Australia, where this research was conducted.

Authors' Contribution MNK., MLH., and DL developed the study concept. MNK, DMS, and AL reviewed the articles independently, extracted data, and assessed study quality. MNK conducted the formal analysis and drafted the manuscript. MLH and DL critically reviewed the manuscript. All authors approved the final version of this manuscript.

Funding The first author is supported by a PhD research scholarship from the University of Newcastle, Australia. Dr Melissa L. Harris is supported by an Australian Research Council Discovery Early Career Research Award.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Availability of data and material Associated data of this study are available upon submitting a reasonable request to the corresponding author.

References

Abosse Z, Woldie M, Ololo S (2010) Factors influencing antenatal care service utilization in hadiya zone. Ethiop J Health Sci 20:75–82

Achyut P, Mishra A, Montana L, Sengupta R, Calhoun LM, Nanda P (2015) Integration of family planning with maternal health services: an opportunity to increase postpartum modern contraceptive use in urban Uttar Pradesh, India. J Fam Plann Reprod Health Care 42:107–115

Ali SA, Tikmani SS, Qidwai W (2016) Prevalence and determinants of unintended pregnancy: systematic review. Middle East J Fam Med 14:37

Amo-Adjei J, Tuoyire DA (2016) Effects of planned, mistimed and unwanted pregnancies on the use of prenatal health services in sub-Saharan Africa: a multicountry analysis of demographic and health survey data. Tropical Med Int Health 21:1552–1561

Barrett G, Wellings K (2002) What is a 'planned'pregnancy? Empirical data from a British study. Soc Sci Med 55:545–557

Bassani DG, Surkan PJ, Olinto MTA (2009) Inadequate use of prenatal services among Brazilian women: the role of maternal characteristics. Int Perspect Sex Reprod Health 35:15–20

Bearak J, Popinchalk A, Alkema L, Sedgh G (2018) Global, regional, and subregional trends in unintended pregnancy and its outcomes from 1990 to 2014: estimates from a Bayesian hierarchical model. The Lancet Global Health 6:e380–e389

Bitew T, Hanlon C, Kebede E, Honikman S, Onah MN, Fekadu A (2017) Antenatal depressive symptoms and utilisation of delivery and postnatal care: a prospective study in rural Ethiopia. BMC Pregnancy Childbirth 17:206

Chao F, You D, Pedersen J, Hug L, Alkema L (2018) National and regional under-5 mortality rate by economic status for low-income and middle-income countries: a systematic assessment. The Lancet Global Health 6:e535–e547

Chompikul J, Isaranurug S (2008) Factors related to the utilization of antenatal care services among pregnant women at health centers

in Aceh Besar district, Nanggroe Aceh Darussalam province, Indonesia. J Publ Health Dev 6:99–108
Cripe SM, Sanchez SE, Perales MT, Lam N, Garcia P, Williams MA (2008) Association of intimate partner physical and sexual violence with unintended pregnancy among pregnant women in Peru. Int J Gynecol Obstet 100:104–108
Dahiru T, Oche OM (2015) Determinants of antenatal care, institutional delivery and postnatal care services utilization in Nigeria. Pan Afr Med J 21:321
Dansereau E et al (2016) Coverage and timing of antenatal care among poor women in 6 Mesoamerican countries. BMC Pregnancy Childbirth 16:234
Dibaba Y, Fantahun M, Hindin MJ (2013) The effects of pregnancy intention on the use of antenatal care services: systematic review and meta-analysis. Reprod Health 10:50
Duval S, Tweedie R (2000) Trim and fill: a simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. Biometrics 56:455–463
Egger M, Smith GD, Schneider M, Minder C (1997) Bias in meta-analysis detected by a simple, graphical test. BMJ 315:629–634
Feyisso M, Girma A, Yimam H, Hailu S (2017) Magnitude of unintended pregnancy and its determinants among pregnant women visiting Dilla University Referral Hospital, South Ethiopia. J Women's Health Care 6:2167-0420
Fullman N et al (2018) Measuring performance on the Healthcare Access and Quality Index for 195 countries and territories and selected subnational locations: a systematic analysis from the Global Burden of Disease Study 2016. The Lancet 391:2236–2271
Green S, Higgins J (2005) Cochrane handbook for systematic reviews of interventions. The Cochrane Collaboration and John Wiley & Sons Ltd, Chichester
Guliani H, Sepehri A, Serieux J (2013) Determinants of prenatal care use: evidence from 32 low-income countries across Asia, Sub-Saharan Africa and Latin America. Health Policy Plan 29:589–602
Gupta S, Yamada G, Mpembeni R, Frumence G, Callaghan_Koru JA, Stevenson R, Brandes N, Baqui AH (2014) Factors associated with four or more antenatal care visits and its decline among pregnant women in Tanzania between 1999 and 2010. PLoS ONE 9:e101893
Herrera CA et al (2017) Governance arrangements for health systems in low-income countries: an overview of systematic reviews. The Cochrane Library, London
Higgins JP, Thompson SG, Deeks JJ, Altman DG (2003) Measuring inconsistency in meta-analyses. BMJ 327:557
Hunt P, Bueno de Mesquita J (2007) Reducing maternal mortality: the contribution of the right to the highest attainable standard of health. The University of Essex, United Kingdom
Islam M (2007) The safe motherhood initiative and beyond. Bull World Health Organ 85(10):735
Kanté AM, Chung CE, Larsen AM, Exavery A, Tani K, Phillips JF (2015) Factors associated with compliance with the recommended frequency of postnatal care services in three rural districts of Tanzania. BMC Pregnancy Childbirth 15:341
Kaufmann RB, Morris L, Spitz AM (1997) Comaparison of two question sequences for assessing pregnancy intentions. Am J Epidemiol 145:810–816
Kuuire VZ et al (2017) Timing and utilisation of antenatal care service in Nigeria and Malawi. Global Public Health 12:711–727
Kuzara J, Woodriff Sprinkel A, Mekuria FT, Rubardt M, Maguiraga F, Sissoko K, Hastings P (2018) Addressing social and gender norms to improve uptake of maternal health services in Mali: a descriptive study of CARE's Project Hope for Mothers and Newborns (PEMN). Culture Health Sex 20:1–14
Mahler H (1987) The safe motherhood initiative: a call to action. Lancet (London, England) 1:668
Modesti PA et al (2016) Panethnic differences in blood pressure in Europe: a systematic review and meta-analysis. PLoS ONE 11:e0147601
Mohan D, Gupta S, LeFevre A, Bazant E, Killewo J, Baqui AH (2015) Determinants of postnatal care use at health facilities in rural Tanzania: multilevel analysis of a household survey. BMC Pregnancy Childbirth 15:282
Moher D, Liberati A, Tetzlaff J, Altman DG (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Ann Intern Med 151:264–269
Nair M, Ariana P, Webster P (2012) What influences the decision to undergo institutional delivery by skilled birth attendants? A cohort study in rural Andhra Pradesh, India. Rural Remote Health 12:2311
Ochako R, Gichuhi W (2016) Pregnancy wantedness, frequency and timing of antenatal care visit among women of childbearing age in Kenya. Reprod Health 13:51
Pallitto CC, Campbell JC, O'Campo P (2005) Is intimate partner violence associated with unintended pregnancy? A review of the literature. Trauma, Violence Abuse 6:217–235
Pantoja T et al (2017) Implementation strategies for health systems in low-income countries: an overview of systematic reviews. The Cochrane Library, London
Paredes I, Hidalgo L, Chedraui P, Palma J, Eugenio J (2005) Factors associated with inadequate prenatal care in Ecuadorian women. Int J Gynecol Obstet 88:168–172
Peters DH, Garg A, Bloom G, Walker DG, Brieger WR, Rahman MH (2008) Poverty and access to health care in developing countries. Ann N Y Acad Sci 1136:161–171
Rahman MM, Rahman MM, Tareque MI, Ferdos J, Jesmin SS (2016) Maternal pregnancy intention and professional antenatal care utilization in Bangladesh: a nationwide population-based survey. PLoS ONE 11:e0157760
Regassa N (2011) Antenatal and postnatal care service utilization in southern Ethiopia: a population-based study. Afr Health Sci 11(3):390–397
Sedgh G, Hussain R (2014) Reasons for contraceptive nonuse among women having unmet need for contraception in developing countries. Stud Fam Plann 45:151–169
Sedgh G, Bankole A, Oye-Adeniran B, Adewole IF, Singh S, Hussain R (2006) Unwanted pregnancy and associated factors among Nigerian women. Int Fam Plan Perspect 32(4):175–184
Singh A, Singh A, Mahapatra B (2013) The consequences of unintended pregnancy for maternal and child health in rural India: evidence from prospective data. Matern Child Health J 17:493–500
Tafere TE, Afework MF, Yalew AW (2018) Antenatal care service quality increases the odds of utilizing institutional delivery in Bahir Dar city administration, North Western Ethiopia: a prospective follow up study. PLoS ONE 13:e0192428
Tebekaw Y, James Mashalla Y, Thupayagale-Tshweneagae G (2015) Factors influencing Women's preferences for places to give birth in Addis Ababa, Ethiopia. Obstet Gynecol Int 2015:439748
Tegegne TK, Chojenta C, Loxton D, Smith R, Kibret KT (2018) The impact of geographic access on institutional delivery care use in low and middle-income countries: systematic review and meta-analysis. PLoS ONE 13:e0203130
Tesfaye G, Loxton D, Chojenta C, Semahegn A, Smith R (2017) Delayed initiation of antenatal care and associated factors in Ethiopia: a systematic review and meta-analysis. Reprod Health 14(1):150
Thompson SG, Higgins JP (2002) How should meta-regression analyses be undertaken and interpreted? Stat Med 21:1559–1573

Titaley CR, Dibley MJ, Roberts CL (2009) Factors associated with non-utilization of postnatal care services in Indonesia. J Epidemiol Community Health 63:827–831

UN (2015) Transforming our world: the 2030 agenda for sustainable development. United Nations, New York

UN (2018) Millennium Development Goals (MDGs) The United Nation, USA Retrieved 10 June 2017 from http://www.whoint/news-room/fact-sheets/detail/millennium-development-goals-(mdgs)

Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, Initiative S (2007) The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. PLoS Med 4:e296

Wado YD, Afework MF, Hindin MJ (2014) Effects of maternal pregnancy intention, depressive symptoms and social support on risk of low birth weight: a prospective study from southwestern Ethiopia. PLoS ONE 9:e96304

WHO (2015) State of inequality: reproductive, maternal, newborn and child health. The World Health Organization, Geneva

WHO (2016) New guidelines on antenatal care for a positive pregnancy experience. The world health Organization, Geneva, Swezarland Accessed from https://www.whoint/reproductive health/news/antenatal-care/en/. 1 Jan 2019

WHO (2018a) Maternal Mortality. The world health Organization, Geneva, Swezarland Accessed from http://www.whoint/news-room/fact-sheets/detail/maternal-mortalityon. 10 Oct 2018

WHO (2018b) New borns: Reducing mortality. The world health Organization, Geneva, Swezarland Accessed from http://www.whoint/news-room/fact-sheets/detail/newborns-reducing-mortality. 20 Oct 2018

World Bank (2017) World Bank Country and Lending Groups: Country Classification. URL: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups. Accessed 8 Oct 2018

Zegeye K, Gebeyehu A, Melese T (2014) The role of geographical access in the Utilization of institutional delivery service in rural Jimma Horro District, Southwest Ethiopia. Primary Health Care 4(2167–1079):1000150