The Efficacy of Maternity Waiting Homes in Decreasing Maternal and Perinatal Mortality in Low-Income Countries – A Systematic Review

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Abstract

Background: Maternal and perinatal mortality remains significantly high in low-income countries with over 800 deaths per day of women around childbirth [1]. Greater than 90% of such deaths occur in low-income countries [1]. The concept of maternity waiting homes (MWH) was reintroduced to aid in decreasing maternal and perinatal mortality. Since the previous Cochrane Review in 2012 on maternity waiting homes, there hasn't been any published randomized controlled studies.

Research Question: Do observational studies on MWHs decrease maternal and perinatal mortality in low-income countries when compared with the standard of care (non-MWH)?

Methods: We searched for primary articles that reported maternal and perinatal deaths as major outcomes in studies who compared MWHs to other methods such as direct hospital admissions. Search engines used were: Cochrane Review, Medline and CINAHL. Meta-analyses and forests plots were formulated using MedCalc Software.

Results: A total of seven articles met criteria. In terms of maternal mortality, Relative risk (RR) of MWH vs non-MWH was 0.145 (P<0.001). RR for perinatal deaths was 0.782 (P=0.341), 0.204 (P=0.001) for stillbirths and 0.862 (P=0.775) for neonatal deaths.

Conclusion: MHWs statistically decreased maternal deaths and stillbirths. Overall, the study designs of the articles introduce selection biases that may have altered the results of the studies. We suggest a cluster-randomized study to further evaluate the effect of MWHs.

Introduction

The disparity in maternal mortality between developed and developing countries continues to be a relevant aspect in global health. The Millennium Developmental Goal number 8 aimed to decrease maternal mortality by 75% from the years 1990 to 2015 [2]. Reports indicate that maternal mortality was only reduced by 44%, suggesting the need for further innovation in the care of patients during pregnancy and post-partum periods [1]. Emphasis on prenatal care, training skilled birth attendants and infectious disease prevention campaigns have aided in the decrease of mortality. Maternity waiting homes (MWHs) were employed by some countries to decrease maternal mortality. MWHs are built in rural areas of low-income countries to house women with high risk pregnancies towards the end of their pregnancies. These homes are strategically built close to major district hospitals and equipped with qualified birth attendants to monitor patients during their stay. This concept was utilized in European countries, Canada and the USA in early 20th century with much success [3]. A systematic review published in 2012 was unable to recommend MWHs as a means to decrease maternal mortality due to lack of evidence and robust experimental designs [4]. This study sought to evaluate the effect of MWHs in reducing maternal and perinatal deaths in low-income countries since the previous systematic review in 2012. We propose that appropriate use of MWH will be effective in decreasing both mortalities.

Methods

- A comprehensive review was constructed prior to the systematic review to gain a deeper understanding of maternal mortality and MWHs
- Inclusion/Exclusion Criteria of systematic review:
  - Article in English or translated into English
  - Study had to be published
  - We considered randomized controlled trials and observational studies
  - Study must have utilized MWHs as an intervention and compared it to the standard of care
  - Study must have reported primary outcomes such as maternal and perinatal deaths
  - Study had to be based in a low-income country
  - Sources included the librarian at the University of Arizona College of Medicine – Phoenix, Medline PubMed, Cochrane Library and CINAHL
- Search terms included: "maternity waiting homes," "maternal mortality and maternity waiting homes," "maternity waiting homes in decreasing maternal mortality"
- We also searched bibliographies of published articles
- Studies were independently reviewed by myself (AM) and my mentor (DVC), and selected based on the above criteria
- We found 7 observational studies that met criteria, no randomized controlled trials were found
- Primary outcomes extracted were: maternal deaths, perinatal deaths (stillbirths and neonatal deaths) and cesarean deliveries.
- Meta-analysis was performed on data using MedCalc Software with fixed and random effects modeling
- The systematic review was drafted using the MOOSE guidelines for meta-analysis and systematic reviews of observational studies

Results

- 7 observational studies with a comparison group met criteria for the study
- No randomized controlled trials were found on the topic
- Not all outcomes are presented here

Table 1: Meta-Analysis of Maternal Deaths

Variable for studies	Articles						
1. Intervention groups							
Variable for total number of cases	MWH_Total_Births MWH Total Births						
Variable for number of positive cases	MWH_Maternal_Deaths MWH Maternal Deaths						
2. Control groups							
Variable for total number of cases	NMWH_Total_Births NMWH Total Births						
Variable for number of positive cases	NMWH_Maternal_Deaths NMWH Maternal Deaths						
Study	Intervention	Controls	Relative risk	95% CI	z	P	Weight (%) Fixed / Random
1	0/218	1/292	0.446	0.0183 to 10.896			3.55 / 4.95
2	1/280	3/773	0.920	0.0961 to 8.811			7.09 / 9.46
4	3/1573	28/2915	0.199	0.0605 to 0.652			25.61 / 27.68
5	0/474	5/266	0.0511	0.00266 to 0.921			4.33 / 5.99
6	6/6805	187/17343	0.0818	0.0363 to 0.184			54.86 / 45.63
7	0/142	13/635	0.165	0.00985 to 2.755			4.56 / 6.29
Total (fixed effects)	10/9492	237/22224	0.112	0.0620 to 0.204	-7.193	<0.001	100.00 / 100.00
Total (random effects)	10/9492	237/22224	0.145	0.0701 to 0.301	-5.191	<0.001	100.00 / 100.00

Table 2: Test of Heterogeneity of Maternal Deaths

Q	5.8655
DF	5
Significance level	P = 0.3195
I^2 (inconsistency)	14.76%
95% CI for I^2	0.00 to 78.99

Study Key

1. Lonkhuijzen et al., African Journal of Reproductive Health (2003)
2. Tumwine et al., Annals of Tropical Pediatrics (1996)
3. Millard et al., Central African Journal of Medicine (1991)
4. Chandramohan et al., International Journal of Gynecology and Obstetrics (1994)
5. Andemichael et al., Journal of Eritrean Medical Association (2009)
6. Kohls et al., International Journal of Obstetrics and Gynecology (2010)
7. Poovan et al., World Health Forum (1990)

Figure 1: Forest Plot of Maternal Deaths

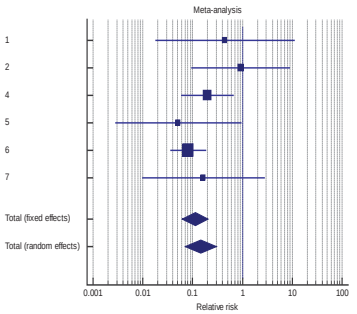


Figure 2: Forest Plot of Perinatal Deaths

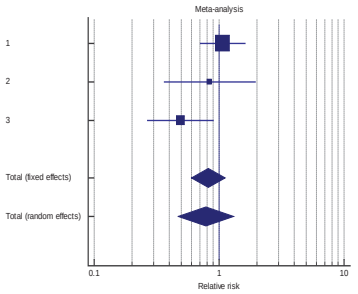


Figure 3: Forest Plot of Neonatal Deaths

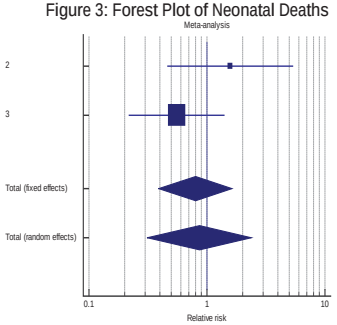
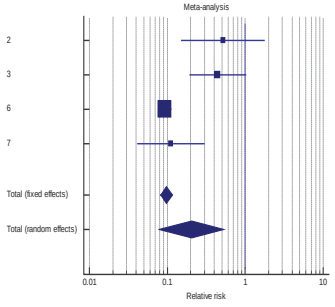


Figure 4: Forest Plot of Stillbirths



Discussion and Conclusions

The results from our study show that MWHs can be beneficial, but the type of experimental design and amount of available studies on the topic are major drawbacks to the conclusion. The pooled results indicate that MWHs statistically decreased the risk of maternal deaths and stillbirths when compared to the standard of care (non-MWHs). The relative risk of perinatal and neonatal deaths on the other hand were reduced, however, the results were not statistically significant (p value > 0.05).

It is imperative to consider study design and biases that can alter the results of studies, while not discrediting the impact of the intervention. One major limitation to this study was the lack of published randomized controlled trials, which is the gold standard for construction of systematic reviews. Observational studies introduce selection and confounding biases by default. Although there was a statistically significant decrease in maternal deaths and stillbirths occurring in MWHs, it is difficult to accept that conclusion given the reasons listed above. To illustrate the biases, women in an obstetric emergency will likely report directly to major hospitals as opposed to the MWH, potentially making the patients who delivered at the hospital sicker at baseline. This could possibly explain the increase in maternal deaths in non-MWH deliveries.

In order to satisfactorily answer the research question, there needs to be robust, randomized trials that can eliminate biases and grant statistical confidence in the results. We recommend a cluster randomized trial in addressing the question at hand. Hypothetically, a cluster randomized trial can identify several towns in low-income countries with similar characteristics (maternal mortality, population, education level, number of hospitals etc.), and randomly assign all pregnant women from one town to either a MWH or standard of care. Gathered data from such a design is more credible when compared to observational studies and could potential shed more light on the topic.

Surveys given to women who were aware of MWHs but unable to take advantage of them highlighted several barriers that need to be addressed. Barriers to fully embracing maternity homes include accommodation fees, distance from homes and restriction on the accompanying guests [4]. Addressing these barriers could create an increase in participation, and subsequently power in the individual studies.

There is insufficient data to confidently state that MWHs decrease maternal and perinatal mortality based on the information we gathered. This was the same conclusion the previous Cochrane Review drew in 2012, suggesting the need for robust experimental designs.

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