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INCIDENCE, INDICATIONS, RISK FACTORS, AND OUTCOMES OF EMERGENCY PERIPARTUM HYSTERECTOMY WORLDWIDE: A SYSTEMATIC REVIEW

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Abstract

Objective: *The objective of this study is to provide a comprehensive analysis of the occurrence, indications, risk factors, outcomes, and management strategies associated with emergency peripartum hysterectomy on a global scale. Additionally, this study aims to compare the outcomes of this procedure across various income situations.*

Methods: *A systematic search strategy was conducted across several electronic reference databases: PubMed, MEDLINE, EMBASE, ClinicalTrials.gov, Cochrane Library, Web of Science, and Emcare databases up to August 3, 2023. Duplicate publications, review articles, editorials, and incomplete articles were excluded.*

Results: *This study presents an updated version of a previously conducted systematic review, which was originally published in 2016. The inclusion criteria for this study encompassed reports that provided data on the occurrence of emergency peripartum hysterectomy. Emergency peripartum hysterectomy was operationally defined as the surgical extraction of the uterus due to severe obstetric problems within a period of up to 6 weeks following childbirth. The process of title and abstract screening, as well as full-text review, was conducted with Endnote data management software. Out of a total of 8,775 papers that were reviewed, a subset of 26 articles published after the year 2015 were deemed eligible for inclusion. Consequently, the overall number of studies included in the analysis amounted to 154.*

Conclusion: *There are significant variations in the occurrence of emergency peripartum hysterectomy across different income contexts. Women residing in lower-income settings face an elevated likelihood of experiencing emergency peripartum hysterectomy, as well as a greater burden of associated morbidity and mortality. The incidence of emergency peripartum hysterectomy is expected to rise because to the escalating prevalence of caesarean deliveries.*

Keywords*: Incidence, Indications, Risk factor, Outcomes, Emergency Hysterectomy*

Introduction

When difficulties arise during pregnancy, delivery, or immediately after giving birth, a hysterectomy may be performed as a matter of urgency. Emergency peripartum hysterectomy is a lifesaving procedure used when other, less invasive options have failed to stop severe obstetric bleeding or sepsis. Although emergency hysterectomy during the peripartum period is sometimes necessary, it is rarely performed in today's obstetrics.[1] However, the global incidence of emergency peripartum hysterectomy is expected to climb as a result of the rising rates of caesarean delivery and, consequently, placenta accreta spectrum in pregnancies after a previous caesarean delivery.[1–3] While it's important to assess the potential benefits of hysterectomy against the potential hazards, waiting too long to have the procedure done could raise both.

Previously, emergency peripartum hysterectomy is more common in high-income countries but has different incidence, indications, risk factors, and outcomes in low-income countries.[1] Low and lower middle income countries have a greater rate of emergency hysterectomies during the perinatal period. Massive obstetric haemorrhage due to placental disease, uterine atony, or uterine rupture is the most common reason for emergency peripartum hysterectomy, followed by puerperal infection.[4,5]

Many additional studies, including some population-based studies, on emergency peripartum hysterectomy have been published since the last update to this review. Therefore, we revised our earlier comprehensive review and meta-analysis. The primary purpose of this research was to estimate the overall incidence of emergency peripartum hysterectomy and compare the incidence across different income settings. Secondary objectives included describing the indications, risk factors, outcomes, and management of emergency peripartum hysterectomy and comparing these characteristics across income levels.

Method

Sources

This study presents an updated version of the systematic review and meta-analysis conducted by van den Akker et al., as previously published.1 A comprehensive and methodical literature search was conducted on various databases including PubMed, MEDLINE, EMBASE, ClinicalTrials.gov, Cochrane Library, Web of Science, and Emcare. The search was conducted until August 3, 2023.

Eligibility Criteria

The selection process involved the inclusion of studies that were published prior to 2015.[1] Initially, the evaluation of articles was conducted by considering their title and abstract. The eligibility of selected studies was further evaluated based on the complete text. The inclusion criteria employed in this study were consistent with those used in previous research. In essence, studies were deemed eligible for inclusion if they provided data on the occurrence, treatment, or consequences of emergency peripartum hysterectomy within a timeframe of up to 6 weeks following childbirth, within the context of a hospital, region, or nation. Emergency peripartum hysterectomy refers to the surgical procedure involving the partial or complete removal of the uterus in response to serious obstetric problems. The study designs that were considered eligible included case-control, cohort, and cross-sectional designs.

The study designs that were not considered in this analysis included case reports, case series with a sample size of fewer than 10, comments, and personal correspondence. Additional exclusion criteria encompassed research that were not documented in the English language and those that were published in journals with an impact factor below 1. Additionally, studies were omitted if they failed to provide the precise figures for both the total number of births and the number of emergency peripartum hysterectomies. Whenever feasible, the inclusion of hysterectomies performed for malignancies or nonobstetric reasons was avoided when determining the incidence, indications, and outcomes. The exclusion criteria did not encompass elective or scheduled hysterectomies, as these procedures were primarily conducted in cases involving placenta accreta spectrum disease.

Data Extraction and Outcomes

The present study involved the extraction and integration of data pertaining to the incidence, indications, complications, maternal features, and preventive strategies. These data were then merged with the findings from the previous systematic review.[1] In the event that multiple studies were conducted on the same research population, only the most current study was used.

The primary outcome was the cumulative incidence that was pooled across all studies. The incidence was computed for each income setting, as well as for each individual country. The secondary outcomes encompassed indications, risk factors, results, and management aspects associated with emergency peripartum hysterectomy. The indications for emergency peripartum hysterectomy were categorised into various subgroups, including placental pathology (such as placenta accreta spectrum, placenta previa, combined placental pathology, or placental abruption), uterine atony, uterine rupture, unspecified haemorrhage, infection, cervical tear or laceration, leiomyomas with major obstetric haemorrhage, disseminated intravascular coagulation, hematoma, abnormal location of pregnancy, other, and unknown. The observed outcomes encompassed several factors, such as the administration of transfusions of any kind, admission to the critical care unit, occurrence of complications, and instances of maternal morbidity and mortality. The stated characteristics of

emergency peripartum hysterectomy encompassed the kind of hysterectomy (total or subtotal), the preventive measures employed before to the procedure (medical or surgical), the duration of the surgery, the amount of blood loss, and any supplementary procedures conducted. The study stratified indications, outcomes, and management characteristics according on income setting, and afterwards provided a description of the highest and lowest proportions seen. The maternal variables that were considered in this study included antenatal care registration, age, and parity.

Results

A total of 154 research were incorporated, as depicted in Figure 1. Among them, 128 papers had been previously included in the meta-analysis.[1] This update incorporates an extra 26 studies and provides data for an additional 7,741 women across 22 different countries.[6–31] A total of 154 research were incorporated, as depicted in Figure 1. Among these, 128 papers were previously included in the meta-analysis.[1] The new update encompasses an augmentation of 26 supplementary studies, so incorporating data from an additional 7,741 women residing in 22 nationalities, namely Belgium, France, Germany, Romania, Slovakia, Sweden, Iceland, and Papua New Guinea, for which data was previously unavailable. The collective body of research encompassed a cohort of 15,599 female individuals who underwent emergency peripartum hysterectomy. Among these participants, 193 (1.2%) hailed from low-income contexts, 2,403 (15.4%) from lower middle–income contexts, 1,975 (12.7%) from upper middle–income contexts, and 11,028 (70.7%) from high-income contexts.

A total of seventeen research included in the analysis were conducted at the population level. Out of the total sample size, the remaining 137 research were conducted within hospital settings, with six of them being multicenter studies. Two studies conducted on a population-based level have presented data from multiple countries.[8,9] The data pertaining to these countries was partitioned and examined individually.

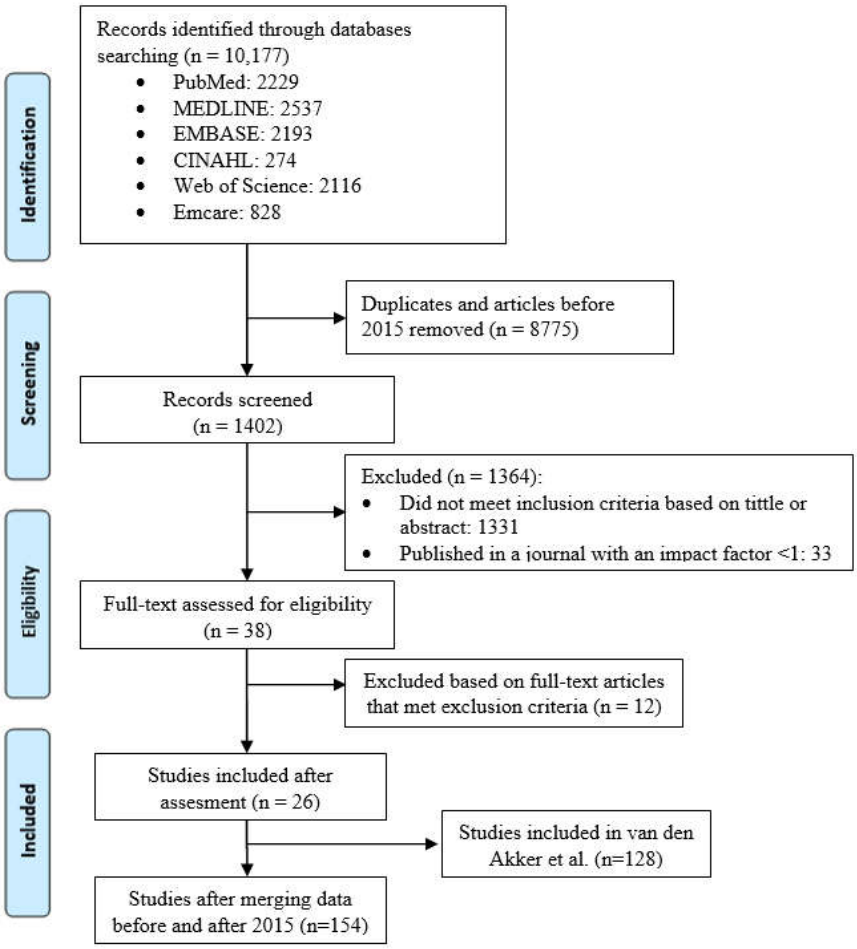

Figure 1. The search strategy based on PRISMA flow diagram

A total of 89 papers have provided descriptions of case definitions for emergency peripartum hysterectomy. The definitions shown significant variation throughout the various research. Thirteen studies were conducted to examine the inclusion of women who underwent hysterectomy within six weeks after giving birth. These studies encompassed women who had undergone the procedure within 24 hours postpartum, as well as women within another time range but still within the six-week postpartum period. The inclusion criteria for the 31 studies encompassed solely emergency peripartum hysterectomies occuring after the 24th week of gestation. An additional 20 studies implemented exclusion criteria for women that extended beyond the gestational age of 24 weeks. A total of nine papers were included in the

analysis, which examined peripartum hysterectomies without considering the gestational age. The remaining 91 studies did not provide explicit criteria for excluding participants based on gestational age. No case-control studies have been conducted since 2015. The data pertaining to indications, complications, and preventive strategies for hysterectomy were derived from a comprehensive analysis of medical records across 130 studies.

A total of 147 studies were examined to determine the occurrence of emergency peripartum hysterectomy. However, seven studies were excluded because to their focus on caesarean or postpartum hysterectomies, or their failure to disclose any incidence data. In total, a cohort of 14,409 emergency peripartum hysterectomies were conducted among a population of 17,127,499 births across 42 diverse nations. The weighted incidence rate for the entire population was calculated to be 1.1 instances per 1,000 births, with a 95% confidence interval ranging from 1.0 to 1.3.

There was significant variation in the reported incidence rates seen across different income settings, as shown in Table 1. The study found that the occurrence of the highest incidence was recorded in lower middle-income settings, with a rate of 3.0 (95% CI 2.5-3.5). Conversely, the lowest incidence was observed in high-income settings, with a rate of 0.7 (95% CI 0.5-0.8). The incidence of the aforementioned condition exhibited a range of values, with Denmark, Ireland, Norway, and Turkey reporting a rate of 0.2 per 1,000 births, while India had a notably higher rate of 10.1 per 1,000 births.

Table 1. Incidence of hysterectomy based on income settings

Income Setting	No. of Studies	No. of Emergency Peripartum Hysterectomies	No. of Women	Incidence (95% CI)
Low	2	193	93,355	1.5 (0.6–4.0)
Lower middle	43	2.257	849,772	3.0 (2.5–3.5)
Upper middle	34	1.924	2,573,707	0.9 (0.7–1.1)
High	75	10,035	13,610,665	0.7 (0.5–0.8)
Total	154	14,409	17,127,499	1.1 (1.0–1.3)

* Weighted incidence per 1,000 births using random-effects model.

Table 2. Indications for Emergency Peripartum Hysterectomy

Indication	No. of Studies	No. of Women (n/N)	Proportion (95% CI)*
Placental pathology	157	3,791/9,213	38.0 (33.9–42.4)
Placenta accreta spectrum	130	2,293/8,115	23.9 (20.5–27.7)
Placenta previa	71	809/4,822	13.9 (11.8–17.1)
Combined or unspecified placental pathology	32	416/1,606	26.1 (20.5–32.5)
Placental abruption	42	147/2,913	5.2 (4.0–6.9)
Uterine atony	143	2,638/8,157	27.0 (24.6–29.5)
Uterine rupture†	140	2,019/8,421	21.2 (17.8–25.0)
Unspecified hemorrhage	48	397/2,549	13.3 (9.8–17.9)
Infection‡	41	170/3,083	4.4 (3.9–6.0)
Cervical tear or laceration	25	99/2,250	4.0 (2.7–5.9)
DIC	15	104/1,551	4.0 (1.8–8.8)
Hematoma§	18	41/1,117	4.3 (3.2–5.8)
Abnormal location of pregnancyk	8	14/465	3.0 (1.8–5.0)
Leiomyomas with major obstetric hemorrhage	30	65/2,970	2.3 (1.6–3.1)
Other¶	22	55/1,590	3.8 (2.7–5.4)
Unknown	14	149/2,313	3.7 (2.0–6.8)

DIC, disseminated intravascular coagulation.
* Proportions calculated using random-effects model and exceed 100% because more than one indication was possible.
† Includes both uterine rupture and extension of uterine incision.
‡ Includes endometritis, pelviperitonitis, chorioamnionitis, gangrenous uterus, puerperal sepsis, pelvic abscess, and hemorrhage due tothese infections.
§ Includes broad ligament, retroperitoneal, and unspecified hematoma.
k Includes abdominal, cervical, molar, and ruptured cornual pregnancy.
¶ Includes avulsion of uterine artery, uterine inversion, septic abortion, medical termination of pregnancy perforation, malignancy withhemorrhage, sterilization, arteriovenous malformation, uterine anomaly, and retained tissue.

The range of maternal age observed in the study varied from 1196 to 5422.47 years, with a mean age of 32.1 years (95% CI 31.9-32.8). The average gestational age was determined to be 36 5/7 weeks, with a 95% confidence interval ranging from 35 3/7 to 37 1/7 weeks. Parity was seen in a total of 105 investigations, encompassing a sample size of 7,555 women. Among these women, 6,324 individuals, accounting for 83.7% of the sample, were classified as multiparous.

Table 3. Indications of hysterectomy based on income setting

Income setting	Placental pathology		Uterine atony		Uterine rupture	
	Proportion (95% CI)	No. of studies	Proportion (95% CI)	No. of studies	Proportion (95% CI)	No. of studies
Low	25 (—)	1	36 (—)	1	25 (—)	1
Lower middle	20.7 (15.8–26.8)	44	20.9 (17.6–24.7)	38	44.5 (36.6–52.7)	44
Upper middle	41.8 (33.3–50.9)	35	31.0 (25.0–37.6)	33	13.8 (9.8–19.2)	34
High	48.4 (43.4–53.4)	77	28.9 (25.7–32.3)	71	9.3 (7.0–12.1)	77

* Proportion of indications per 100 emergency peripartum hysterectomies, calculated using random-effects model.

The indications for emergency peripartum hysterectomy were documented in a total of 157 investigations, encompassing a cohort of 9,258 women (as shown in Table 2). The predominant indications observed in this study were placental pathology (38.0%, 95% confidence interval [CI] 33.9–42.4), uterine atony (27.0%, 95% CI 24.6–29.5), and uterine rupture (21.2%, 95% CI 17.8–25.0). The prevalence of these symptoms exhibited significant variation across different income contexts. In lower middle-income settings, uterine rupture was shown to be the most prevalent indication, accounting for 44.5% (95% CI 36.5–52.7) of cases. Conversely, in high-income nations, placental pathology was identified as the most common indication, representing 48.4% (95% CI 43.5–53.4) of cases (Table 3).

Table 4. Mechanical Measures to Prevent Emergency Peripartum Hysterectomy

Measure	No. of Studies	No. of Patients (n/N)	Proportion (95% CI)*
Fundal massage	6	210/319	83.8 (33.7–98.1)
Compression†	36	1,274/2,700	62.6 (38.3–81.9)
Bimanual compression	7	235/686	98.9 (6.6–100)
Vaginal or uterine packing	21	266/1,195	20.5 (14.3–28.5)
Uterine balloon tamponade	20	382/1,870	16.3 (11.9–22.0)
Uterine compression sutures‡	26	383/2,367	14.3 (9.3–21.4)
Artery ligation§	38	603/2,407	22.4 (16.4–29.8)
Oversewing of placental bed‖	17	190/985	19.1 (13.4–26.5)
Manual removal of placenta¶	8	68/493	10.8 (6.1–18.4)
Uterine artery embolization	14	136/1,569	7.9 (5.5–11.2)
Curettage	10	116/583	2.2 (8.0–48.1)
Other#	9	143/787	15.9 (10.7–23.0)

Weighted proportions per 100 emergency peripartum hysterectomies using random-effects model.
† Including eight cases in which compression was unspecified.
‡ Includes B-Lynch procedure and other or unspecified procedures.
§ Includes ligation of the uterine, ovarian, internal iliac, and hypogastric arteries.
‖ Includes suturing of bleeding points and cervical lacerations.
¶ Includes examination under anesthesia.
# Includes placenta left in utero, intra-abdominal packing, internal iliac artery balloon placement, hot saline packs, lower segment belt, securing of uterine angles, and unspecified measures.

Table 5. Procedures in addition to hysterectomy

Procedure	No. of Studies	No. of Patients (n/N)	Proportion (95% CI)*
Salpingo-oophorectomy	33	234/2,244	10.1 (8.2–12.5)
Relaparotomy	63	434/4,014	9.0 (6.9–11.6)
Bladder or ureteral repair	23	115/1,156	8.6 (6.1–12.0)
Artery ligation or embolization	7	35/406	8.2 (3.9–16.5)
Other†	5	20/308	6.8 (2.8–15.4)

* Weighted proportions per 100 emergency peripartum hysterectomies using random-effects model.
† Includes abdominal packing, bowel repair, appendectomy, uterine curettage, and unspecified procedures.

Table 6. Complications After Emergency Peripartum Hysterectomy

Complication	No. of Studies	No. of Patients (n/N)	Proportion (95% CI)[1]
Febrile morbidity	81	1,175/4,252	29.7 (25.4–34.3)
Hematologic[2]	115	1,787/4,058	27.5 (20.4–35.9)
Infection[3]	77	647/4,372	12.7 (10.0–15.9)
Wound[4]	88	643/4,643	11.8 (9.8–14.3)
Genitourinary[5]	109	713/6,531	9.9 (8.5–11.5)
Pulmonary[6]	38	179/2,229	6.1 (4.1–8.9)
Psychological disturbance	16	60/990	5.9 (3.7–9.3)
Gastrointestinal[7]	55	170/2,827	5.5 (4.2–7.2)
Renal[8]	45	181/3,428	4.2 (3.0–6.4)
Cardiovascular[9]	31	69/2,504	3.2 (2.4–4.4)
Thromboembolic[10]	35	67/2,137	3.2 (2.5–4.3)
Neurologic[11]	6	8/295	3.0 (1.5–5.9)

Endocrinologic[12]	5	8/243	3.3 (1.7–6.4)
Other[13]	19	93/1,728	4.6 (2.6–7.9)

[1] Weighted proportions per 100 emergency peripartum hysterectomies using random-effects model.
[2] Includes bleeding, anemia, hypovolemic shock, hematomas, and coagulopathy.
[3] Includes septicemia; pelvic, subphrenic, or vaginal cuff abscess; thrombophlebitis; respiratory infection; urinary infection; urinary tractinfection; and peritonitis.
[4] Includes dehiscence, hematoma, infection or sepsis, and incisional hernia.
[5] Includes bladder or ureteric injury, fistula, incontinence, and urine retention.
[6] Includes atelectasis, pneumothorax, pulmonary edema, pleural effusion, acute respiratory distress syndrome, and ventilation requirement.
[7] Includes paralytic ileus, jaundice, liver dysfunction, ascites, bowel injury, and intestinal obstruction.
[8] Includes acute renal failure, hydronephrosis, and oliguria.
[9] Includes cardiac arrest, myocardial infarction, heart failure, and cardiomyopathy.
[10] Includes deep vein thrombosis, pulmonary embolism, air embolism, and amniotic fluid embolism.
[11] Includes stroke, seizure, and coma.
[12] Includes Sheehan's syndrome and premature ovarian failure.
[13] Includes prolonged pain, reactive splenomegaly, multiorgan failure, compartment syndrome, bed sores, anaphylactic shock, and corticalblindness.

Discussion

Previously identified differences in incidence, indications, management, and outcomes of emergency peripartum hysterectomy persist between countries of varying income levels. A substantial proportion of the 26 newly included studies were population-based, contributing to the validity of this review. Overall, the incidence of emergent peripartum hysterectomy was 1.1 per 1,000 births, with the greatest incidence observed in settings with lower middle-income levels (2.0/1,000 births). In low-income settings, the most prevalent indication was uterine perforation; in high-income settings, it was placental pathology. The majority of women undergoing emergency peripartum hysterectomy have previously given birth via caesarean section.

There was a substantial disparity in the incidence of emergency peripartum hysterectomy across income brackets. Variations in maternal age and health status, caesarean delivery rates, clinical management of major obstetric haemorrhage, study setting, and the definition and availability of alternative surgical and radiologic interventions may account for international differences in the incidence of emergency peripartum hysterectomy.[1,32,33] There are indications that the incidence differs between countries with high incomes. This may be attributable to significant geographic distances within countries; countries with widely dispersed populations (e.g., Canada and Australia) appear to have a higher incidence of emergency peripartum hysterectomy. Women presenting in shock in the event of a haemorrhage necessitating prompt intervention, or transport to a referral hospital where uterus-sparing interventions are logistically impracticable, may cause a delay in accessing health care facilities.

The incidence of emergency peripartum hysterectomy in low-income countries should be interpreted with caution due to the fact that it was based on only two hospital-based studies from Tanzania (which was low-income during the study period) and Nepal. In low-income countries, access to health care facilities is challenging for women, conservative management options are scarce, and birth attendants are in short supply. In addition, research output is limited compared to countries with higher incomes and may be published in journals with lower impact, making it more difficult to identify. This reduces the representativeness of our findings for these nations.

Placental pathology was the most prevalent cause of emergency peripartum hysterectomy worldwide. This is presumably due to the rising incidence of caesarean delivery.[34] Indicators varied based on income levels. In lower middle-income settings, uterine rupture was the most prevalent indication, while placental pathology was the most common finding in high-income settings. This disparity may be attributable to higher rates of obstructed labour, a lack of monitoring the progress of labour, and diminished accessibility and availability of maternity care in low-income settings.[35]

The rates of maternal morbidity and mortality following surgery were high. One-fourth of the women experienced infectious or bleed-related complications. This is likely owing to the high volume of blood loss associated with emergency peripartum hysterectomy (3.9 L on average).[36] The greatest blood transfusion rates were found in lower middle-income countries. However, the greatest quantities of red blood cells were transfused in high-income regions. This inverse relationship may be explained by the limited availability of alternative preventive measures and blood transfusions in low-income settings.[37] The ability to transfuse a woman will undoubtedly influence the decision to conduct an emergency peripartum hysterectomy, which may be performed earlier in the course of a woman's haemorrhage in certain settings. The same may occur when there are few alternative conservative management options available. Access to safe blood transfusions is likely an efficient and cost-effective intervention for reducing maternal mortality caused by emergency peripartum hysterectomy in low-income settings.

There was also a remarkable difference in perinatal mortality between income settings; rates were disproportionally higher in low-income settings than in high-income settings. In lower middle-income settings, the risk of perinatal mortality was up to nine times higher than in high-income settings. These significant disparities can be attributed to limited resources, delays in accessing maternity care, inadequate management, and a lack of competent birth attendants.[35,38,39]

This study has a number of limitations. In the first place, low-income women were underrepresented in this meta-analysis. Second, the population-based studies included in this meta-analysis are limited. However, population-based studies have their own limitations, such as unknown data quality, non-researcher data acquisition, and possibly missing confounding information. In the absence of individual data, multivariable analysis was not possible, and multiple or sequential measures could not be described, as is commonly the case in practise. Fourth, 35.7% of the studies were rated as having a high risk of bias. To compute a more precise estimate of mean values, we did not exclude studies based on quality assessment. In addition, by excluding such a large number of studies, we determined that incidence estimates would become problematic.

Conclusion

Incidence, morbidity, and mortality associated with emergency peripartum hysterectomy vary considerably across the globe. Only by increasing the accessibility, availability, and quality of care for the vulnerable population of expectant women worldwide can this inequality be reduced.

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