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Consequences of maternal morbidity on health-related functioning: a systematic scoping review

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ABSTRACT

Objectives: To assess the scope of the published literature on the consequences of maternal morbidity on health-related functioning at the global level, identify key substantive findings and research and methodological gaps.

Methods: We searched for articles published between 2005 and 2014 using Medline, Embase, Popline, CINAHAL Plus, LILACS, African Index Medicus and the West Pacific Region Index Medicus in January 2015.

Design: Systematic review

Primary outcome: Health-related functioning

Results: After screening 17,706 potentially relevant studies, 136 articles were identified for inclusion. While a substantial number of papers have documented mostly negative effects of morbidity on functioning and well-being, the body of evidence is not spread evenly across conditions, domains or geographical regions. Most studies focus on indirect conditions such as depression, diabetes and incontinence. Health functioning is often assessed by instruments designed for the general population including SF-36, or disease-specific tools. The functioning domains most frequently documented are physical and mental; studies that examined physical, mental, social, economic, and specifically focused on marital, maternal and sexual functioning, are rare. Few studies were conducted in low-income countries.

Conclusions: Many assessments have not been comprehensive and have paid little attention to functioning domains of importance for pregnant and postpartum women. The development of a comprehensive instrument specific to maternal health would greatly facilitate the appreciation of burden of ill health associated with maternal morbidity and help with setting priorities. The lack of attention to consequences on functioning associated with the main direct obstetric complications is of particular concern.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

- Comprehensive review which includes a full range of maternal morbidities during pregnancy and after childbirth, and assesses the impact on physical, mental, economic and social functioning.
- A quantitative meta-analysis could not be conducted given the range of conditions, tools and timing of measurement of functioning.

KEYWORDS

Maternal health, Maternal morbidity, Functioning, Health status, Quality of life, International Classification of Functioning, Disability and Health, Systematic review, Questionnaires

INTRODUCTION

Maternal morbidity is very common, but poorly studied. At present, there are an estimated 27 million episodes of direct complications occur annually.[1] The burden of maternal morbidity is much larger than this estimate when indirect complications and sequelae are added to the calculation, some of which can be particularly frequent.[1,2] For example, anaemia affects 32 million (a range of 28 to 36 million) pregnant women per year according to a recent model.[3] However, these estimates on the epidemiology of maternal morbidity are based upon varying criteria; which has prompted the establishment of the World Health Organization (WHO) Maternal Morbidity Working Group (MMWG) to develop a standard definition and measurement criteria.

By defining maternal morbidity as "any health condition attributed to and/or complicating pregnancy and childbirth that has a negative impact on the woman's wellbeing and/or functioning",[4] the WHO Maternal Morbidity Working Group (MMWG) emphasizes the need for comprehensiveness in the evaluation of the maternal morbidity burden. Indeed, while there is increased focus on describing the levels and patterns of maternal morbidity,[1,5,6] the extent to which this morbidity collectively impacts upon women's health-related functioning is poorly understood.[7,8] Studies in the USA and Canada have demonstrated that pregnancy itself limits aspects of women's functioning,[9,10] and therefore the additional effects of maternal morbidity on women's functioning are important to comprehend, particularly with respect to differentials in patterns, duration, size and risk factors.

Pronounced declines in physical functioning from first to second trimesters, and from second to third trimester have been observed among women with uncomplicated pregnancies.[9,11-13] While acute complications soon disappear after childbirth for most women, others may develop sequelae and experience certain health conditions, such as fatigue, sleep-related problems, pain and concerns about sexual activities, depression, anxiety, haemorrhoids and constipation. These often last well

over six weeks of the puerperium[14,15] and have even been documented to peak around six months after delivery before declining.[16]

The effects of pregnancy and maternal morbidity are not just physical or psychological but also social and economic. In Sri Lanka, 90% of pregnant women reported at least one episode of perceived ill health during pregnancy and 26% of them reported that they required another person to replace them in their routine activities because they were unwell.[17] One hypothesis is that the more severe the maternal morbidity experienced the more likely the negative consequences. A handful of recent cohort studies have shown that women diagnosed with severe obstetric complications (including 'near-miss') had a higher risk of health, social and economic adversities persisting well beyond pregnancy and the six-week postpartum period compared to women with uncomplicated childbirth.[18-26]

The most comprehensive source of summarised evidence to date on the consequences of maternal morbidity is a systematic review on health- related quality of life (HRQOL) after childbirth.[27] This review of 66 articles concentrated on the physical, social and psychological domains, and while it was not focusing specifically on the effects of maternal morbidity, the authors found that urinary incontinence and HIV were negatively correlated with quality of life, and that depression had an impact on health status scores such as those measured by Short Form 36 (SF-36).[27] More recently, Andreucci et al. reviewed the effects of maternal morbidity on sexual dysfunction. Despite the substantial methodological heterogeneity between studies they found an association between perineal injuries with increased dyspareunia and delayed resumption of sex after childbirth,[28] while a recent cohort study shows sexual function at 3 months after delivery of women who had severe maternal morbidity was similar to the level of the control group.[29] The effects of other

maternal morbidities on health-related functioning and quality of life have been rarely investigated in systematic reviews.[27]

Why does functioning and wellbeing matter?

As well as informing on the meaning and repercussions of morbidity for women, health-related functioning and health-related quality of life are important patient-reported health outcomes which have been used in other sectors of public health to measure the effectiveness of intervention or to allocate resources. However, most of the existing studies of maternal health focuses on mortality and morbidity, and there is limited research which aims to assess women's quality of life as a primary outcome of studies.[30] The guidelines on postnatal care up to 8 weeks after births developed by the UK's National Institute for Health and Care Excellence (NICE) recommends health professionals to check women's physical, emotional and social wellbeing.[31] More complete data on maternal morbidities and consequences would make contribution in setting priorities to reduce the burden of maternal ill-health.

In practice, the difference between health-related functioning and HRQOL can be complicated, as there is overlap. Functioning and disability (the negative correlate of functioning) are conceptualised by the International Classification of Functioning, Disability and Health (ICF). The ICF classified functioning and disability into three levels: at the level of body or body part, the whole person, the whole person in a social context. Disability is defined as "the outcome of the interaction between a person with an impairment and the environmental and attitudinal barriers he or she may face".[32] The concept of disability is not restricted to impairment of body function and structures. It encompasses loss or limited capacity to execute a task or action by individual (e.g. eating, standing, walking), and to be involved in a life situation in an environment (e.g. employment). The ICF is also the international classification and metrics for organising and reporting health and disability data which would enables us to use common metrics over time and space.

Quality of life (QOL) and the more specific notion of HRQOL are also widely used to understand how diseases or the absence of disease influence the lives of individuals. It relates to the broader concept of wellbeing and perception on life satisfaction which is shaped by many factors including health than the concept of health-related functioning.[33] Although there are many definitions, QOL has been defined by WHO as the "individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns".[33] As explicitly stated in the WHO's definition, QOL gives weight to individual's perception on ability to lead a fulfilling life.[34] The concept of HRQOL encompasses aspects of QOL which can clearly affect health or be affected by health conditions, and is defined as "optimum levels of mental, physical role and social functioning, including relationships and perceptions of health, fitness, life satisfaction and wellbeing".[35]

Measurement of the concepts of health-related functioning and quality of life is complex. While these concepts are concerned with individual's perceptions of personal health, wellbeing and satisfaction with health status and life, pre-determined quantitative scales are often applied. There are a number of standardised generic instruments used to measure functioning and quality of life. For instance, the SF-36 is one of the most commonly used tools for assessing functioning and well-being, and often employed to assess the performance of new instruments. The SF-36 has been validated among women in early pregnancy.[36] However, women during late pregnancy or postpartum were not taken into account during the process of the instrument development, and indeed, few generic tools assessed their reliability, validity or responsiveness for these specific populations.[37] Tools developed specifically for use in relation to maternal health include the Inventory of Functional Status After Childbirth (IFSAC), which focuses on social functioning,[38] the Mother Generated Index, which is self-created by each individual woman to assess the effect of having a new baby on her quality of life,[39] and the Maternal Postpartum Quality of Life tool

(MAPP-QOL) on women's satisfaction with various areas of their life during early postpartum.[40] All of these tools are concerned with events in the postpartum period in relation to the mostly normal experience of childbirth and have been applied infrequently.

As members of the MMWG, we conducted a scoping systematic review of the published literature on the consequence of maternal morbidity on health-related functioning to assess the scope of the literature at the global level, identify key substantive findings and research and methodological gaps.[41] In this paper, we critically appraise the available literature with particular interests in an emphasis on the type of conditions studied, the tools used, the range of domains considered, the timing of assessment, the study design and geographical coverage. We then assess qualitatively the range of domains studied and the effects of morbidity. Finally, we focus on two conditions, hyperemesis gravidarum and incontinence during pregnancy to illustrate characteristics of included studies and the impacts on health-related functioning.

METHODS

Data sources and search strategy

We adapted a WHO generic protocol used in all the systematic reviews conducted by members of the MMWG.[8,42] The protocol is registered in PROSPERO (CRD42015017774. http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015017774). We searched relevant articles published between 1st January 2005 and 31st December 2014 using a structured search strategy in four bibliographic electronic databases (Medline, Embase, Popline, CINAHAL Plus) and three WHO regional databases (Latin American and Caribbean Center on Health Sciences Information (LILACS), African Index Medicus (AIM) and the West Pacific Region Index Medicus (WPRIM)) in January 2015.

A full search strategy for each database was developed using thesaurus (including MeSH) and free-text terms for maternal morbidity and health-related functioning. We added terms relating individual maternal health conditions in the search terms based on the maternal morbidity matrix constructed by Chou et al.[4] The outcome for this review, health-related functioning, encompasses multiple dimensions, such as cognitive, physical, mental, social and economic functions, and the terms relating to each of these concepts were included in the search strategy. While the primary focus of the systematic review is the negative impact of morbidity on health-related functioning, health-related quality of life findings (and other concepts capturing the consequences of morbidity) were added to make sure that we capture all of the relevant literature. This is also because the WHO maternal morbidity definition includes both the terms 'wellbeing' and 'functioning'. The search strategy is available in supplementary appendix 1.

Inclusion and exclusion criteria

All studies were eligible for inclusion if they met the following criteria: 1) the study population included at least 30 women who experienced maternal morbidity during pregnancy, childbirth or one year after delivery or spontaneous abortion; and 2) results included relevant quantitative data on health-related functioning by maternal morbidity status. We excluded intervention studies if respondents were all treated and the primary objective of the study was comparisons of treatment. Studies with no primary data were excluded. All other study types were eligible. There were no language restrictions.

Induced abortion, stillbirth and preterm birth were excluded from this review when they were the only exposure in a study. While these outcomes may be associated with maternal complications, they are not maternal morbidities. Intimate partner violence, substance use, smoking, alcohol, female genital mutilation and multiple pregnancies were also not considered maternal morbidities for the purposes of this review, though these factors increase the risk of maternal morbidities. A

number of studies assessed depression or depressive symptoms as consequences of maternal morbidities using screening tools such as the Edinburgh Postnatal Depression Scale (EPDS) or the 9-item Patient Health Questionnaire (PHQ-9). Although individual questionnaire items in some of these tools imply women with the condition have low level of functioning, we excluded studies that did not explicitly report on mental functioning as an outcome as it was not possible to separate characteristics and severity of depressive symptoms, and level of functioning. Studies which assessed any of the following: practice of breastfeeding, self-efficacy, locus of control, confidence, competence, self-esteem, life satisfaction and social support, as an outcome but did not assess this in the context of women's health-related functioning were not included. Although maternal-infant interaction was sometimes chosen as an outcome in studies on depression, this review excluded studies if they did not explicitly examine woman's ability to care for her child as functioning.

Selection and data extraction

Four authors (KM, AH, JC, VF) with help from a research assistant (LP) screened title and abstracts. At the beginning of the screening, a pilot test of 100 papers by three reviewers (KM, AH, JC) was conducted to help achieve inter-rater reliability. Evaluation of full text reports was done by four authors (KM, AH, JC, VF), with reasons for exclusion recorded for excluded papers. Data extraction from the full-text report was conducted by a single author for each retained paper (KM, AH, JC, VF, MB, DC); information was extracted on: location of study, study dates, study design, study population, sampling, case definition of maternal morbidity, methods of measurement of health-related functioning and the timing of the assessment, and measures of functioning by morbidity status. When a study assessed multiple maternal morbidities or examined health-related function several times, data of functioning for each health condition and at each time point of observation were extracted. Throughout the reviewing and extraction processes, articles where uncertainty existed were discussed with another reviewer and consensuses reached. Finally, two authors (KM, VF) qualitatively assessed each paper to determine the impact of the morbidity on five domains:

physical, mental, economic, social and other (see supplementary appendix 2). Self-reported general health status, maternal, sexual or marital functioning were categorised as 'other' domain. The economic domain was interpreted broadly and included ability to conduct both paid and unpaid work. We relied on authors' interpretations of their study findings when the studies did not have a control or comparison group, or did not provide a statistical test comparing women's functioning between morbid and non-morbid groups. Appraisal of the quality of studies was conducted based on definition of maternal morbidity and health functioning, inclusion of relevant controls, sampling methods and completeness of data. Despite a high proportion of poor quality of studies for the purpose of the study, we included all publications relevant to our study aim in this scoping review.

RESULTS

Our initial search identified 17,706 potentially relevant studies. After screening of titles and abstracts, 382 papers were retained. Of those, we excluded a total of 246 articles after full-text review and data extraction. Finally, 136 papers were identified for inclusion (Fig. 1).

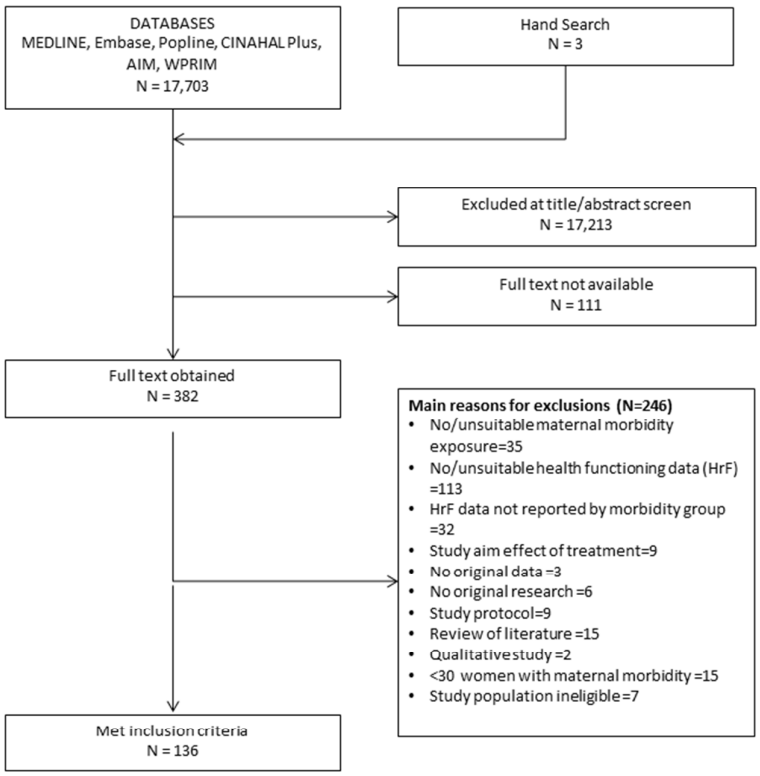

Fig 1. Study selection for inclusion in the systematic review

Using the classification of maternal morbidity constructed by Chou et al.,[4] the vast majority of the included articles, 84 articles out of 136 (62%), addressed the consequences of indirect causes of morbidity on health-related functioning (see Table 1). The studies were concentrated in Europe and North America (56%), and only 12% were located in Africa. Health-related functioning in the immediate or extended postpartum period, especially within one year of delivery, was commonly studied, relative to the antepartum period. Cohort study was a particularly common study design. Almost half of the included papers (46%) did not have a control group.

Table 1: Description of included studies

	Direct morbidity (N=52)	Indirect morbidity (N=84)	Total (N=136)
Region			
Africa	5.8%	15.5%	11.8%
Asia	15.4%	20.2%	18.4%
Europe	48.1%	26.2%	34.6%
Latin America and the Caribbean	3.8%	6.0%	5.1%
North America	13.5%	26.2%	21.3%
Oceania	7.7%	3.6%	5.1%
Multiple	5.8%	2.4%	3.7%
Timing of assessment of functioning			
Antepartum	19.2%	27.4%	24.3%
Antepartum and postpartum	11.5%	7.1%	8.8%
Postpartum (<=1 year)	26.9%	42.9%	36.8%
Postpartum (>1 year)	23.1%	6.0%	12.5%
Postpartum (both <=1 year and > 1 year)	7.7%	11.9%	10.3%
Postpartum (unknown)	1.9%	2.4%	2.2%
Not specified	9.6%	2.4%	5.1%
Study design			
Cohort	63.5%	40.5%	49.3%
Cross-sectional	23.1%	41.7%	34.6%
Trial	7.7%	15.5%	12.5%
Case-control	5.8%	2.4%	3.7%
Comparison (control) group relevant to maternal morbidity & functioning			
Yes	61.5%	48.8%	53.7%
No	38.5%	51.2%	46.3%
Total	**100%**	**100%**	**100%**

Table 2 presents distributions of 140 maternal health conditions which were studied as exposures in the 136 included articles. The three most frequent maternal morbidity diagnoses studied were mental disorders, incontinence and perineal laceration. Thirty-three percent focused on mental disorders, particularly depression (45 studies). Among 140 maternal conditions, 12% studied incontinence (17 studies) and 9% examined perineal laceration (13 studies). Hyperemesis gravidarum, and nausea and vomiting of pregnancy were studied in 9 studies (See Box 1). The consequences on health-related functioning of potentially more severe direct obstetric conditions, such as obstetric haemorrhage or severe pre-eclampsia and eclampsia, were not frequently studied.

There is limited data on the consequences of puerperal sepsis on health functioning except in a small number of near-miss studies.

Health-related functioning and well-being were measured by applying a number of existing tools (Table 3). The SF-36 was the most common tool applied and used in 32 studies. It was particularly common in studies of gestational diabetes and mental disorders. The Short Form 12 (SF-12), the World Health Organization Quality of Life tool (WHOQOL-BREF), and WHO Disability Assessment Scale (WHODAS) 2.0 were used in fewer than 10 studies each. Over 30 studies used disease-specific tools. Seventeen studies on incontinence were documented, and ICIQ-UI-SF, the Incontinence Impact Questionnaire (IIQ-7), the Faecal Incontinence Quality of Life (FIQL) Score, King's Health Questionnaire and Manchester Health Questionnaire were commonly used. While these existing tools were often adopted, many studies applied other tools, especially in studies on mental disorders, including Female Sexual Function Index (6 studies), Global Assessment of Functioning (4 studies), and Pittsburgh Sleep Quality Index (2 studies).

Table 2: Distribution of maternal conditions

DIRECT MATERNAL MORBIDITY		
Delivery/Termination (N=7)		
Gestational Trophoblastic Disease	6	4.3
Obstructed Labour	1	0.7
Hypertensive Disorders (N=7)		
Gestational hypertension	2	1.4
Pre-eclampsia/eclampsia	5	3.6
Obstetric Haemorrhage (N=3)		
Postpartum Haemorrhage	3	2.1
Other obstetric complications (N=23)		
Gastrointestinal (N=9)		
Nausea and Vomiting of Pregnancy	3	2.1
Hyperemesis gravidarum	6	4.3
Endocrine(N=8)		
Diabetes Mellitus (Gestational Diabetes)	8	5.7
Others (N=6)		
Deep Vein Thrombosis	1	0.7
Near-miss[1]	3	2.1
Multiple obstetric conditions	2	1.4
Unanticipated complications (N=14)		
Perineal laceration	13	9.3
Spontaneous abortion	1	0.7
INDIRECT MATERNAL MORBIDITY		
Anaemia	3	2.1
Endocrine, nutritional and metabolic diseases (N=2)		
Type 1 diabetes	1	0.7
Cystic Fibrosis	1	0.7
Infection (N=5)		
HIV infection	5	3.6
Mental disorders (N=45)		
Depression	42	30.0
Obsessive Compulsive Disorder	1	0.7
Multiple	2	1.4
Diseases of the respiratory system complicating pregnancy, childbirth and the puerperium (N=1)		
Bronchial asthma	1	0.7
Diseases of the Genitourinary System (N=24)		
Urinary/Faecal/Anal incontinence	17	12.1
Fistula	7	5.0
Diseases of the Nervous System (N=2)		
Multiple Sclerosis	2	1.4
Diseases of the circulatory system (N=1)		
Heart disease	1	0.7
Diseases of the digestive system (N=3)		
Enteritis and colitis	1	0.7
Gastro-oesophageal reflux disease	1	0.7
Functional intestinal disorders	1	0.7
TOTAL	140	100.0

[1]includes an indirect cause, severe anaemia.

Table 3: Type of tools used in the included studies to measure wellbeing and functioning

	SF-36	SF-12	WHOQOL-BREF	WHODAS 2.0	Disease-specific	Own tool	Others	Total
DIRECT MATERNAL MORBIDITY								
Delivery/Termination	0	1	1	0	1	2	2	7
Hypertensive Disorders	3	1	1	0	1	1	0	7
Obstetric Haemorrhage	2	0	0	0	0	1	0	3
Other obstetric complications	7	0	2	0	4	6	5	24
Unanticipated complications	3	1	0	0	6	2	4	16
INDIRECT MATERNAL MORBIDITY								
Maternal infectious and parasitic diseases	1	0	1	0	0	2	1	5
Mental disorders	11	4	2	2	0	1	27	47
Diseases of the Genitourinary System	1	0	1	0	13	8	3	26
Other indirect courses	4	0	0	0	6	0	3	13
Total	32	7	8	2	31	23	45	148

Note: 12 studies used more than one type of tool.

A list of the included articles and the impact of the morbidity on five domains of functioning: physical, mental, economic, social and other, which we assessed for each article qualitatively, is provided in supplementary appendix 2. Among the 136 papers, 116 studies reported negative consequences of maternal morbidity; only 20 articles found no negative impact. It is not possible to summarise the results statistically across studies by morbidity because of their differences with respect to research questions, study designs, outcome measures, timing of measurement and control group. However, there is no health condition for which studies consistently showed no impact. Physical and mental functioning were frequently assessed, and economic function was rarely studied. Studies of fistulae were often concerned with social, marital and economic domains, and perineal laceration studies often documented sexual functioning. Lastly, environmental factors (facilitators and barriers) of women's functioning were rarely reported in the included papers except

for a handful papers such as those addressed fistulae[43-47] and near-miss.[21] Boxes 1 and 2 illustrate characteristics of studies of hyperemesis gravidarum and incontinence during pregnancy and the impacts on health-related functioning.

Box 1: Hyperemesis gravidarum

Hyperemesis gravidarum (HG), a severe and persistent form of nausea and vomiting in pregnancy, affects up to 1.5% of pregnant women, with an onset at about the 5th week of pregnancy, peaking at 8-12 weeks and usually resolving before the 20th week.[48] Only five studies examined health-related functioning as a consequence of HG during pregnancy. They were all conducted in high-income countries except for one conducted in Turkey. Existing generic tools were used in three of these studies (Perceived Stress Scale (PSS), Brief Disability Questionnaire (BDQ), and Social Functioning Questionnaire (SFQ)); a disease-specific tool, Hyperemesis Impact Symptoms Questionnaire, was used in one study; and one study did not use any existing tool and created own items. Despite the different tools used, there was evidence of a significant impact of morbidity on women's daily lives in four studies and one study reported no impact. In a prospective cohort study of pregnant women with and without HG, McCarthy et al. applied the PSS and a Behavioural Response to Pregnancy Scale comprising of two subscales: limiting / resting behaviour (referring to a tendency to curtail activities of daily living in response to symptoms by resting) and all-or-nothing behaviour.[49] Limiting / resting response and PSS scores were higher in women with HG than women without HG after adjusting for possible confounders, such as age, smoking and ethnicity. As the limiting behaviour score normalised several weeks after vomiting ceased, a causal association between HG and deteriorated functioning was suggested in this study. Ezberci et al. used the 11-item BDQ to assess physical and social disability and showed that the BDQ score was higher in women with HG than women without (11.2 vs 8.5).[50] Power et al. developed and validated the 10-item Hyperemesis Impact of Symptom (HIS) questionnaire to assess how symptoms of HG were impacting women's lives.[51] The authors showed a significantly higher mean HIS score in women

with HG than without HG (16.3 vs 5.6). On the other hand, McCormack et al. (2011) used a short 8-item SFQ to assess social functioning in different situations (such as at home, work or in relationships) and showed no difference in SFQ scores between women with and without HG, both at around the peak of symptoms and after 26th week when vomiting had ceased.[52] It was unclear whether the small sample size (32 with HG and 41 without HG) or difference in gestational weeks among the women (HG: 9.66 weeks (95% CI: 8.69-10.63), non-HG: 12.27 weeks (95% CI: 11.71-12.83)) might have been responsible for the lack of association between HG and impaired social functioning, or whether HG may not have manifested on daily functioning of the women. Poursharif et al. (2008) presented the type of problems women reported to have experienced as a consequence of HG in a spontaneous response to the question "how have your life or future plans changed after experiencing hyperemesis?" These included problems with job or school, marital or family relationship and social isolation.[53] However, while the paper documented the negative psychological and social impact of HG, the study had important limitations. It did not specifically focus on health-related functioning nor did it use a comprehensive conceptual framework, the online recruitment survey relied on self-referral and self-diagnosis of HG, the duration (since HG onset was not explored) and there was no comparison group.

HG is an example of a condition for which there is no dominant condition-specific tool. While three studies used generic tools and one study used only own questions, the condition-specific tool developed by Power et al. appears to capture well how HG-associated morbidity impacts key aspects of women's daily life. However, other domains of health functioning considered in the review (e.g sexual functioning) were not part of the condition-specific tool.

Box 2: Faecal and urinary incontinence during pregnancy

Incontinence is an example of a condition for which there are existing health-related functioning or quality of life tools, developed in the 1990s, and sometimes applied in pregnant and postpartum populations. Faecal or urinary incontinence, i.e. involuntary leakage of stool or urine, is a common antenatal condition from which up to 60% of women suffer during pregnancy.[54,55] Anatomical changes such as enlargement of the uterus putting increased pressure on the bladder are responsible. Five studies examined the association between UI and health-related functioning during pregnancy, one examined the association with faecal incontinence and another assessed both faecal and urinary incontinence. Three were conducted in high-income countries and four in middle-income countries. Three studies used ICIQ-UI-SF, which is comprised of three questions relating to severity of urinary incontinence and one question regarding impact on daily life. However, the studies differ with respect to the research question, study designs, outcome measures and control group.

In a Brazilian study, the mean composite ICIQ score was just above 12, which is considered as severe impact on quality of life.[56] A Nigerian cross sectional study, which used ICIQ-UI-SF, reported that in 17% of women's urinary incontinence interfered with daily life. The mean score of ICIQ-UI-SF among 43 women was 4.05.[57] In a cohort study conducted in Spain, the impact of urinary incontinence was measured using the ICIQ-UI-SF and the percentage of women reporting an impact on daily life was high in each trimester with an upward trend as pregnancies progressed. Similar results were reported in women with double (urinary and anal) incontinence in this study. Another study in Spain, which used IIQ-7 reported no impact on daily life.[58] The 28-item, condition-specific Wagner's Quality of Life Scale was used in a cross-sectional study from Turkey and 71% of women with UI reported that UI had an impact on their quality of life.[59] Erbil et al. developed 23-item questionnaire based on existing literature to explore the aspect of daily life affected by urinary

incontinence in Turkey.[54] The study found that a large proportion of women were affected by UI in some areas of their lives. Particularly affected were: daily activities (75%), feeling of discomfort (73%), liquid avoidance (53%), sexual life (47%), and isolation from environment (36 %). Johannessen et al. studied faecal incontinence during pregnancy and used the 29-item Faecal Incontinence Quality of Life Score (FIQOL) which has 4 sub-scales.[60] One quarter of the women in Norway reported that faecal incontinence in late pregnancy affected their behaviour and increased embarrassment. These studies suggest that women's daily lives were negatively affected by incontinence to a great extent. However, because of the use of condition-specific tools in assessing health-related functioning and hence the lack of a comparison group, functioning of healthy counterparts were not used as benchmark in the majority of these studies.

DISCUSSION

While a substantial number of studies (N=116) have documented mostly negative effects of morbidity on health-related functioning and well-being, the body of evidence is not spread evenly amongst conditions, domains or geographically. Most studies focus on indirect conditions such as depression, diabetes and incontinence. The effects of direct obstetric complications, including haemorrhage and pre-eclampsia have rarely been studied, except for obstetric fistulae linked to obstructed labour, despite their importance in low and middle-income countries. The functioning domains most frequently documented are physical and mental; studies of fistulae were often concerned with social, marital and economic domains; and perineal laceration studies often documented sexual functioning. Studies that documented comprehensively all domains, including physical, mental, social, economic, and specifically focused on marital, maternal and sexual limitations, were rare and used their own tools instead of tools previously validated by others. Furthermore, most of the instruments reviewed have no link with a common data standard such as ICF. This is another reason that the data from the instruments are in data silos, and it is impossible to

compare and aggregate data across the studies. Finally, the number of studies, conducted in low-income countries, where the morbidity DALYS are the highest,[5] is small, with only 17 studies. These mostly concentrated on the effects of fistulae, depression and near-miss complications.

The geographical imbalance in our findings may be due to research in low- and middle-income countries putting greater emphasis on reducing maternal mortality, as maternal mortality has been a central focus of the Millennium Development Goals (MDGs). Greater localised interest in mental health and other chronic conditions which affects women over many years, including into menopause, is another reason for the concentration of the studies in high-income countries. The proportion of studies on depression is also related to its high prevalence among postpartum women (prevalence from 13% to 19%),[5] and specialised interest by psychiatrists and psychologists and concerns over its impact on child development [61]. UI is a very prevalent condition (estimated prevalence of stress urinary incontinence at 41% ranging from 19% to 60%[62]) and widely studied. As shown in the current review, UI has been found to has negative impact on physical and psychological quality of life, but also socio-economical and sexual well-being of women's lives.

A high proportion of papers were found to be of poor quality for the purpose of this review, as many (46%) did not have an appropriate control group. The lack of adequate comparison group (such as women without the morbidity of interest, women with uncomplicated childbirth or at the very least women of reproductive age) is problematic when assessing the effects of maternal morbidity. Several cohort studies attempted to circumvent this problem by using the normative findings for their chosen tools available for the general population. However, this is not fully appropriate as pregnant women and women with small babies are different from the general population and have special circumstances, such as those related to physically carrying a pregnancy and breastfeeding their small babies. They may also experience cultural limitations including their ability to leave home

and perform the 'normal' activities of healthy adults such as paid and unpaid work. Use of normative findings could also lead to an under-estimation of the impact of maternal morbidity, as women who become pregnant are mostly very healthy.[63]

As found in the other systematic review of health related functioning,[27] the majority of papers used SF-36. WHOQOL-BREF is also applied to capture quality of life. SF-36 is widely used, in view of its longevity (it was created in 1992), its availability being translated for use in more than 40 countries and the accumulated evidence on its psychometric properties for different populations. It allows researchers to compare the impact of a range of diagnoses and conditions, not just obstetric and gynaecological conditions. It is also comprehensive, as it documents general health, physical functioning, mental health, bodily pain, vitality, role limitations because of physical and emotional problems, and social functioning. Several maternal morbidity studies that used SF-36 and WHODAS 2.0 showed a correlation with morbidity, indicating that they have discriminant or predictive validity. Similar correlation was observed with condition-specific tools such as those available for incontinence. However, these generic and condition-specific tools do not include maternal functioning, and they do not provide sufficient emphasis on economic, marital and sexual functioning which are important domains for women of reproductive age. Several reviewed studies assessed the consequences of maternal morbidity on the ability to breastfeed and on response to babies' needs, although they did not assess them in the context of women's functioning.[64,65] This is a particularly important aspect of maternal functioning to investigate.

Therefore, we believe that a health-related functioning tool specific to maternal health should be developed for use when the impact of additional maternal morbidity or pregnancy is of interest. The three currently available tools for postpartum populations have limitations as they are either quality of life tools with an emphasis on satisfaction or feeling (MAPP-QOL and Mother Generated Index) or

too narrow in scope (IFSAC). The MAPP-QOL tool includes the majority of relevant domains including physical, psychological, social, marital sexual, economic and maternal functioning, but its focus on satisfaction and areas such as physical appearance and environment makes it unsuitable for measurement of health related functioning. Ideally, a health functioning tool specific to maternal health would be comprehensive (physical, mental, social, economic, marital, sexual and maternal functioning) and should be applicable to conditions that occur during both pregnancy and postpartum periods. A new tool specific to maternal health needs to link existing and new functional status measurement instruments to/from a common data standard and conceptual framework of the ICF to enable us to compare the health-related functioning data across studies.

Inclusion of environmental factors (facilitators and barriers) of women's functioning should also be taken into account in development of a new instrument specific to maternal health. As noted earlier, disability is the outcome of the interaction with a person with a impairment and the environment.[32] Level of functioning varies by environmental factors, such as health services, support and attitudes from family members, communities.[66] Interventions that addresses not only women's impairment and personal factors but also modify the environment in which women with maternal morbidities live could improve women's health-related functioning in their daily lives.

The main strength of our systematic review is its comprehensive search strategy with 17,706 papers screened. However, there are also limitations. While most of the papers found reduced health functioning among unwell pregnant or delivered women, this finding could be due to publication bias. As we only considered the published literature, we were unable to access the extent to which this was the case. In addition, we may have over-emphasised the degree to which existing tools document economic functions as some of the tools does not specifically ask functioning at work, an ask difficulty in work or other regular daily activities to appreciate economic function (e.g. SF-36

"During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems?"). On the other hand, we may have underestimated the number of depression studies documenting maternal dysfunction as we excluded studies of mother-child interactions which did not explicitly address the functionality element. Lastly, while our qualitative approach fitted well the objective of our scoping review, a quantitative meta-analysis of the findings to summarise the effects was not possible for any condition, as studies did not use the same analytical approach, tools, measures and timing of assessment for the different conditions under consideration.

CONCLUSION

While we found ample evidence that maternal morbidity impacts health-related functioning, the available literature does not appear to be sufficiently comprehensive because not all relevant functioning domains are studied and not all complications are studied to the same extent. The development of a scale specifically for maternal health, to be used alongside generic or condition-specific scales, would greatly facilitate the appreciation of burden of ill health associated with maternal morbidity and facilitate priority setting in maternal health, particularly with respect to its global dimension.

In the transition from the MDG to the Sustainable Development Goal (SDG) framework, tremendous attention is rightfully being placed upon the need to understand the entire context of maternal health. As countries reduce maternal mortality and improve overall health systems, denominated as the "obstetric transition", demonstrates an increasing proportion of maternal morbidity events.[67] The UN Secretary General's Strategy for Women's, Children's, and Adolescent Health, and initiatives such as the Ending Preventable Maternal Mortality (EPMM) consultations focus direct attention on

this phenomenon and call for a holistic approach to improve the health and well-being of women, children, and adolescents.[68,69] The objective is to ensure that all "survive, thrive, and transform". With regard to maternal health, it is critical to holistically understand the socioeconomic and environmental determinants that contribute to pregnancy and the spectrum of maternal health functioning. To achieve this, we suggest the use of a frequently applied generic tool such as SF-36 and WHODAS 2.0 when comparability with other studies is needed. We also call for more research on the effects of direct complication on health-related functioning.

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CONTRIBUTORSHIP STATEMENT

Conceived and designed the experiments: VF, DC, LS, KM. Developed protocol: KM, VF, JC, AH. Performed the experiments: KM, AH, JC, VF, MB, DC. Wrote the paper: KM, VF, AH. Commented on and helped revised the manuscript: JC, DC, MB, NK, LS.

DISCLAIMER

The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated.

COMPETEING INTERESTS

None declared.

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DATA SHARING STATEMENT

No additional data available.

SUPPLEMENTARY APPENDICES

Appendix 1: Search strategy for Medline

Appendix 2: A list of included papers

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Supplementary Appendix 1: Search Strategy for Medline

1. (maternal or gestation$ or obstetric or labo$r or pregnan$ or partum or antepartum or intrapartum or postpartum or post partum or antenatal or postnatal or post partal or puerperal or puerperium).mp.
2. ((maternal or gestation$ or obstetric or labo$r or pregnan$ or partum or antepartum or intrapartum or postpartum or post partum or antenatal or postnatal or post partal or puerperal or puerperium) adj2 (health or well$being or morbid* or ill* or disorder$ or disease$ or disabilit* or impairment)).ab,ti.
3. exp obstetric labor complications/
4. exp pregnancy complications/

Insert Search StatementEdit Search Statement Delete Search Statement

5. ((pregnan$ or obstetric labo$r or maternal) and complication$).mp.
6. episiotomy/ or extraction, obstetrical/ or labor, induced/ or vaginal birth after cesarean/ or version, fetal/
7. or/3-6
8. ((ectopic or heterotopic or molar) and pregnancy).mp.
9. spontaneous abortion.mp.
10. or/8-9
11. 1 and (hyperten$ or eclampsia or pre-eclampsia or HELLP).mp.
12. (uter$ and (hemorrhage or haemorrhage or prolapse or inversion or rupture or trauma or damage or laceration or tear or dehiscence)).mp.
13. (placenta previa or placenta praevia).mp.
14. exp Hemorrhage/
15. (haemorrhage or hemorrhage).mp.
16. 1 and (or/12-15)
17. puerperal infection$.mp.
18. 1 and sepsis.mp.
19. exp Mastitis/
20. (amnionitis or chorioamnionitis or membranitis or placentitis or sepsis or endometritis or peritonitis or cervictis or vaginitis or trichomoniasis or Septic pelvic thrombosis or breast engorgement or ((breast or mammary or subareolar) and abscess)).mp.
21. ((breast or uter$ or genit$ or perineal or pelvic) and infection$).mp.
22. 1 and (or/17-21)
23. ((Hyperemesis or hyper-emesis) and gravidarum).mp.
24. 1 and exp "Wounds and Injuries"/
25. 1 and (trauma or damage or laceration or tear or dehiscence or rupture).mp.
26. or/23-25
27. exp Rectovaginal Fistula/ or exp urinary fistula/ or exp vesicovaginal fistula/ or exp vaginal fistula/
28. exp pelvic organ prolapse/
29. ((obstetric or vesico-vaginal or vesicovaginal or vaginal or rectovaginal or urinary) and fistula).mp.
30. exp Urinary Incontinence/
31. incontinence.mp.
32. 1 and (or/27-31)
33. exp depression/ or exp Depressive Disorder/ or exp Stress Disorders, Post-Traumatic/ or exp Mental disorders/ or exp Anxiety/ or exp Anxiety Disorders/ or exp Psychotic Disorders/ or exp mental health/ or exp panic/
34. (((Mental or psycho$) and (ill$ or disorder or health)) or psychosis or anxiety or phobi$ or panic).mp.

35. exp Suicide/
36. 1 and (or/33-35)
37. 1 and (exp bacterial infections/ or exp infection/ or exp virus diseases/ or exp parasitic diseases/)
38. 1 and (exp cardiovascular diseases/ or exp Respiratory Tract Diseases/)
39. 1 and exp skin diseases/
40. 1 and exp Endocrine System Diseases/
41. 1 and exp Digestive System Diseases/
42. 1 and exp Female Urogenital Diseases/
43. 1 and (exp Hematologic Diseases/ or exp Lymphatic Diseases/)
44. 1 and (exp Anemia/ or anemia.mp.)
45. 1 and exp Nervous System Diseases/
46. 1 and exp neoplasms/
47. 1 and exp Musculoskeletal Diseases/
48. 1 and (exp Metabolic Diseases/ or exp Nutrition Disorders/)
49. or/36-48
50. 2 or 7 or 10 or 11 or 16 or 22 or 26 or 32 or 49
51. (wellbeing or well-being).ab,ti.
52. exp Quality of life/
53. (quality of life or life qualit$).ab,ti.
54. exp "Activities of Daily Living"/
55. ((daily adj2 (work or activit$)) or activit$ of daily).ab,ti.
56. ((physical adj2 (health or function$ or ill$ problem$ or symptom$)) or mobility).ab,ti.
57. ((mental or psych$) adj2 (health or function$ or ill$ problem$ or symptom$ or distress)).ab,ti.
58. (depression or anxiety).ab,ti.
59. or/51-58
60. exp epidemiologic studies/
61. cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/ or retrospective studies/ or cohort.ti,ab. or longitudinal.ti,ab. or prospective.ti,ab. or retrospective.ti,ab.
62. Cross-Sectional Studies/ or cross-sectional.ti,ab. or ("prevalence study" or "incidence study" or "prevalence studies" or "incidence studies" or "transversal studies" or "transversal study").ti,ab.
63. Case-Control Studies/ or Control Groups/ or Matched-Pair Analysis/ or ((case* adj5 control*) or (case adj3 comparison*) or control group*).ti,ab.
64. Intervention Studies/ or evaluation studies/ or evaluation studies as topic/ or program evaluation/ or validation studies as topic/ or ((pre- adj5 post-) or (pretest adj5 posttest) or (program* adj6 evaluat*)).ti,ab. or (effectiveness or intervention*).ti,ab.
65. (((comprehensive* or systematic*) adj3 (bibliographic* or review* or literature)) or (meta-analy* or metaanaly* or "research synthesis" or ((information or data) adj3 synthesis) or (data adj2 extract*))).ti,ab.
66. or/60-65
67. 50 and 59 and 66
68. limit 67 to yr="1990-2014"
69. limit 68 to humans
70. limit 69 to female

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
Delivery/Termination													
1	1	Gestational Trophoblastic Disease	Cagayan	2008	Philippines	>1 year since remission	Own	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
2	2	Gestational Trophoblastic Disease	Quan	2010	China	>1 year since remission	Own tool based on SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
3	3	Gestational Trophoblastic Disease	Stafford	2011	Australia	>1 year since remission	FSFI	No	Not clear	Not assessed	Not clear	Not clear	Yes
4	4	Gestational Trophoblastic Disease	Ferreira	2009	Brazil	Antepartum	WHOQOL-BREF	No	No	Yes	Not assessed	No	No
5	5	Gestational Trophoblastic Disease	Cagayan	2010	Philippines	Not specified	SF-12	No	Yes	No	Not clear	Not clear	Not clear
6	6	Gestational Trophoblastic Disease	Ung	2005	Australia	Not specified	Sexual History Form-12 (SHF-12)	No	Not assessed	Not assessed	Not assessed	Not assessed	No
7	7	Obstructed labour	Badiou	2010	France	Postpartum (> 1 year)	FIQL	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
Hypertensive Disorders of Pregnancy													
8	8	Eclampsia	Wiegman	2012	The Netherlands	Postpartum (> 1 year)	the National Eye Institute Visual Function	Yes	Yes	No	No	Yes	Yes
9	9	Pre-eclampsia (Mild and severe)	Hoedjes	2011	The Netherlands	Postpartum (<=1 year) (6 wks)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
9	9	Pre-eclampsia (Mild and severe)	Hoedjes	2011	The Netherlands	Postpartum (<=1 year) (12 wks)	SF-36	No	No	Yes	Yes	Yes	Yes
10	10	Pre-eclampsia (Mild and severe)	Hoedjes	2012	The Netherlands	Postpartum (<=1 year)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear
11	11	Pre-eclampsia (Mile and severe)/Eclamp	Stern	2014	Austria	Postpartum (both <=1 and >6 year)	SF-12	Yes	No	Yes	Not clear	Not clear	Not clear
12	12	Pre-eclampsia (Severe)	Roes	2005	The Netherlands	Postpartum (both <=1 and >1 year)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Yes
13	13	Pregnancy-induced hypertension (PIH)	Kim	2005	USA	Antepartum	SF-36	Yes	Yes	No	Not assessed	Not assessed	No
14	14	Pregnancy-induced hypertension (PIH)	Mautner	2009	Austria	Antepartum	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
13	13	Pregnancy-induced hypertension (PIH)	Kim	2005	USA	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Not assessed	Not assessed	Yes
14	14	Pregnancy-induced hypertension (PIH)	Mautner	2009	Austria	Postpartum (<=1 year)	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
Obstetric haemorrhage													
15	15	Postpartum haemorrhage	Thompson Jane	2011	Australia&New Zealand	Postpartum (<=1 year) (2 mos)	SF-36	No	No	No	No	No	No
15	15	Postpartum haemorrhage	Thompson Jane	2011	Australia&New Zealand	Postpartum (<=1 year) (4 mos)	SF-36	No	No	No	No	No	No
16	16	Postpartum haemorrhage	Sentilhes	2011	France	Postpartum (> 1 year)	Own tool	No	Not assessed	Yes	Not assessed	Not assessed	Not clear
17	17	Postpartum haemorrhage	Prick	2014	Netherland	Postpartum (<=1 year)	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
Other obstetric complicatons													
18	18	Multiple	Iyengar	2012	India	Postpartum (<=1 year) (6-8 wks)	Own	Yes	Not assessed	Not assessed	Yes	Not assessed	No
18	18	Multiple	Iyengar	2012	India	Postpartum (<=1 year) (12 mos)	Own	Yes	Not assessed	No	Yes	Not assessed	Yes
19	19	Multiple	Leung	2010	Hong Kong	Postpartum (> 1 year)	SF-36	No	Yes	No	No	Yes	No
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (3 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Not assessed
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (6 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Not assessed
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (12 mos)	Own	Yes	No	Yes	Not assessed	Not assessed	Not assessed
21	21	Near-miss'	Filippi	2010	Benin	Postpartum (<=1 year) (6 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	No
21	21	Near-miss'	Filippi	2010	Benin	Postpartum (<=1 year) (12 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	No

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22	22	Near-miss'	Ilboudo	2013	Burkina Faso	Postpartum (> 1 year)	WHOQOL-BREF,Own tool	Yes	Yes	No	No	No	Yes
23	23	Gestational diabetes mellitus	Crowther	2005	Australia/UK	Postpartum (<=1 year)	SF-36	No	Yes	No	No	No	Yes
24	24	Gestational diabetes mellitus	Dalfrà	2012	Italy	Postpartum (<=1 year)	SF-36	Yes	No	No	No	No	Not assessed
23	23	Gestational diabetes mellitus	Crowther	2005	Australia/UK	Antepartum	SF-36	No	Yes	Yes	Yes	No	Yes
25	25	Gestational diabetes mellitus	Dalfrà	2009	Italy	Antepartum (mean 25wks)	SF-36	No	Yes	No	Yes	No	Not assessed
24	24	Gestational diabetes mellitus	Dalfrà	2012	Italy	Antepartum (3rd trimester)	SF-36	Yes	Yes	No	Yes	No	Not assessed
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (3-4 mos)	SF-36	No	No	No	No	No	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (4-5 mos)	SF-36	No	No	No	No	No	No
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (6-7 mos)	SF-36	No	Yes	Yes	Yes	No	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (8-9 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
13	27	Gestational diabetes mellitus	Kim	2005	USA	Antepartum	SF-36	Yes	Yes	No	Not assessed	Not assessed	Yes
14	28	Gestational diabetes mellitus	Mautner	2009	Austria	Antepartum	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
27	29	Gestational diabetes mellitus	Souza	2013	Brazil	Antepartum	FSFI	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
25	25	Gestational diabetes mellitus	Dalfrà	2009	Italy	Postpartum (<=1 year)	SF-36	No	No	No	No	No	Not assessed
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Postpartum (<=1 year) (3 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Postpartum (<=1 year) (6 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
13	27	Gestational diabetes mellitus	Kim	2005	USA	Postpartum (<=1 year)	SF-36	Yes	No	No	Not assessed	Not assessed	Yes
14	28	Gestational diabetes mellitus	Mautner	2009	Austria	Postpartum (<=1 year)	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
28	30	Gestational diabetes mellitus	Halkoaho	2010	Finland	Postpartum (> 1 year)	15D	Yes	No	No	No	No	No
29	31	Hyperemesis gravidarum	Ezberci	2014	Turkey	Antepartum	Brief Disability Questionnaire	Yes	Yes	Not assessed	Not assessed	Yes	Not assessed
30	32	Hyperemesis gravidarum	McCarthy	2011	Australia, New Zealand, Ireland, UK	Antepartum	Perceived Stress Scale, Behavioural Response to Pregnancy Scale	Yes	Not clear	Not assessed	Not assessed	Not assessed	Yes
31	33	Hyperemesis gravidarum	McCormack	2011	UK	Antepartum	Social Functioning Questionnaire	Yes	Not assessed	Not assessed	No	No	Not assessed
32	34	Hyperemesis gravidarum	Poursharif	2008	UK, Australia, Ireland, NZ	Antepartum	Own	No	Not clear	Yes	Not clear	Not clear	Not clear
33	35	Hyperemesis gravidarum	Power	2010	UK	Antepartum	Hyeremesis Impact Symptoms Questionnaire	Yes	Not clear	Not clear	Not clear	Not clear	Yes
34	36	Nausea and vomiting	Chan	2010	Hong Kong	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
35	37	Nausea and vomiting	Koren	2010	USA	Antepartum	PUQE	No	Not clear	Not clear	Not clear	Not clear	Yes
36	38	Nausea and vomiting	Lacasse	2008	Canada	Antepartum	Health-related quality of Life for Nausea and	Yes	Yes	Yes	Not clear	Not clear	Not clear
37	39	Hyperemesis gravidarum	Christodoulou-Smith	2011	USA	Postpartum (<=1 year)	Own	Yes	Not clear	Yes	Yes	Yes	Yes
38	40	Spontaneous abortion	Nansel	2005	USA	Postpartum (<=1 year)	SF-36R	No	Yes	Yes	Yes	Yes	Not clear
39	41	Perineal laceration	Andrews	2009	UK	Postpartum (<=1 year)	Manchester Health	No	No	No	Not assessed	No	No
40	42	Perineal laceration	Boij	2007	Sweden	Postpartum (> 1 year)	Own	Yes	No	Not assessed	Not assessed	Not assessed	Yes
41	43	Perineal laceration	Samarasekera	2008	UK	Postpartum (> 1 year)	FIQL	Yes	Not assessed	Yes	Not assessed	Yes	Yes
42	44	Perineal laceration	Scheer	2008	UK	Postpartum (<=1 year)	ICIQ-SF	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
43	45	Perineal laceration	Visscher	2014	Netherland	Postpartum (> 1 year)	SF-36, ICIQ-SF, FSFI	No	Not clear	Yes	Not clear	Not clear	Yes
44	46	Perineal laceration	Otero	2006	Switzerland	>5 year)	SF-12	Yes	No	No	Not clear	No	No
45	47	Perineal laceration	Sze	2005	USA	Postpartum (> 1 year)	Own tool	no	Not assessed	Not assessed	Not assessed	Not assessed	Not clear
46	48	Perineal laceration	Langley	2006	UK	Postpartum (<=1 year)	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear

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47	49	Perineal laceration	Andrews	2013	UK	Postpartum (<=1 year)	Manchester Health Questonnaire, ICIQ-SF	Yes	Not clear	Not clear	Not clear	Not clear	Not clear
48	50	Perineal laceration	Palm	2013	Sweden	Postpartum (> 1 year)	ICIQ-SF	Yes	Not assessed	Not assessed	No	No	No
49	51	Perineal laceration	Soerensen	2013	Denmark	Postpartum (> 1 year)	FIQL	Yes	Not assessed	No	Not assessed	No	No
50	52	Perineal laceration	Tin	2010	Canada	Postpartum (unknown)	Pelvic Floor Impact	Yes	Yes	Yes	Not assessed	Yes	Not assessed
51	53	Perineal laceration	Rikard-Bell	2014	Australia	Postpartum (<=1 year)	PISQ-12, PFDI-20	Yes	Not assessed	Not assessed	Not assessed	Not assessed	No
52	54	Deep vein thrombosis	Wik	2011	Norway	Postpartum (> 1 year)	VEINES-QOL/Sym		Not clear	Not clear	Not clear	Not clear	Yes
INDIRECT													
53	55	Functional intestinal disorders	Johnson	2014	USA	Antepartum	Irritable bowel Syndrome Quality of Life Measure	Yes	Yes	Yes	Yes	Yes	Yes
54	56	Gastro-oesophageal reflux disease (K21	Malfertheine	2009	Germany	Antepartum	Quality of Life in Reflux and Dyspepsia	Yes	Yes	Yes	Yes	Yes	Not clear
55	57	Heart disease	Meneguin	2013	Brazil	Antepartum	Ferrans and Powers Quality of Life Index	No	No	No	Not assessed	No	No
56	58	Cystic Fibrosis	Schechter	2013	USA, Canada	Postpartum (> 1 year)	Cystic Fibrosis Questionnaire-Revised (CFQR)	Yes	Yes	Yes	Yes	Not clear	Yes
24	59	Type 1 diabetes	Dalfrà	2012	Italy	Antepartum	SF-36	Yes	No	No	No	No	Yes
24	59	Type 1 diabetes	Dalfrà	2012	Italy	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	No	No	Yes
57	60	HIV	Fawzi	2007	Tanzania	Antepartum	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
58	61	HIV	Nuwagaba-Biribonwoha	2006	Uganda	Antepartum	Dartmouth COOP	Yes	No	Yes	Not assessed	No	Yes
59	62	HIV	Pereira	2012	Portugal	Antepartum	WHOQOL-BREF, Brief Symptom Inventory,the Emotional Assessment Scale	Yes	Yes	Yes	Not assessed	Yes	No
58	61	HIV	Nuwagaba-Biribonwoha	2006	Uganda	Postpartum (<=1 year)	Dartmouth COOP	Yes	Yes	Yes	Not assessed	Yes	Yes
60	63	HIV	Pakdewong	2006	Thailand	Postpartum (<=1 year)	Own	No	Not clear	Not assessed	Not assessed	Not assessed	Not assessed
59	62	HIV	Pereira	2012	Portugal	Postpartum (<=1 year)	WHOQOL-BREF, Brief Symptom Inventory,the Emotional Assessment Scale	Yes	No	Yes	Not assessed	Yes	Yes
61	64	HIV	Ross	2011	Thailand	Postpartum (<=1 year)	Own	No	Not clear	Yes	Not assessed	Not assessed	Not assessed
62	65	Depression	Chang	2012	Taiwan	Antepartum	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
63	66	Depression	Husain	2012	UK	Antepartum	Brief Disability	Yes	Yes	Yes	Not clear	Not clear	Not clear
64	67	Depression	Lara	2006	Mexico	Antepartum	Own	No	Not clear	Yes	Yes	Not assessed	Not assessed
65	68	Depression	Lau	2007	Hong-Kong	Antepartum	Dyadic Adjustment Scale	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
66	69	Depression	Li	2012	China	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
67	70	Depression	Nanzer	2012	Switzerland	Antepartum	GAF Scale, Parent-Infant Relationship Global Assessment Scale (PIR-GAS)	No	Not assessed	Yes	Yes	Yes	No
68	71	Depression	Nicholson	2006	USA	Antepartum	SF-36	Yes	Not clear	Yes	Yes	Yes	Yes
69	72	Depression	Pires	2014	Portugal	Antepartum	EuroHIS-QOL-8	No	Not clear	Not clear	Not clear	Not clear	Yes
70	73	Depression	Setse	2009	USA	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Not clear
71	74	Depression	Wilkins	2012	UK	Antepartum (13 wks)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear

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71	74	Depression	Wilkins	2012	UK	Antepartum (34 wks)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear
72	75	Depression	Abbasi	2014	Iran	Postpartum (<=1 year)	SF-36	No	Yes	Not clear	Not clear	Not clear	Not clear
73	76	Depression	Chang	2010	Taiwan	Postpartum (<=1 year) (3 days)	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	No
73	76	Depression	Chang	2010	Taiwan	Postpartum (<=1 year) (6 wks)	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
74	77	Depression	Chen	2011	Singapore	Postpartum (<=1 year) (2 wks)	GAF Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
74	77	Depression	Chen	2011	Singapore	Postpartum (<=1 year) (6mos)	GAF Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
75	78	Depression	Chen	2007	Singapore	Postpartum (<=1 year) (2 wks)	EuroQol (EQ5D)	No	Not clear	Not clear	Not clear	Not clear	Yes#
75	78	Depression	Chen	2007	Singapore	Postpartum (<=1 year) (6mos)	EuroQol (EQ5D)	No	Not clear	Not clear	Not clear	Not clear	Yes#
76	79	Depression	Cheng	2013	Taiwan & US	Postpartum (<=1 year)	Physical Health Condition checklist	Yes	Yes	Yes	Not assessed	Not assessed	Yes
77	80	Depression	Chivers	2011	Canada	Postpartum (<=1 year)	FSFI	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
78	81	Depression	Cho	2009	Korea	Postpartum (<=1 year)	Pittsburgh Sleep Quality Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
79	82	Depression	Class	2013	USA	Postpartum (<=1 year)	Own	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes#
80	83	Depression	Da Costa	2006	Canada	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
81	84	Depression	Darcy	2011	USA	Postpartum (<=1 year)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Not clear
82	85	Depression	Gjerdingen	2009	USA	Postpartum (<=1 year)	SF-36	Yes	Not clear	Yes	Yes	Not clear	Yes
83	86	Depression	Gjerdingen	2011	USA	Postpartum (<=1 year)	PHQ-9	Yes	Not assessed	Not assessed	Yes	Yes	Not assessed
84	87	Depression	Goutaudier	2014	unknown (France	Postpartum (<=1 year)	Dyadic Adjustment Scale, Quality of Life Scale	Yes	Not clear	Not assessed	Not clear	Not clear	Yes#
85	88	Depression	Hou	2014	China	Postpartum (<=1 year)	Pittsburgh Sleep Quality Index	No	Not assessed	Not assessed	Not assessed	Not assessed	Not clear
86	89	Depression	Howard	2011	UK	Postpartum (<=1 year)	SF-12	Yes	Not clear	Yes	Not clear	Not clear	Not clear
87	90	Depression	Howell	2006	USA	Postpartum (<=1 year)	SF-12	Yes	Yes	Not assessed	Not assessed	Not assessed	Not assessed
88	91	Depression	Logsdon	2011	US	Postpartum (<=1 year)	GAF Scale	No	Not clear	Yes	Yes	Yes	No
89	92	Depression	Meltzer-Brody	2014	US	Postpartum (<=1 year)	Work and Social	No	Not assessed	Not clear	Not clear	Not clear	Not assessed
90	93	Depression	Milgrom	2006	Australia	Postpartum (<=1 year) (6 mos)	Parenting Stress Index (PSI)	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
90	93	Depression	Milgrom	2006	Australia	Postpartum (<=1 year) (12 mos)	Parenting Stress Index (PSI)	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
91	94	Depression	Moayedoddin	2013	Switzerland	Postpartum (<=1 year)	Impression (CGI), Parent-Infant Relationship Global	No	Not clear	Yes	Yes	Yes	Yes
92	95	Depression	O'Mahen	2014	UK	Postpartum (<=1 year)	Work and Social Adjustment Scale (WSAS)	No	Not assessed	Not clear	Not clear	Not clear	Not assessed
93	96	Depression	Posmontier	2008	USA	Postpartum (<=1 year)	Inventory of Functional Status After Childbirth	Yes	Not clear	Not clear	Yes	Yes	Yes#
94	97	Depression	Rojas	2006	Chile	Postpartum (<=1 year)	SF-36	No	Yes	Yes	Yes	Yes	Yes
95	98	Depression	Sadat	2014	Iran	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
96	99	Depression	Sword	2011	Canada	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Not clear	Not clear	Not clear
71	74	Depression	Wilkins	2012	UK	Postpartum (<=1 year)	SF-36	Yes	No	No	Not clear	Not clear	Not clear
90	93	Depression	Milgrom	2006	Australia	Postpartum (> 1 year)	Parenting Stress Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
97	100	Depression	Moel	2010	USA	Postpartum (both <=1 and	Dyadic Adjustment Scale	Yes	Not clear	Not clear	Not clear	Not clear	Yes
98	101	Depression	Mulcahy	2010	Australia	Postpartum (both <=1 and	Dyadic Adjustment Scale	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes

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99	102	Depression	Paris	2009	USA (assumed)	Postpartum (both <=1 and >1 year)	Parenting Stress Index-Short form Maternal Self-Report Inventory-Short form Dyadic Adjustment Scale	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
100	103	Depression	Silver	2006	USA (assumed)	Postpartum (both <=1 and	Parenting Stress Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
81	84	Depression	Darcy	2011	USA	Postpartum (both <=1 and	SF-12	Yes	No	No	Not clear	Not clear	Not clear
101	104	Depression	Morrell	2009	UK	Postpartum (<=1 year) (6 wks)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Yes
101	104	Depression	Morrell	2009	UK	Postpartum (<=1 year) (6 mos)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Yes
102	105	Depression	Paulson	2006	USA	Postpartum (unknown)	Own	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
103	107	Depression	De Tychey	2008	France	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
104	107	Multiple	Bindt	2012	Ghana & Côte d'Iv	Antepartum	WHODAS	no	Not clear	Not clear	Not clear	Not clear	Yes
105	108	Multiple	Senturk	2012	Ethiopia	Antepartum	WHODAS	Yes	Not clear	Not clear	Yes	Not clear	Not clear
105	108	Multiple	Senturk	2012	Ethiopia	Postpartum (<=1 year)	WHODAS	Yes	Not clear	Not clear	Yes	Not clear	Not clear
106	109	Obsessive-compulsive disorder	Gezginc	2008	Turkey	Antepartum	WHOQOL-BREF	Yes	Yes	Yes	Not assessed	Yes	Not assessed
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Antepartum (3rd trimester)	SF-36, Guy's neurological disability scale (GNDS); multiple sclerosis impact scale (MSIS-31); expanded disability status scale (EDSS)	Yes	No	No	No	No	No
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Antepartum (1st trimester)	SF-36, GNDS, MSIS-31, EDSS	No	No	No	No	No	No
108	111	Multiple sclerosis	Gulick	2007	USA	Postpartum (<=1 year)	Activities of Daily Living (ADL) scale for persons	No	Yes	Yes	Yes	Yes	Not assessed
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Postpartum (<=1 year) (4-8 wks)	SF-36, GNDS, MSIS-31, EDSS	Yes	No	No	No	No	No
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Postpartum (both <=1 and >1 year) (9 mos or more)	SF-36, GNDS, MSIS-31, EDSS	Yes	No	No	No	No	No
109	112	Anemia	Beard	2005	South Africa	Postpartum (<=1 year)	Digit Symbol Test, Perceived Stress Scale	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
110	113	Anemia	Perez	2005	South Africa	Postpartum (<=1 year)	Parent/Caregiver Involvement Scale	Yes	Not clear	Not clear	Not clear	Not clear	Yes
111	114	Anemia	Khalafallah	2012	Australia (Tasman	Postpartum (> 1 year)	SF-36	Yes	yes	Yes	Yes	yes	Not clear
112	115	Enteritis and colitis	Ananthakrishnan	2012	USA	Antepartum	Short inflammatory bowel disease questionnaire	No	Not clear	Not clear	Not assessed	Not clear	No
113	116	Bronchial asthma	Nickel	2006	Germany?	Antepartum	SF-36	No	No	Yes	Yes	Yes	Yes
114	117	Faecal incontinence	Espuna-Pons	2012	Spain	Antepartum	Wexner Faecal Continence Grading Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
115	118	Faecal incontinence	Johannessen	2014	Norway	Antepartum	FIQL	No	Not assessed	Yes	Not assessed	Yes	Yes
116	119	Faecal incontinence	Roos	2009	UK	Postpartum (<=1 year)	Manchester Health Questionanire	No	Yes	Yes	Yes	Yes	Yes
117	120	Faecal incontinence	Pla-Marti	2007	Spain	Postpartum (> 1 year)	FIQL	No	Not assessed	Yes	Not assessed	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (6 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (12 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes

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118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (18 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (24 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
119	122	Fistula	Browning	2008	Ethiopia	Not specified	Own	Yes	Yes	Not clear	Not clear	Yes	Yes
120	123	Fistula	Siddle	2012	Tanzania	Not specified	Own	No	Yes	Yes	Yes	Yes	Not assessed
121	124	Fistula	Muleta	2008	Ethiopia	Postpartum (> 1 year)	Own	No	Yes	Not assessed	Not assessed	Not assessed	Yes
122	125	Fistula	Bangser	2011	Uganda	Postpartum (both <=1 and >8 year)	Own	No	Yes	Yes	Yes	Yes	Yes
122	125	Fistula	Bangser	2011	Tanzania	Postpartum (both <=1 and >9 year)	Own	No	Yes	Yes	Yes	Yes	Yes
123	126	Fistula	Umoiyoho	2011	Nigeria	Postpartum (both <=1 and >9 year)	WHOQOL-BREF	Yes	No	Yes	No	Yes	Yes
124	127	Fistula	Landry	2013	Bangladesh, Guine	Postpartum (> 1 year)	Own	No	Not assessed	Not assessed	Yes	Yes	Yes
125	128	Fistula	Nielsen	2009	Ethiopia	Postpartum (> 1 year)			Not clear	Not clear	Not clear	Not clear	Yes
126	129	Urinary incontinence	Adaji	2010	Nigeria	Antepartum	ICIQ-UI	No	Not assessed	Not assessed	Not assessed	Not assessed	No
127	130	Urinary incontinence	Ruiz de Vinaspre H	2011	Spain	Antepartum	IIQ-7	No	Not assessed	Not assessed	Not assessed	Not assessed	No
128	131	Urinary incontinence	Erbil	2011	Turkey	Antepartum	Own	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
114	131	Urinary incontinence	Espuna-Pons	2012	Spain	Antepartum	ICIQ-SF	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
129	133	Urinary incontinence	Kocaoz	2010	Turkey	Antepartum	Wagner's Quality of Life	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
130	134	Urinary incontinence	Oliveira Claudia	2013	Brazil	Antepartum	ICIQ-SF	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
131	135	Urinary incontinence	Arrue	2010	Spain	Postpartum (<=1 year)	ICIQ–UI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
132	136	Urinary incontinence	Hermansen	2010	Denmark	Postpartum (<=1 year)	IIQ-7	No	Yes	Yes	Yes	Yes	Yes
133	137	Urinary incontinence	Jeddi	2014	Iran	Postpartum (<=1 year)	IIQ-7	No	Yes	Yes	Not assessed	Yes	Yes
134	138	Urinary incontinence	Leroy	2005	Brazil	Postpartum (<=1 year)	SF-36, King's Health Questionnaire (KHQ), ICIQ-SF	Yes	Yes	Yes	Yes	Yes	Yes
135	139	Urinary incontinence	Torrisi	2011	Italy	Postpartum (<=1 year)	ICIQ-SF, King's Health Questionnaire	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
136	140	Urinary incontinence	Ege	2008	Turkey	Postpartum (<=1 year)	Own	No	Not assessed	Not assessed	Not assessed	Yes	Yes

Note 1: The impacts are determined based on authors' interpretations of their study findings when the studies did not have a control or comparison group, or did not report women's functioning between morbidity and non-morbidity group statistically. When only summary measures are reported, sub-scales are coded as not clear. Self-reported general health status and sexual functioning were categorised as other domain.

FIQL=Faecal Incontinence Quality of Life Scale, FSFI=Female Sexual Function Index, GAF Scale = Global Assessment of Functioning, ICIQ=International Consultation on Incontinence Questonnaire, IIQ-7=Incontinence Impact Questionnaire, PFDI-20=Pelvic Floor Distress Inventory, PFIQ-7=Pelvic Floor Impact Questionnaire, PHQ-9=Patient Health Questionnaire, PISQ-12=Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire, PUQE=Pregnancy-unique quantification of emesis, VEINES-QOL = The Venous Insufficiency Epidemiological and Economic Study (VEINES)- QOL/Sym Questionnaire

refers to mixed results

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-8
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	8
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	8
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	9-10
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	8-9
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	10-11
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	10
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	10
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	NA
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	NA
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	NA

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	11
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	11-12
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Table 1&2
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	NA
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Appendix 2
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NA
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NA
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	20-25
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	23-24
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	24-25
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	25

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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Consequences of maternal morbidity on health-related functioning: a systematic scoping review

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Consequences of maternal morbidity on health-related functioning: a systematic scoping review

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ABSTRACT

Objectives: To assess the scope of the published literature on the consequences of maternal morbidity on health-related functioning at the global level and identify key substantive findings as well as research and methodological gaps.

Methods: We searched for articles published between 2005 and 2014 using Medline, Embase, Popline, CINAHAL Plus, and 3 regional bibliographic databases in January 2015.

Design: Systematic scoping review

Primary outcome: Health-related functioning

Results: After screening 17,706 studies, 136 articles were identified for inclusion. While a substantial number of papers have documented mostly negative effects of morbidity on functioning and wellbeing, the body of evidence is not spread evenly across conditions, domains or geographical regions. Over 60% of the studies focus on indirect conditions such as depression, diabetes and incontinence. Health-related functioning is often assessed by instruments designed for the general population including the 36-item Short Form (SF-36), or disease-specific tools. The functioning domains most frequently documented are physical and mental; studies that examined physical, mental, social, economic, and specifically focused on marital, maternal and sexual functioning, are rare. Only 16 studies were conducted in Africa.

Conclusions: Many assessments have not been comprehensive and have paid little attention to important functioning domains for pregnant and postpartum women. The development of a comprehensive instrument specific to maternal health would greatly advance our understanding of burden of ill health associated with maternal morbidity and help to set priorities. The lack of attention to consequences on functioning associated with the main direct obstetric complications is of particular concern.

Review registration: CRD42015017774

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Comprehensive review which includes a full range of maternal morbidities during pregnancy, childbirth and postpartum, and assesses the impact on physical, mental, economic and social functioning.
- A quantitative meta-analysis could not be conducted given the wide range of conditions, tools and timing of measurement of functioning.

KEYWORDS

Maternal health, Maternal morbidity, Functioning, Health status, Quality of life, International Classification of Functioning, Disability and Health, Systematic review, Questionnaires

INTRODUCTION

Maternal morbidity occurs frequently, but is poorly studied. At present, there are an estimated 27 million episodes of direct complications occur annually.[1] The burden of maternal morbidity is much larger than this estimate when indirect complications and long-term sequelae are added to the calculation, some of which can be particularly common.[1,2] For example, anaemia affects 32 million (a range of 28 to 36 million) pregnant women per year according to a model.[3] However, these estimates on the epidemiology of maternal morbidity are based upon varying criteria; which has prompted the establishment of the World Health Organization (WHO) Maternal Morbidity Working Group (MMWG) to develop a standard definition and measurement criteria.

By defining maternal morbidity as "any health condition attributed to and/or complicating pregnancy and childbirth that has a negative impact on the woman's wellbeing and/or functioning",[4] the WHO Maternal Morbidity Working Group (MMWG) emphasizes the need for comprehensiveness in the evaluation of the maternal morbidity burden. Concurrently, global attention in policies such as the Strategies toward Ending Preventable Maternal Mortality (EPMM) is shifting from focusing on maternal mortality, which is decreasing, to focusing on women who survive and addressing their morbidities.[5] Indeed, while there is increased focus on describing the levels and patterns of maternal morbidity,[1,6-8] the extent to which this morbidity collectively impacts upon women's health-related functioning is poorly understood.[9,10]

Studies in the United States of America and Canada have demonstrated that pregnancy itself limits aspects of women's functioning.[11,12] Changes in physical functioning from first to second trimesters, and from second to third trimester have been observed among women with uncomplicated pregnancies.[11,13-15] While acute complications soon disappear after childbirth for most women, others may develop sequelae and experience certain health conditions, such as fatigue, sleep-related problems, pain and concerns about sexual activities, depression, anxiety,

haemorrhoids and constipation. These often last well over the six weeks of puerperium[16,17] and have even been documented to peak around six months after delivery before declining.[18] Therefore, the additional effects of maternal morbidity on women's functioning are important to comprehend, particularly with respect to differentials in patterns, duration, size and risk factors.[4]

The effects of maternal morbidity extend beyond the physical or the psychological to also social and economic. In Sri Lanka, 90% of pregnant women reported at least one episode of perceived ill health during pregnancy and 26% of them reported that they required another person to replace them in their routine activities because they were unwell.[19] One hypothesis is that the more severe the maternal morbidity experienced the more likely the negative consequences. A handful of recent cohort studies have shown that women diagnosed with severe obstetric complications (including 'near-miss') had a higher risk of health, social and economic adversities persisting well beyond pregnancy and the six-week postpartum period compared to women with uncomplicated childbirth.[20-28]

The most comprehensive source of summarised evidence to date on the consequences of maternal morbidity is a systematic review on health- related quality of life (HRQOL) after childbirth.[29] This review of 66 articles concentrated on the physical, social and psychological domains. While it did not focus specifically on the effects of maternal morbidity, the authors found that urinary incontinence and HIV were negatively correlated with quality of life, and that depression had an impact on health status scores such as those measured by the 36-item Short Form (SF-36).[29] More recently, Andreucci et al. reviewed the effects of maternal morbidity on sexual dysfunction. Despite the substantial methodological heterogeneity between studies they found an association between perineal injuries with increased dyspareunia and delayed resumption of sex after childbirth.[30] In contrast a recent cohort study shows sexual function 3 months after delivery, for women who had

severe maternal morbidity, was similar to the level of the control group.[31] The effects of other maternal morbidities on health-related functioning and quality of life have rarely been investigated in systematic reviews.[29] Additionally, studies such as those mentioned above, focus on the impact of a morbidity with a limited, anatomical interpretation (i.e. a perineal injury's impact on a woman's sexual life), rather than a more holistic view on how a women's everyday abilities may be impacted (her overall relationship with her partner, not limited to sex, or her ability to care for the child or resume her economic activity).

Concepts and measurement of health-related function and quality of life/wellbeing

In practice, the difference between health-related functioning and health-related quality of life (HRQOL) may be ambigious, as there is overlap. Functioning and disability (the negative correlate of functioning) are conceptualised by the International Classification of Functioning, Disability and Health (ICF). The ICF classified functioning and disability into three levels: at the level of body or body part, the whole person, the whole person in a social context. Disability is defined as "the outcome of the interaction between a person with an impairment and the environmental and attitudinal barriers he or she may face".[32] The concept of disability is not restricted to impairment of body function and structures. It encompasses loss or limited capacity to execute a task or action by individual (e.g. eating, standing, walking), and to be involved in a life situation in an environment (e.g. employment). The ICF is also the international classification and metrics for organising and reporting health and disability data which enables us to use common metrics over time and space.

Quality of life (QOL) and the more specific notion of HRQOL are also widely used to understand how diseases or the absence of disease influence the lives of individuals. It relates to the broader concept of wellbeing than the concept of health-related functioning, and encompasses perception of life satisfaction which is shaped by many factors including health.[33] Although there are many definitions, QOL has been defined by WHO as the "individual's perception of their position in life in

the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns".[33] As explicitly stated in the WHO's definition, QOL gives weight to individual's perception of the ability to lead a fulfilling life.[34] The concept of HRQOL encompasses aspects of QOL which can clearly affect health or be affected by health conditions, and is defined as "optimum levels of mental, physical role and social functioning, including relationships and perceptions of health, fitness, life satisfaction and wellbeing".[35] In contrast, health-related functioning does not focus on individual's perception or subjective wellbeing. It can be based on established comparable parameeters such as the ICF, and provide more precise information on level of functioning than HRQOL.[36] Effective health care planning and management needs comparable data on level of functioning, which predict work performance, return to work potential, likelihood of social integration, or receipt of disability benefits.[32]

Health-related functioning and HRQOL are important patient-reported health outcomes which have been used in other sectors of public health to measure the effectiveness of intervention or to allocate resources.[37] However, most of the existing studies of maternal health focus on mortality and morbidity, and there is limited research that aims to assess women's quality of life as a primary outcome.[38] The guidelines on postnatal care up to 8 weeks after births developed by the British National Institute for Health and Care Excellence (NICE) recommends health professionals to check women's physical, emotional and social wellbeing.[39] More complete data on maternal morbidities and consequences would contribute to setting priorities for reducing the burden of maternal ill-health.

Nonetheless, measurement of health-related functioning and quality of life is complex. While these concepts are concerned with individual's perceptions of personal health, wellbeing and satisfaction with health status and life, pre-determined quantitative scales are often applied. There are a number of standardised generic instruments used to measure functioning and quality of life. For

instance, the SF-36 is one of the most commonly used tools for assessing functioning and wellbeing, and often employed to assess the performance of new instruments. The SF-36 has been validated among women in early pregnancy.[40] However, women during late pregnancy or postpartum were not taken into account during the instrument development process, and indeed, no generic tools assessed their reliability, validity or responsiveness for these specific populations in different settings.[41] Tools developed specifically for use in relation to maternal health include the Inventory of Functional Status After Childbirth (IFSAC), which focuses on social functioning,[42] the Mother Generated Index, which is self-created by each individual woman to assess the effect of having a new baby on her quality of life,[43] and the Maternal Postpartum Quality of Life tool (MAPP-QOL) with emphasis on women's satisfaction with various areas of their life during early postpartum.[44] All of these tools are concerned with events in the postpartum period in relation to the experience of childbirth, were validated in relatively homogenous and small study populations and have been applied infrequently [41].

As members of the MMWG, we conducted a systematic scoping review of the published literature on the consequence of maternal morbidity on health-related functioning to assess the scope of the literature at the global level, identify key substantive findings as well as research and methodological gaps.[45] In this paper, we critically appraise the available literature with particular interest in the type of conditions studied, the tools used, the range of domains considered, the timing of assessment, the study design and geographical coverage. We then qualitatively assess the range of domains studied and the effects of morbidity. Finally, we focus on two conditions, hyperemesis gravidarum and incontinence during pregnancy to illustrate characteristics of included studies and the impacts on health-related functioning.

METHODS

Data sources and search strategy

We adapted a WHO generic protocol used in all the systematic reviews conducted by members of the MMWG.[10,46] The protocol is registered in PROSPERO (CRD42015017774. http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015017774). We searched relevant articles published between 1st January 2005 and 31st December 2014 using a structured search strategy in four bibliographic electronic databases (Medline, Embase, Popline, CINAHAL Plus) and three WHO regional databases (Latin American and Caribbean Center on Health Sciences Information (LILACS), African Index Medicus (AIM) and the West Pacific Region Index Medicus (WPRIM)) in January 2015.

A full search strategy for each database was developed using thesaurus (including MeSH) and free-text terms for maternal morbidity and health-related functioning. We added search terms relating to individual maternal health conditions based on the maternal morbidity matrix constructed by Chou et al.[4] The outcome for this review, health-related functioning, encompasses multiple dimensions, such as cognitive, physical, mental, social and economic functions, and the terms relating to each of these concepts were included in the search strategy. While the primary focus of the systematic scoping review is the negative impact of morbidity on health-related functioning, health-related quality of life findings (and other concepts capturing the consequences of morbidity) were added to make sure that we captured all of the relevant literature. This is also because the WHO maternal morbidity definition includes both the terms 'wellbeing' and 'functioning'. The search strategy is available in supplementary appendix 1.

Inclusion and exclusion criteria

All studies were eligible for inclusion if they met the following criteria: 1) the study population included at least 30 women who experienced maternal morbidity during pregnancy, childbirth or

one year after delivery or spontaneous abortion; and 2) results included quantitative data on health-related functioning by maternal morbidity status. We excluded intervention studies if respondents were all treated and the primary objective of the study was comparisons of treatment. Studies with no primary data were excluded. All other study types were eligible. There were no language restrictions.

Induced abortion, stillbirth and preterm birth were excluded from this review when they were the only exposure in a study. While these outcomes may be associated with maternal complications, they are not exclusively maternal morbidities. Intimate partner violence, substance use, smoking, alcohol, female genital mutilation and multiple pregnancies were also not considered maternal morbidities for the purposes of this review, though these factors increase the risk of maternal morbidities. A number of studies assessed depression or depressive symptoms as consequences of maternal morbidities using screening tools such as the Edinburgh Postnatal Depression Scale (EPDS) or the 9-item Patient Health Questionnaire (PHQ-9). Although individual questionnaire items in some of these tools imply women with the condition have low level of functioning, we excluded studies that did not explicitly report on mental functioning as an outcome as it was not possible to separate characteristics and severity of depressive symptoms, and level of functioning. Studies which assessed any of the following: practice of breastfeeding, self-efficacy, locus of control, confidence, competence, self-esteem, life satisfaction and social support, as an outcome but did not assess this in the context of women's health-related functioning were not included. Although maternal-infant interaction was sometimes chosen as an outcome in studies on depression, this review excluded studies if they did not explicitly examine woman's ability to care for her child as functioning.

Selection and data extraction

Four authors (KM, AH, JC, VF) with help from a research assistant (LP) screened title and abstracts. At the beginning of the screening, a pilot test of 100 papers by three reviewers (KM, AH, JC) was

conducted to help achieve inter-rater reliability. Evaluation of full text reports was done by four authors (KM, AH, JC, VF), with reasons for exclusion recorded for excluded papers. Data extraction from the full-text report was conducted by a single author for each retained paper (KM, AH, JC, VF, MB, DC); information was extracted on: location of study, study dates, study design, study population, sampling, case definition of maternal morbidity, methods of measurement of health-related functioning and the timing of the assessment, and measures of functioning by morbidity status. When a study assessed multiple maternal morbidities or examined health-related function several times, data of functioning for each health condition and at each time point of observation were extracted. Throughout the reviewing and extraction processes, articles where uncertainty existed were discussed with another reviewer and consensuses reached. Finally, as it is not possible to summarise the results statistically across studies by morbidity because of their differences with respect to research questions, study designs, outcome measures, timing of measurement and control group, two authors (KM, VF) qualitatively assessed each paper to determine the impact of the morbidity on five domains: physical, mental, economic, social and other (see supplementary appendix 2). Self-reported general health status, maternal, sexual or marital functioning were categorised as 'other' domain. The economic domain was interpreted broadly and included ability to conduct both paid and unpaid work. We relied on authors' interpretations of their study findings when the studies did not have a control or comparison group, or did not provide a statistical test comparing women's functioning between morbid and non-morbid groups. Appraisal of the quality of studies was conducted based on definition of maternal morbidity and health-related functioning, inclusion of relevant controls, sampling methods and completeness of data. Despite a high proportion of poor quality of studies for the purpose of the study, we included all publications relevant to our study aim in this scoping review.

RESULTS

Our initial database search identified 17,706 relevant studies. After screening of titles and abstracts, 382 papers were retained. Of those, we excluded a total of 246 articles after full-text review and data extraction. The main reason for exclusion was lack of well-defined maternal morbidity or health functioning data. Finally, 136 papers were identified for inclusion (Fig. 1).

< Fig 1 insert here>

Fig 1. Study selection for inclusion in the systematic scoping review

Using the classification of maternal morbidity constructed by Chou et al.,[4] the vast majority of the included articles, 84 articles out of 136 (62%), addressed the consequences of indirect causes of morbidity on health-related functioning (see Table 1). The studies were concentrated in Europe and North America (56%, 76 studies), and only 12% (16 studies) were located in Africa. Health-related functioning in the immediate or extended postpartum period, especially within one year of delivery, was more commonly studied, compared to the antepartum period. Cohort study was a particularly common study design. Almost half of the included papers (46%, 63 studies) did not have a control group.

Table 1: Description of included studies

	Direct morbidity (N=52)	Indirect morbidity (N=84)	Total (N=136)
Region			
Africa	5.8%	15.5%	11.8%
Asia	15.4%	20.2%	18.4%
Europe	48.1%	26.2%	34.6%
Latin America and the Caribbean	3.8%	6.0%	5.1%
North America	13.5%	26.2%	21.3%
Oceania	7.7%	3.6%	5.1%
Multiple	5.8%	2.4%	3.7%
Timing of assessment of functioning			
Antepartum	19.2%	27.4%	24.3%

Antepartum and postpartum	11.5%	7.1%	8.8%
Postpartum (<=1 year)	26.9%	42.9%	36.8%
Postpartum (>1 year)	23.1%	6.0%	12.5%
Postpartum (both <=1 year and > 1 year)	7.7%	11.9%	10.3%
Postpartum (unknown)	1.9%	2.4%	2.2%
Not specified	9.6%	2.4%	5.1%
Study design			
Cohort	63.5%	40.5%	49.3%
Cross-sectional	23.1%	41.7%	34.6%
Trial	7.7%	15.5%	12.5%
Case-control	5.8%	2.4%	3.7%
Comparison (control) group relevant to maternal morbidity & functioning			
Yes	61.5%	48.8%	53.7%
No	38.5%	51.2%	46.3%
Total	**100%**	**100%**	**100%**

Table 2 presents distributions of 140 maternal health conditions which were studied as exposures in the 136 included articles. The three most frequent maternal morbidity diagnoses studied were mental disorders (33%, 45 studies), incontinence (12%, 17 studies) and perineal laceration (9%, 13 studies). Hyperemesis gravidarum, and nausea and vomiting of pregnancy were studied in 9 studies (6%) (See Box 1). The consequences on health-related functioning of potentially more severe direct obstetric conditions, such as obstetric haemorrhage or severe pre-eclampsia and eclampsia, were not frequently studied. There is limited data on the consequences of puerperal sepsis on health-related functioning except in 3 near-miss studies.

Health-related functioning and wellbeing were measured by applying a number of existing tools (Table 3). The SF-36 was the most common tool applied and used in 32 studies (22%). It was particularly common in studies of gestational diabetes and mental disorders. The Short Form 12 (SF-12), the World Health Organization Quality of Life tool (WHOQOL-BREF), and WHO Disability Assessment Scale (WHODAS) 2.0 were used in fewer than 10 studies each. Over 30 studies used disease-specific tools. Seventeen studies on incontinence were documented, and the International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form (ICIQ-UI-SF), the Incontinence Impact Questionnaire (IIQ-7), the Faecal Incontinence Quality of Life (FIQL) Score, and

the King's Health Questionnaire and Manchester Health Questionnaire were commonly used. While these existing tools were often adopted, many studies applied other tools, especially in studies on mental disorders, including Female Sexual Function Index (6 studies), Global Assessment of Functioning (4 studies) and Pittsburgh Sleep Quality Index (2 studies).

Table 2: Distribution of maternal conditions

DIRECT MATERNAL MORBIDITY	Number of conditions	Percent
Delivery/Termination (N=7)		
Gestational Trophoblastic Disease	6	4.3
Obstructed Labour	1	0.7
Hypertensive Disorders (N=7)		
Gestational hypertension	2	1.4
Pre-eclampsia/eclampsia	5	3.6
Obstetric Haemorrhage (N=3)		
Postpartum Haemorrhage	3	2.1
Other obstetric complications (N=23)		
Gastrointestinal (N=9)		
Nausea and Vomiting of Pregnancy	3	2.1
Hyperemesis gravidarum	6	4.3
Endocrine(N=8)		
Diabetes Mellitus (Gestational Diabetes)	8	5.7
Others (N=6)		
Deep Vein Thrombosis	1	0.7
Near-miss[1]	3	2.1
Multiple obstetric conditions	2	1.4
Unanticipated complications (N=14)		
Perineal laceration	13	9.3
Spontaneous abortion	1	0.7
INDIRECT MATERNAL MORBIDITY		
Anaemia	3	2.1
Endocrine, nutritional and metabolic diseases (N=2)		
Type 1 diabetes	1	0.7
Cystic Fibrosis	1	0.7
Infection (N=5)		
HIV infection	5	3.6
Mental disorders (N=45)		
Depression	42	30.0
Obsessive Compulsive Disorder	1	0.7
Multiple	2	1.4
Diseases of the respiratory system complicating pregnancy, childbirth and the puerperium (N=1)		
Bronchial asthma	1	0.7
Diseases of the Genitourinary System (N=24)		
Urinary/Faecal/Anal incontinence	17	12.1
Fistula	7	5.0
Diseases of the Nervous System (N=2)		
Multiple Sclerosis	2	1.4
Diseases of the circulatory system (N=1)		
Heart disease	1	0.7
Diseases of the digestive system (N=3)		
Enteritis and colitis	1	0.7
Gastro-oesophageal reflux disease	1	0.7
Functional intestinal disorders	1	0.7

TOTAL	140	100.0

[1]includes an indirect cause, severe anaemia.

Table 3: Distribution of maternal conditions by type of tools used in the included studies to measure wellbeing and functioning

	Health-functioning tool							
	SF-36	SF-12	WHOQOL-BREF	WHODAS 2.0	Disease-specific	Own tool	Others	Total
DIRECT MATERNAL MORBIDITY								
Delivery/Termination	0	1	1	0	1	2	2	7
Hypertensive Disorders	3	1	1	0	1	1	0	7
Obstetric Haemorrhage	2	0	0	0	0	1	0	3
Other obstetric complications	7	0	2	0	4	6	5	24
Unanticipated complications	3	1	0	0	6	2	4	16
INDIRECT MATERNAL MORBIDITY								
Maternal infectious and parasitic diseases	1	0	1	0	0	2	1	5
Mental disorders	11	4	2	2	0	1	27	47
Diseases of the Genitourinary System	1	0	1	0	13	8	3	26
Other indirect courses	4	0	0	0	6	0	3	13
Total	32	7	8	2	31	23	45	148

Note: 12 studies used more than one type of tool.

A list of the included articles and the impact of the morbidity on five domains of functioning: physical, mental, economic, social and other, which we assessed for each article qualitatively, is provided in supplementary appendix 2. Among the 136 papers, 116 studies reported negative consequences of maternal morbidity; only 20 articles found no negative impact. There is no maternal health condition for which studies consistently showed no impact on health-related functioning. Physical and mental functioning were frequently assessed, and economic function was rarely studied. Studies of fistulae were often concerned with social, marital and economic domains,

and perineal laceration studies often documented sexual functioning. Lastly, environmental factors (facilitators and barriers) of women's functioning were rarely reported in the included papers except for a handful papers such as those addressing fistulae[47-51] and near-miss.[23] Boxes 1 and 2 illustrate characteristics of studies of hyperemesis gravidarum and incontinence during pregnancy and the impacts on health-related functioning.

Box 1: Hyperemesis gravidarum

Hyperemesis gravidarum, a severe and persistent form of nausea and vomiting in pregnancy, affects up to 1.5% of pregnant women, with an onset at about the 5th week of pregnancy, peaking at 8-12 weeks and usually resolving before the 20th week.[52] Only five studies examined health-related functioning as a consequence of hyperemesis gravidarum during pregnancy. They were all conducted in high-income countries except for one conducted in Turkey. Existing generic tools were used in three of these studies (Perceived Stress Scale (PSS), Brief Disability Questionnaire (BDQ), and Social Functioning Questionnaire (SFQ)). A disease-specific tool, Hyperemesis Impact Symptoms Questionnaire, was used in one study; and one study did not use any existing tool and researchers created their own items. Despite the different tools used, there was evidence of a significant impact of morbidity on women's daily lives in four studies while one study reported no impact. In a prospective cohort study of pregnant women with and without hyperemesis gravidarum, McCarthy et al. applied the Perceived Stress Scale and a Behavioural Response to Pregnancy Scale comprising of two subscales: limiting / resting behaviour (referring to a tendency to curtail activities of daily living in response to symptoms by resting).[53] Limiting / resting response and Perceived Stress Scale scores were higher in women with hyperemesis gravidarum than women without hyperemesis gravidarum after adjusting for possible confounders, such as age, smoking and ethnicity. As the limiting behaviour score normalised several weeks after vomiting ceased, a causal association between hyperemesis gravidarum and deteriorated functioning was suggested in this study. Ezberci et al. used the 11-item Brief Disability Questionanire to assess physical and social disability and

showed that the score was higher in women with hyperemesis gravidarum than women without (11.2 vs 8.5).[54] Power et al. developed and validated the 10-item Hyperemesis Impact of Symptom (HIS) questionnaire to assess how symptoms of hyperemesis gravidarum were impacting women's lives.[55] The authors showed a significantly higher mean HIS score in women with hyperemesis gravidarum than those without it (16.3 vs 5.6). On the other hand, McCormack et al. (2011) used a short 8-item Social Functioning Questionnaire to assess social functioning in different situations (such as at home, work or in relationships) and showed no difference in the Social Functioning Questionanire scores between women with and without hyperemesis gravidarum, both at around the peak of symptoms and after 26th week when vomiting had ceased.[56] It was unclear whether the small sample size (32 with hyperemesis gravidarum and 41 without hyperemesis gravidarum) or difference in gestational weeks among the women (hyperemesis gravidarum: 9.66 weeks (95% CI: 8.69-10.63), non-hyperemesis gravidarum: 12.27 weeks (95% CI: 11.71-12.83)) might have been responsible for the lack of association between hyperemesis gravidarum and impaired social functioning, or whether hyperemesis gravidarum may not have impacted the women's daily functioning. Poursharif et al. (2008) presented the type of problems women reported to have experienced as a consequence of hyperemesis gravidarum in a spontaneous response to the question "how have your life or future plans changed after experiencing hyperemesis?" These included problems with job or school, marital or family relationships and social isolation.[57] However, while the paper documented the negative psychological and social impact of hyperemesis gravidarum, the study had important limitations. It did not specifically focus on health-related functioning nor did it use a comprehensive conceptual framework, the online recruitment survey relied on self-referral and self-diagnosis of hyperemesis gravidarum, the duration (since hyperemesis gravidarum onset was not explored) and there was no comparison group.

Hyperemesis gravidarum is an example of a condition for which there is no dominant condition-specific tool. While three studies used generic tools and one study used only its own questions, the condition-specific tool developed by Power et al. appears to capture well how hyperemesis gravidarum-associated morbidity impacts key aspects of women's daily life. However, other domains of health-related functioning considered in the review (e.g sexual functioning) were not part of the condition-specific tool.

Box 2: Faecal and urinary incontinence during pregnancy

Incontinence is an example of a condition for which there are existing health-related functioning or quality of life tools, developed in the 1990s, and sometimes applied in pregnant and postpartum populations. Faecal or urinary incontinence, i.e. involuntary leakage of stool or urine, is a common antenatal condition from which up to 60% of women suffer during pregnancy.[58,59] Anatomical changes such as enlargement of the uterus putting increased pressure on the bladder are responsible. Five studies examined the association between urinary incontinence and health-related functioning during pregnancy, one examined the association with faecal incontinence and another assessed both faecal and urinary incontinence. Three were conducted in high-income countries and four in middle-income countries. Three studies used the International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form (ICIQ-UI-SF), which is comprised of three questions relating to severity of urinary incontinence and one question regarding impact on daily life. However, the studies differ with respect to the research question, study designs, outcome measures and control group.

In a Brazilian study, the mean composite ICIQ score was just above 12. There is no cutoff in the ICIQ score, but a mean score of 12 is considered as severe impact on quality of life.[60] A Nigerian cross-sectional study, which used ICIQ-UI-SF, reported that in 17% of women, urinary incontinence

interfered with daily life. The mean score of ICIQ-UI-SF among 43 women in this study was much lower than in the Brazilian study (4.05).[61] In a cohort study conducted in Spain, the impact of urinary incontinence was measured using the ICIQ-UI-SF and the percentage of women reporting an impact on daily life was high in each trimester with an upward trend as pregnancies progressed. Similar results were reported in women with double (urinary and anal) incontinence in this study. Another study in Spain, which used Incontinence Impact Questionnaire (IIQ-7) reported no impact on daily life.[62] The 28-item, condition-specific Wagner's Quality of Life Scale was used in a cross-sectional study from Turkey and 71% of women with urinary incontinence reported that it had an impact on their quality of life.[63] Erbil et al. developed 23-item questionnaire based on existing literature to explore the aspects of daily life affected by urinary incontinence in Turkey.[58] The study found that a large proportion of women were affected by urinary incontinence in some areas of their lives. Particularly affected were: daily activities (75%), feeling of discomfort (73%), liquid avoidance (53%), sexual life (47%), and isolation from environment (36 %). Johannessen et al. studied faecal incontinence during pregnancy and used the 29-item Faecal Incontinence Quality of Life Score (FIQOL) which has 4 sub-scales.[64] One quarter of the women in Norway reported that faecal incontinence in late pregnancy affected their behaviour and increased embarrassment. These studies suggest that women's daily lives were negatively affected by incontinence to a great extent. However, because of the use of condition-specific tools in assessing health-related functioning and hence the lack of a comparison group, functioning of healthy counterparts were not used as a benchmark in the majority of these studies.

DISCUSSION

While a substantial number of studies (N=116) have documented mostly negative effects of morbidity on health-related functioning and wellbeing during pregnancy and after childbirth, the body of evidence is not spread evenly amongst conditions, domains of health-related functioning or

geographically. Most studies focus on indirect conditions such as depression, diabetes and incontinence. The effects of direct obstetric complications, including haemorrhage and pre-eclampsia have rarely been studied, except for obstetric fistulae linked to obstructed labour, despite their importance in low- and middle-income countries. The functioning domains studied were also limited, most frequently documenting physical and mental categories; studies of fistulae were often concerned with social, marital and economic domains; and perineal laceration studies often documented sexual functioning. Studies that comprehensively documented all domains, including physical, mental, social, economic, and specifically focused on marital, maternal and sexual limitations, were rare and used their own tools instead of tools previously validated by others. This overall narrow focus on the women's perspective highlights the need for a tool to address the women's health-related functioning more holistically. Furthermore, most of the instruments reviewed have no link with a common data standard such as ICF. This is another reason why the data gathered from the instruments are in data silos, and it is impossible to compare and aggregate data across the studies. Finally, the number of studies, conducted in Africa region, where the morbidity DALYS are the highest, is small, with only 16 studies. These mostly concentrated on the effects of fistulae, depression and near-miss complications.

The geographical imbalance in our findings may be due to research in low- and middle-income countries putting greater emphasis on reducing maternal mortality, which has been a central focus of the Millennium Development Goals (MDGs) [65]. Greater localised interest in mental health and other chronic conditions which affect women over many years, including into menopause, is another reason for the concentration of studies in high-income countries. The proportion of studies on depression is also related to its high prevalence among postpartum women (prevalence from 13% to 19%),[8] specialised interest by psychiatrists and psychologists and concerns over its impact on child development[66]. Urinary incontinence is a very prevalent condition (estimated prevalence of stress

urinary incontinence at 41%, ranging from 19% to 60%[67]) and widely studied. As shown in the current review, urinary incontinence has been found to has negative impact on physical and psychological quality of life, but also socio-economical and sexual wellbeing of women's lives.

A high proportion of papers were found to be of poor quality for the purpose of this review, as many (46%) did not have an appropriate control group. The lack of adequate comparison group (such as women without the morbidity of interest, women with uncomplicated childbirth or at the very least women of reproductive age) is problematic when assessing the effects of maternal morbidity. Several cohort studies attempted to circumvent this problem by using the normative findings for their chosen tools available for the general population. However, this is not fully appropriate as pregnant women and women with small babies may be different from the general population and have special circumstances, such as those related to physically carrying a pregnancy and breastfeeding their small babies. They may also experience cultural limitations including their ability to leave home and perform the 'normal' activities of healthy adults such as paid and unpaid work. Use of normative findings could also lead to an under-estimation of the impact of maternal morbidity, as women who become pregnant are mostly very healthy.[68] It is these differences from the general population that need further research and a tool based on standardised concepts to provide better, more scientifically sound comparsions among pregnant and postpartum women.

As found in the other systematic review of health related functioning,[29] the majority of papers used SF-36. WHOQOL-BREF is also applied to capture quality of life. SF-36 is widely used, in view of its longevity (it was created in 1992), its availability (having been translated for use in more than 40 countries) and the accumulated evidence on its psychometric properties for different populations. It allows researchers to compare the impact of a range of diagnoses and conditions, not just obstetric and gynaecological conditions. It is also comprehensive, as it documents general health, physical

functioning, mental health, bodily pain, vitality, role limitations because of physical and emotional problems, and social functioning. Several maternal morbidity studies that used SF-36 and WHODAS 2.0 showed a correlation with morbidity, indicating that they have discriminant or predictive validity. Similar correlation was observed with condition-specific tools such as those available for incontinence. However, these generic and condition-specific tools have not been validated among pregnant or postpartum women in different settings. They also do not include maternal functioning, and they do not provide sufficient emphasis on economic, marital and sexual functioning which are important domains for women of reproductive age. Several reviewed studies assessed the consequences of maternal morbidity on the ability to breastfeed and respond to the baby's needs, although they did not assess them in the context of women's functioning.[69,70] This is a particularly important aspect of maternal functioning to investigate.

Therefore, we believe that a health-related functioning tool specific to maternal health should be developed to measure the impact of additional maternal morbidity or pregnancy. The tool would contribute to addressing the evidence gap in our knowledge on consequences of maternal morbidity on woman's daily life, and will advocate for the importance in improving the health of women during pregnancy, childbirth and postpartum. The three currently available tools for postpartum populations discussed earlier have limitations as they are either quality of life tools with an emphasis on satisfaction or feeling (MAPP-QOL and Mother Generated Index) or have too narrow in scope (IFSAC). The MAPP-QOL tool includes the majority of relevant domains including physical, psychological, social, marital sexual, economic and maternal functioning, but its focus on satisfaction and areas such as physical appearance and environment makes it unsuitable for measurement of health-related functioning. Ideally, a health-related functioning tool specific to maternal health would be comprehensive (physical, mental, social, economic, marital, sexual and maternal functioning) and should be applicable to conditions that occur during both pregnancy and

postpartum periods and comparable across different populations. A new tool specific to maternal health needs to link existing and new functional status measurement instruments to/from a common data standard and the conceptual framework of the ICF to enable us to compare health-related functioning data across studies.

Inclusion of environmental factors (facilitators and barriers) of women's functioning should also be accounted for in the development of a new instrument specific to maternal health. As noted earlier, disability is the outcome of the interaction with a person with a impairment and the environment.[32] Level of functioning varies by environmental factors, such as health services, support and attitudes from family members and communities.[71] Interventions that address not only women's impairment and personal factors but also modify the environment in which women with maternal morbidities live could improve women's health-related functioning in their daily lives.

The main strength of our systematic scoping review is its comprehensive search strategy with 17,706 papers screened. However, there are also limitations. While most of the papers found reduced health-related functioning among unwell pregnant or delivered women, this finding could be due to publication bias. As we only considered the published literature and did not review grey literature, we were unable to access the extent to which this was the case. Although we assessed quality of the studies based on definition of maternal morbidity and health-related functioning, inclusion of relevant controls, sampling methods and completeness of data, all publications relevant to our study aim in this scoping review were included. We relied on authors' interpretations of their study results when the studies did not have a control or comparison group, or did not provide a statistical test comparing women's functioning between morbid and non-morbid groups. Therefore, a bias may have been introduced in reporting impact of maternal morbidity on health-related functioning in the studies of poor quality. In addition, we may have over-emphasised the degree to which existing tools

document economic functions as some of the tools do not specifically address functioning at work, but rather asked about any difficulty in performing work or other regular daily activities to appreciate economic function (e.g. SF-36 "During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems?"). On the other hand, we may have underestimated the number of depression studies documenting maternal dysfunction as we excluded studies of mother-child interactions which did not explicitly address the functionality element. Lastly, while our qualitative approach fit well the objective of our scoping review, a quantitative meta-analysis of the findings to summarise the effects was not possible for any condition, as studies did not use the same analytical approach, tools, measures or timing of assessment for the different conditions under consideration.

CONCLUSION

While we found ample evidence that maternal morbidity impacts health-related functioning, the available literature does not appear to be sufficiently comprehensive because not all relevant functioning domains are studied and not all complications are studied to the same extent. The development of a scale specifically for maternal health, to be used alongside expansion of exisiting generic or condition-specific scales, such as WHODAS 2.0, would greatly advance our understanding of the burden of ill health associated with maternal morbidity and facilitate priority setting in maternal health, particularly with respect to its global dimension.

In the transition from the MDG to the Sustainable Development Goal (SDG) framework, tremendous attention is rightfully being placed upon the need to understand the entire context of maternal health. As countries reduce maternal mortality and improve overall health systems, denominated as the "obstetric transition", demonstrates an increasing proportion of maternal morbidity events.[72] The UN Secretary General's Strategy for Women's, Children's, and Adolescent Health, and initiatives

such as the Ending Preventable Maternal Mortality (EPMM) consultations focus direct attention on this phenomenon and call for a holistic approach to improve the health and wellbeing of women, children, and adolescents.[5,73] The objective is to ensure that all "survive, thrive, and transform". With regard to maternal health, it is critical to holistically understand the socioeconomic and environmental determinants that contribute to pregnancy and the spectrum of maternal health-related functioning. To achieve this, we suggest the use of a frequently applied generic tool such as SF-36 and WHODAS 2.0 when comparability with other studies is needed. We also call for more research on the effects of direct complication on health-related functioning.

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CONTRIBUTORSHIP STATEMENT

Conceived and designed the experiments: VF, DC, LS, KM. Developed protocol: KM, VF, JC, AH. Performed the experiments: KM, AH, JC, VF, MB, DC. Wrote the paper: KM, VF, AH. Commented on and helped revised the manuscript: JC, DC, MB, NK, LS.

DISCLAIMER

The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated.

COMPETING INTERESTS

None declared.

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DATA SHARING STATEMENT

No additional data available.

SUPPLEMENTARY APPENDICES

Appendix 1: Search strategy for Medline

Appendix 2: A list of included papers

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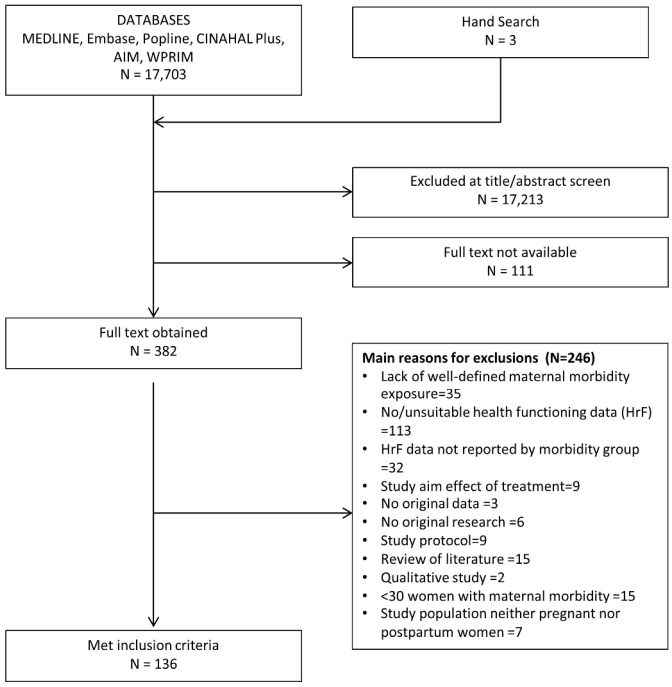

Fig 1. Study selection for inclusion in the systematic scoping review

254x190mm (300 x 300 DPI)

Supplementary Appendix 1: Search Strategy for Medline

1. (maternal or gestation$ or obstetric or labo$r or pregnan$ or partum or antepartum or intrapartum or postpartum or post partum or antenatal or postnatal or post partal or puerperal or puerperium).mp.
2. ((maternal or gestation$ or obstetric or labo$r or pregnan$ or partum or antepartum or intrapartum or postpartum or post partum or antenatal or postnatal or post partal or puerperal or puerperium) adj2 (health or well$being or morbid* or ill* or disorder$ or disease$ or disabilit* or impairment)).ab,ti.
3. exp obstetric labor complications/
4. exp pregnancy complications/

Insert Search StatementEdit Search Statement Delete Search Statement

5. ((pregnan$ or obstetric labo$r or maternal) and complication$).mp.
6. episiotomy/ or extraction, obstetrical/ or labor, induced/ or vaginal birth after cesarean/ or version, fetal/
7. or/3-6
8. ((ectopic or heterotopic or molar) and pregnancy).mp.
9. spontaneous abortion.mp.
10. or/8-9
11. 1 and (hyperten$ or eclampsia or pre-eclampsia or HELLP).mp.
12. (uter$ and (hemorrhage or haemorrhage or prolapse or inversion or rupture or trauma or damage or laceration or tear or dehiscence)).mp.
13. (placenta previa or placenta praevia).mp.
14. exp Hemorrhage/
15. (haemorrhage or hemorrhage).mp.
16. 1 and (or/12-15)
17. puerperal infection$.mp.
18. 1 and sepsis.mp.
19. exp Mastitis/
20. (amnionitis or chorioamnionitis or membranitis or placentitis or sepsis or endometritis or peritonitis or cervictis or vaginitis or trichomoniasis or Septic pelvic thrombosis or breast engorgement or ((breast or mammary or subareolar) and abscess)).mp.
21. ((breast or uter$ or genit$ or perineal or pelvic) and infection$).mp.
22. 1 and (or/17-21)
23. ((Hyperemesis or hyper-emesis) and gravidarum).mp.
24. 1 and exp "Wounds and Injuries"/
25. 1 and (trauma or damage or laceration or tear or dehiscence or rupture).mp.
26. or/23-25
27. exp Rectovaginal Fistula/ or exp urinary fistula/ or exp vesicovaginal fistula/ or exp vaginal fistula/
28. exp pelvic organ prolapse/
29. ((obstetric or vesico-vaginal or vesicovaginal or vaginal or rectovaginal or urinary) and fistula).mp.
30. exp Urinary Incontinence/
31. incontinence.mp.
32. 1 and (or/27-31)
33. exp depression/ or exp Depressive Disorder/ or exp Stress Disorders, Post-Traumatic/ or exp Mental disorders/ or exp Anxiety/ or exp Anxiety Disorders/ or exp Psychotic Disorders/ or exp mental health/ or exp panic/
34. (((Mental or psycho$) and (ill$ or disorder or health)) or psychosis or anxiety or phobi$ or panic).mp.

35. exp Suicide/
36. 1 and (or/33-35)
37. 1 and (exp bacterial infections/ or exp infection/ or exp virus diseases/ or exp parasitic diseases/)
38. 1 and (exp cardiovascular diseases/ or exp Respiratory Tract Diseases/)
39. 1 and exp skin diseases/
40. 1 and exp Endocrine System Diseases/
41. 1 and exp Digestive System Diseases/
42. 1 and exp Female Urogenital Diseases/
43. 1 and (exp Hematologic Diseases/ or exp Lymphatic Diseases/)
44. 1 and (exp Anemia/ or anemia.mp.)
45. 1 and exp Nervous System Diseases/
46. 1 and exp neoplasms/
47. 1 and exp Musculoskeletal Diseases/
48. 1 and (exp Metabolic Diseases/ or exp Nutrition Disorders/)
49. or/36-48
50. 2 or 7 or 10 or 11 or 16 or 22 or 26 or 32 or 49
51. (wellbeing or well-being).ab,ti.
52. exp Quality of life/
53. (quality of life or life qualit$).ab,ti.
54. exp "Activities of Daily Living"/
55. ((daily adj2 (work or activit$)) or activit$ of daily).ab,ti.
56. ((physical adj2 (health or function$ or ill$ problem$ or symptom$)) or mobility).ab,ti.
57. ((mental or psych$) adj2 (health or function$ or ill$ problem$ or symptom$ or distress)).ab,ti.
58. (depression or anxiety).ab,ti.
59. or/51-58
60. exp epidemiologic studies/
61. cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/ or retrospective studies/ or cohort.ti,ab. or longitudinal.ti,ab. or prospective.ti,ab. or retrospective.ti,ab.
62. Cross-Sectional Studies/ or cross-sectional.ti,ab. or ("prevalence study" or "incidence study" or "prevalence studies" or "incidence studies" or "transversal studies" or "transversal study").ti,ab.
63. Case-Control Studies/ or Control Groups/ or Matched-Pair Analysis/ or ((case* adj5 control*) or (case adj3 comparison*) or control group*).ti,ab.
64. Intervention Studies/ or evaluation studies/ or evaluation studies as topic/ or program evaluation/ or validation studies as topic/ or ((pre- adj5 post-) or (pretest adj5 posttest) or (program* adj6 evaluat*)).ti,ab. or (effectiveness or intervention*).ti,ab.
65. (((comprehensive* or systematic*) adj3 (bibliographic* or review* or literature)) or (meta-analy* or metaanaly* or "research synthesis" or ((information or data) adj3 synthesis) or (data adj2 extract*))).ti,ab.
66. or/60-65
67. 50 and 59 and 66
68. limit 67 to yr="1990-2014"
69. limit 68 to humans
70. limit 69 to female

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
Delivery/Termination													
1	1	Gestational Trophoblastic Disease	Cagayan	2008	Philippines	>1 year since remission	Own	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
2	2	Gestational Trophoblastic Disease	Quan	2010	China	>1 year since remission	Own tool based on SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
3	3	Gestational Trophoblastic Disease	Stafford	2011	Australia	>1 year since remission	FSFI	No	Not clear	Not assessed	Not clear	Not clear	Yes
4	4	Gestational Trophoblastic Disease	Ferreira	2009	Brazil	Antepartum	WHOQOL-BREF	No	No	Yes	Not assessed	No	No
5	5	Gestational Trophoblastic Disease	Cagayan	2010	Philippines	Not specified	SF-12	No	Yes	No	Not clear	Not clear	Not clear
6	6	Gestational Trophoblastic Disease	Ung	2005	Australia	Not specified	Sexual History Form-12 (SHF-12)	No	Not assessed	Not assessed	Not assessed	Not assessed	No
7	7	Obstructed labour	Badiou	2010	France	Postpartum (> 1 year)	FIQL	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
Hypertensive Disorders of Pregnancy													
8	8	Eclampsia	Wiegman	2012	The Netherlands	Postpartum (> 1 year)	the National Eye Institute Visual Function	Yes	Yes	No	No	Yes	Yes
9	9	Pre-eclampsia (Mild and severe)	Hoedjes	2011	The Netherlands	Postpartum (<=1 year) (6 wks)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
9	9	Pre-eclampsia (Mild and severe)	Hoedjes	2011	The Netherlands	Postpartum (<=1 year) (12 wks)	SF-36	No	No	Yes	Yes	Yes	Yes
10	10	Pre-eclampsia (Mild and severe)	Hoedjes	2012	The Netherlands	Postpartum (<=1 year)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear
11	11	Pre-eclampsia (Mile and severe)/Eclamp	Stern	2014	Austria	Postpartum (both <=1 and >6 year)	SF-12	Yes	No	Yes	Not clear	Not clear	Not clear
12	12	Pre-eclampsia (Severe)	Roes	2005	The Netherlands	Postpartum (both <=1 and >1 year)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Yes
13	13	Pregnancy-induced hypertension (PIH)	Kim	2005	USA	Antepartum	SF-36	Yes	Yes	No	Not assessed	Not assessed	No
14	14	Pregnancy-induced hypertension (PIH)	Mautner	2009	Austria	Antepartum	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
13	13	Pregnancy-induced hypertension (PIH)	Kim	2005	USA	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Not assessed	Not assessed	Yes
14	14	Pregnancy-induced hypertension (PIH)	Mautner	2009	Austria	Postpartum (<=1 year)	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
Obstetric haemorrhage													
15	15	Postpartum haemorrhage	Thompson Jane	2011	Australia&New Zealand	Postpartum (<=1 year) (2 mos)	SF-36	No	No	No	No	No	No
15	15	Postpartum haemorrhage	Thompson Jane	2011	Australia&New Zealand	Postpartum (<=1 year) (4 mos)	SF-36	No	No	No	No	No	No
16	16	Postpartum haemorrhage	Sentilhes	2011	France	Postpartum (> 1 year)	Own tool	No	Not assessed	Yes	Not assessed	Not assessed	Not clear
17	17	Postpartum haemorrhage	Prick	2014	Netherland	Postpartum (<=1 year)	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
Other obstetric complicatons													
18	18	Multiple	Iyengar	2012	India	Postpartum (<=1 year) (6-8 wks)	Own	Yes	Not assessed	Not assessed	Yes	Not assessed	No
18	18	Multiple	Iyengar	2012	India	Postpartum (<=1 year) (12 mos)	Own	Yes	Not assessed	No	Yes	Not assessed	Yes
19	19	Multiple	Leung	2010	Hong Kong	Postpartum (> 1 year)	SF-36	No	Yes	No	No	Yes	No
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (3 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Not assessed
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (6 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Not assessed
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (12 mos)	Own	Yes	No	Yes	Not assessed	Not assessed	Not assessed
21	21	Near-miss'	Filippi	2010	Benin	Postpartum (<=1 year) (6 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	No
21	21	Near-miss'	Filippi	2010	Benin	Postpartum (<=1 year) (12 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	No

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
22	22	Near-miss'	Ilboudo	2013	Burkina Faso	Postpartum (> 1 year)	WHOQOL-BREF,Own tool	Yes	Yes	No	No	No	Yes
23	23	Gestational diabetes mellitus	Crowther	2005	Australia/UK	Postpartum (<=1 year)	SF-36	No	Yes	No	No	No	Yes
24	24	Gestational diabetes mellitus	Dalfrà	2012	Italy	Postpartum (<=1 year)	SF-36	Yes	No	No	No	No	Not assessed
23	23	Gestational diabetes mellitus	Crowther	2005	Australia/UK	Antepartum	SF-36	No	Yes	Yes	Yes	No	Yes
25	25	Gestational diabetes mellitus	Dalfrà	2009	Italy	Antepartum (mean 25wks)	SF-36	No	Yes	No	Yes	No	Not assessed
24	24	Gestational diabetes mellitus	Dalfrà	2012	Italy	Antepartum (3rd trimester)	SF-36	Yes	Yes	No	Yes	No	Not assessed
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (3-4 mos)	SF-36	No	No	No	No	No	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (4-5 mos)	SF-36	No	No	No	No	No	No
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (6-7 mos)	SF-36	No	Yes	Yes	Yes	No	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (8-9 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
13	27	Gestational diabetes mellitus	Kim	2005	USA	Antepartum	SF-36	Yes	Yes	No	Not assessed	Not assessed	Yes
14	28	Gestational diabetes mellitus	Mautner	2009	Austria	Antepartum	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
27	29	Gestational diabetes mellitus	Souza	2013	Brazil	Antepartum	FSFI	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
25	25	Gestational diabetes mellitus	Dalfrà	2009	Italy	Postpartum (<=1 year)	SF-36	No	No	No	No	No	Not assessed
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Postpartum (<=1 year) (3 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Postpartum (<=1 year) (6 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
13	27	Gestational diabetes mellitus	Kim	2005	USA	Postpartum (<=1 year)	SF-36	Yes	No	No	Not assessed	Not assessed	Yes
14	28	Gestational diabetes mellitus	Mautner	2009	Austria	Postpartum (<=1 year)	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
28	30	Gestational diabetes mellitus	Halkoaho	2010	Finland	Postpartum (> 1 year)	15D	Yes	No	No	No	No	No
29	31	Hyperemesis gravidarum	Ezberci	2014	Turkey	Antepartum	Brief Disability Questionnaire	Yes	Yes	Not assessed	Not assessed	Yes	Not assessed
30	32	Hyperemesis gravidarum	McCarthy	2011	Australia, New Zealand, Ireland, UK	Antepartum	Perceived Stress Scale, Behavioural Response to Pregnancy Scale	Yes	Not clear	Not assessed	Not assessed	Not assessed	Yes
31	33	Hyperemesis gravidarum	McCormack	2011	UK	Antepartum	Social Functioning Questionnaire	Yes	Not assessed	Not assessed	No	No	Not assessed
32	34	Hyperemesis gravidarum	Poursharif	2008	UK, Australia, Ireland, NZ	Antepartum	Own	No	Not clear	Yes	Not clear	Not clear	Not clear
33	35	Hyperemesis gravidarum	Power	2010	UK	Antepartum	Hyeremesis Impact Symptoms Questionnaire	Yes	Not clear	Not clear	Not clear	Not clear	Yes
34	36	Nausea and vomiting	Chan	2010	Hong Kong	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
35	37	Nausea and vomiting	Koren	2010	USA	Antepartum	PUQE	No	Not clear	Not clear	Not clear	Not clear	Yes
36	38	Nausea and vomiting	Lacasse	2008	Canada	Antepartum	Health-related quality of Life for Nausea and	Yes	Yes	Yes	Not clear	Not clear	Not clear
37	39	Hyperemesis gravidarum	Christodoulou-Smith	2011	USA	Postpartum (<=1 year)	Own	Yes	Not clear	Yes	Yes	Yes	Yes
38	40	Spontaneous abortion	Nansel	2005	USA	Postpartum (<=1 year)	SF-36R	No	Yes	Yes	Yes	Yes	Not clear
39	41	Perineal laceration	Andrews	2009	UK	Postpartum (<=1 year)	Manchester Health	No	No	No	Not assessed	No	No
40	42	Perineal laceration	Boij	2007	Sweden	Postpartum (> 1 year)	Own	Yes	No	Not assessed	Not assessed	Not assessed	Yes
41	43	Perineal laceration	Samarasekera	2008	UK	Postpartum (> 1 year)	FIQL	Yes	Not assessed	Yes	Not assessed	Yes	Yes
42	44	Perineal laceration	Scheer	2008	UK	Postpartum (<=1 year)	ICIQ-SF	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
43	45	Perineal laceration	Visscher	2014	Netherland	Postpartum (> 1 year)	SF-36, ICIQ-SF, FSFI	No	Not clear	Yes	Not clear	Not clear	Yes
44	46	Perineal laceration	Otero	2006	Switzerland	>5 year)	SF-12	Yes	No	No	Not clear	No	No
45	47	Perineal laceration	Sze	2005	USA	Postpartum (> 1 year)	Own tool	no	Not assessed	Not assessed	Not assessed	Not assessed	Not clear
46	48	Perineal laceration	Langley	2006	UK	Postpartum (<=1 year)	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear

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Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
47	49	Perineal laceration	Andrews	2013	UK	Postpartum (<=1 year)	Manchester Health Questonnaire, ICIQ-SF	Yes	Not clear	Not clear	Not clear	Not clear	Not clear
48	50	Perineal laceration	Palm	2013	Sweden	Postpartum (> 1 year)	ICIQ-SF	Yes	Not assessed	Not assessed	No	No	No
49	51	Perineal laceration	Soerensen	2013	Denmark	Postpartum (> 1 year)	FIQL	Yes	Not assessed	No	Not assessed	No	No
50	52	Perineal laceration	Tin	2010	Canada	Postpartum (unknown)	Pelvic Floor Impact	Yes	Yes	Yes	Not assessed	Yes	Not assessed
51	53	Perineal laceration	Rikard-Bell	2014	Australia	Postpartum (<=1 year)	PISQ-12, PFDI-20	Yes	Not assessed	Not assessed	Not assessed	Not assessed	No
52	54	Deep vein thrombosis	Wik	2011	Norway	Postpartum (> 1 year)	VEINES-QOL/Sym		Not clear	Not clear	Not clear	Not clear	Yes
INDIRECT													
53	55	Functional intestinal disorders	Johnson	2014	USA	Antepartum	Irritable bowel Syndrome Quality of Life Measure	Yes	Yes	Yes	Yes	Yes	Yes
54	56	Gastro-oesophageal reflux disease (K21	Malfertheine	2009	Germany	Antepartum	Quality of Life in Reflux and Dyspepsia	Yes	Yes	Yes	Yes	Yes	Not clear
55	57	Heart disease	Meneguin	2013	Brazil	Antepartum	Ferrans and Powers Quality of Life Index	No	No	No	Not assessed	No	No
56	58	Cystic Fibrosis	Schechter	2013	USA, Canada	Postpartum (> 1 year)	Cystic Fibrosis Questionnaire-Revised (CFQR)	Yes	Yes	Yes	Yes	Not clear	Yes
24	59	Type 1 diabetes	Dalfrà	2012	Italy	Antepartum	SF-36	Yes	No	No	No	No	Yes
24	59	Type 1 diabetes	Dalfrà	2012	Italy	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	No	No	Yes
57	60	HIV	Fawzi	2007	Tanzania	Antepartum	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
58	61	HIV	Nuwagaba-Biribonwoha	2006	Uganda	Antepartum	Dartmouth COOP	Yes	No	Yes	Not assessed	No	Yes
59	62	HIV	Pereira	2012	Portugal	Antepartum	WHOQOL-BREF, Brief Symptom Inventory,the Emotional Assessment Scale	Yes	Yes	Yes	Not assessed	Yes	No
58	61	HIV	Nuwagaba-Biribonwoha	2006	Uganda	Postpartum (<=1 year)	Dartmouth COOP	Yes	Yes	Yes	Not assessed	Yes	Yes
60	63	HIV	Pakdewong	2006	Thailand	Postpartum (<=1 year)	Own	No	Not clear	Not assessed	Not assessed	Not assessed	Not assessed
59	62	HIV	Pereira	2012	Portugal	Postpartum (<=1 year)	WHOQOL-BREF, Brief Symptom Inventory,the Emotional Assessment Scale	Yes	No	Yes	Not assessed	Yes	Yes
61	64	HIV	Ross	2011	Thailand	Postpartum (<=1 year)	Own	No	Not clear	Yes	Not assessed	Not assessed	Not assessed
62	65	Depression	Chang	2012	Taiwan	Antepartum	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
63	66	Depression	Husain	2012	UK	Antepartum	Brief Disability	Yes	Yes	Yes	Not clear	Not clear	Not clear
64	67	Depression	Lara	2006	Mexico	Antepartum	Own	No	Not clear	Yes	Yes	Not assessed	Not assessed
65	68	Depression	Lau	2007	Hong-Kong	Antepartum	Dyadic Adjustment Scale	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
66	69	Depression	Li	2012	China	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
67	70	Depression	Nanzer	2012	Switzerland	Antepartum	GAF Scale, Parent-Infant Relationship Global Assessment Scale (PIR-GAS)	No	Not assessed	Yes	Yes	Yes	No
68	71	Depression	Nicholson	2006	USA	Antepartum	SF-36	Yes	Not clear	Yes	Yes	Yes	Yes
69	72	Depression	Pires	2014	Portugal	Antepartum	EuroHIS-QOL-8	No	Not clear	Not clear	Not clear	Not clear	Yes
70	73	Depression	Setse	2009	USA	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Not clear
71	74	Depression	Wilkins	2012	UK	Antepartum (13 wks)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
71	74	Depression	Wilkins	2012	UK	Antepartum (34 wks)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear
72	75	Depression	Abbasi	2014	Iran	Postpartum (<=1 year)	SF-36	No	Yes	Not clear	Not clear	Not clear	Not clear
73	76	Depression	Chang	2010	Taiwan	Postpartum (<=1 year) (3 days)	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	No
73	76	Depression	Chang	2010	Taiwan	Postpartum (<=1 year) (6 wks)	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
74	77	Depression	Chen	2011	Singapore	Postpartum (<=1 year) (2 wks)	GAF Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
74	77	Depression	Chen	2011	Singapore	Postpartum (<=1 year) (6mos)	GAF Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
75	78	Depression	Chen	2007	Singapore	Postpartum (<=1 year) (2 wks)	EuroQol (EQ5D)	No	Not clear	Not clear	Not clear	Not clear	Yes#
75	78	Depression	Chen	2007	Singapore	Postpartum (<=1 year) (6mos)	EuroQol (EQ5D)	No	Not clear	Not clear	Not clear	Not clear	Yes#
76	79	Depression	Cheng	2013	Taiwan & US	Postpartum (<=1 year)	Physical Health Condition checklist	Yes	Yes	Yes	Not assessed	Not assessed	Yes
77	80	Depression	Chivers	2011	Canada	Postpartum (<=1 year)	FSFI	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
78	81	Depression	Cho	2009	Korea	Postpartum (<=1 year)	Pittsburgh Sleep Quality Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
79	82	Depression	Class	2013	USA	Postpartum (<=1 year)	Own	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes#
80	83	Depression	Da Costa	2006	Canada	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
81	84	Depression	Darcy	2011	USA	Postpartum (<=1 year)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Not clear
82	85	Depression	Gjerdingen	2009	USA	Postpartum (<=1 year)	SF-36	Yes	Not clear	Yes	Yes	Not clear	Yes
83	86	Depression	Gjerdingen	2011	USA	Postpartum (<=1 year)	PHQ-9	Yes	Not assessed	Not assessed	Yes	Yes	Not assessed
84	87	Depression	Goutaudier	2014	unknown (France	Postpartum (<=1 year)	Dyadic Adjustment Scale, Quality of Life Scale	Yes	Not clear	Not assessed	Not clear	Not clear	Yes#
85	88	Depression	Hou	2014	China	Postpartum (<=1 year)	Pittsburgh Sleep Quality Index	No	Not assessed	Not assessed	Not assessed	Not assessed	Not clear
86	89	Depression	Howard	2011	UK	Postpartum (<=1 year)	SF-12	Yes	Not clear	Yes	Not clear	Not clear	Not clear
87	90	Depression	Howell	2006	USA	Postpartum (<=1 year)	SF-12	Yes	Yes	Not assessed	Not assessed	Not assessed	Not assessed
88	91	Depression	Logsdon	2011	US	Postpartum (<=1 year)	GAF Scale	No	Not clear	Yes	Yes	Yes	No
89	92	Depression	Meltzer-Brody	2014	US	Postpartum (<=1 year)	Work and Social	No	Not assessed	Not clear	Not clear	Not clear	Not assessed
90	93	Depression	Milgrom	2006	Australia	Postpartum (<=1 year) (6 mos)	Parenting Stress Index (PSI)	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
90	93	Depression	Milgrom	2006	Australia	Postpartum (<=1 year) (12 mos)	Parenting Stress Index (PSI)	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
91	94	Depression	Moayedoddin	2013	Switzerland	Postpartum (<=1 year)	Impression (CGI), Parent-Infant Relationship Global	No	Not clear	Yes	Yes	Yes	Yes
92	95	Depression	O'Mahen	2014	UK	Postpartum (<=1 year)	Work and Social Adjustment Scale (WSAS)	No	Not assessed	Not clear	Not clear	Not clear	Not assessed
93	96	Depression	Posmontier	2008	USA	Postpartum (<=1 year)	Inventory of Functional Status After Childbirth	Yes	Not clear	Not clear	Yes	Yes	Yes#
94	97	Depression	Rojas	2006	Chile	Postpartum (<=1 year)	SF-36	No	Yes	Yes	Yes	Yes	Yes
95	98	Depression	Sadat	2014	Iran	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
96	99	Depression	Sword	2011	Canada	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Not clear	Not clear	Not clear
71	74	Depression	Wilkins	2012	UK	Postpartum (<=1 year)	SF-36	Yes	No	No	Not clear	Not clear	Not clear
90	93	Depression	Milgrom	2006	Australia	Postpartum (> 1 year)	Parenting Stress Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
97	100	Depression	Moel	2010	USA	Postpartum (both <=1 and	Dyadic Adjustment Scale	Yes	Not clear	Not clear	Not clear	Not clear	Yes
98	101	Depression	Mulcahy	2010	Australia	Postpartum (both <=1 and	Dyadic Adjustment Scale	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
99	102	Depression	Paris	2009	USA (assumed)	Postpartum (both <=1 and >1 year)	Parenting Stress Index-Short form Maternal Self-Report Inventory-Short form Dyadic Adjustment Scale	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
100	103	Depression	Silver	2006	USA (assumed)	Postpartum (both <=1 and	Parenting Stress Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
81	84	Depression	Darcy	2011	USA	Postpartum (both <=1 and	SF-12	Yes	No	No	Not clear	Not clear	Not clear
101	104	Depression	Morrell	2009	UK	Postpartum (<=1 year) (6 wks)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Yes
101	104	Depression	Morrell	2009	UK	Postpartum (<=1 year) (6 mos)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Yes
102	105	Depression	Paulson	2006	USA	Postpartum (unknown)	Own	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
103	107	Depression	De Tychey	2008	France	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
104	107	Multiple	Bindt	2012	Ghana & Côte d'Iv	Antepartum	WHODAS	no	Not clear	Not clear	Not clear	Not clear	Yes
105	108	Multiple	Senturk	2012	Ethiopia	Antepartum	WHODAS	Yes	Not clear	Not clear	Yes	Not clear	Not clear
105	108	Multiple	Senturk	2012	Ethiopia	Postpartum (<=1 year)	WHODAS	Yes	Not clear	Not clear	Yes	Not clear	Not clear
106	109	Obsessive-compulsive disorder	Gezginc	2008	Turkey	Antepartum	WHOQOL-BREF	Yes	Yes	Yes	Not assessed	Yes	Not assessed
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Antepartum (3rd trimester)	SF-36, Guy's neurological disability scale (GNDS); multiple sclerosis impact scale (MSIS-31); expanded disability status scale (EDSS)	Yes	No	No	No	No	No
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Antepartum (1st trimester)	SF-36, GNDS, MSIS-31, EDSS	No	No	No	No	No	No
108	111	Multiple sclerosis	Gulick	2007	USA	Postpartum (<=1 year)	Activities of Daily Living (ADL) scale for persons	No	Yes	Yes	Yes	Yes	Not assessed
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Postpartum (<=1 year) (4-8 wks)	SF-36, GNDS, MSIS-31, EDSS	Yes	No	No	No	No	No
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Postpartum (both <=1 and >1 year) (9 mos or more)	SF-36, GNDS, MSIS-31, EDSS	Yes	No	No	No	No	No
109	112	Anemia	Beard	2005	South Africa	Postpartum (<=1 year)	Digit Symbol Test, Perceived Stress Scale	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
110	113	Anemia	Perez	2005	South Africa	Postpartum (<=1 year)	Parent/Caregiver Involvement Scale	Yes	Not clear	Not clear	Not clear	Not clear	Yes
111	114	Anemia	Khalafallah	2012	Australia (Tasman	Postpartum (> 1 year)	SF-36	Yes	yes	Yes	Yes	yes	Not clear
112	115	Enteritis and colitis	Ananthakrishnan	2012	USA	Antepartum	Short inflammatory bowel disease questionnaire	No	Not clear	Not clear	Not assessed	Not clear	No
113	116	Bronchial asthma	Nickel	2006	Germany?	Antepartum	SF-36	No	No	Yes	Yes	Yes	Yes
114	117	Faecal incontinence	Espuna-Pons	2012	Spain	Antepartum	Wexner Faecal Continence Grading Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
115	118	Faecal incontinence	Johannessen	2014	Norway	Antepartum	FIQL	No	Not assessed	Yes	Not assessed	Yes	Yes
116	119	Faecal incontinence	Roos	2009	UK	Postpartum (<=1 year)	Manchester Health Questionanire	No	Yes	Yes	Yes	Yes	Yes
117	120	Faecal incontinence	Pla-Marti	2007	Spain	Postpartum (> 1 year)	FIQL	No	Not assessed	Yes	Not assessed	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (6 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (12 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (18 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (24 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
119	122	Fistula	Browning	2008	Ethiopia	Not specified	Own	Yes	Yes	Not clear	Not clear	Yes	Yes
120	123	Fistula	Siddle	2012	Tanzania	Not specified	Own	No	Yes	Yes	Yes	Yes	Not assessed
121	124	Fistula	Muleta	2008	Ethiopia	Postpartum (> 1 year)	Own	No	Yes	Not assessed	Not assessed	Not assessed	Yes
122	125	Fistula	Bangser	2011	Uganda	Postpartum (both <=1 and >8 year)	Own	No	Yes	Yes	Yes	Yes	Yes
122	125	Fistula	Bangser	2011	Tanzania	Postpartum (both <=1 and >9 year)	Own	No	Yes	Yes	Yes	Yes	Yes
123	126	Fistula	Umoiyoho	2011	Nigeria	Postpartum (both <=1 and >9 year)	WHOQOL-BREF	Yes	No	Yes	No	Yes	Yes
124	127	Fistula	Landry	2013	Bangladesh, Guine	Postpartum (> 1 year)	Own	No	Not assessed	Not assessed	Yes	Yes	Yes
125	128	Fistula	Nielsen	2009	Ethiopia	Postpartum (> 1 year)			Not clear	Not clear	Not clear	Not clear	Yes
126	129	Urinary incontinence	Adaji	2010	Nigeria	Antepartum	ICIQ-UI	No	Not assessed	Not assessed	Not assessed	Not assessed	No
127	130	Urinary incontinence	Ruiz de Vinaspre H	2011	Spain	Antepartum	IIQ-7	No	Not assessed	Not assessed	Not assessed	Not assessed	No
128	131	Urinary incontinence	Erbil	2011	Turkey	Antepartum	Own	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
114	131	Urinary incontinence	Espuna-Pons	2012	Spain	Antepartum	ICIQ-SF	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
129	133	Urinary incontinence	Kocaoz	2010	Turkey	Antepartum	Wagner's Quality of Life	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
130	134	Urinary incontinence	Oliveira Claudia	2013	Brazil	Antepartum	ICIQ-SF	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
131	135	Urinary incontinence	Arrue	2010	Spain	Postpartum (<=1 year)	ICIQ–UI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
132	136	Urinary incontinence	Hermansen	2010	Denmark	Postpartum (<=1 year)	IIQ-7	No	Yes	Yes	Yes	Yes	Yes
133	137	Urinary incontinence	Jeddi	2014	Iran	Postpartum (<=1 year)	IIQ-7	No	Yes	Yes	Not assessed	Yes	Yes
134	138	Urinary incontinence	Leroy	2005	Brazil	Postpartum (<=1 year)	SF-36, King's Health Questionnaire (KHQ), ICIQ-SF	Yes	Yes	Yes	Yes	Yes	Yes
135	139	Urinary incontinence	Torrisi	2011	Italy	Postpartum (<=1 year)	ICIQ-SF, King's Health Questionnaire	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
136	140	Urinary incontinence	Ege	2008	Turkey	Postpartum (<=1 year)	Own	No	Not assessed	Not assessed	Not assessed	Yes	Yes

Note 1: The impacts are determined based on authors' interpretations of their study findings when the studies did not have a control or comparison group, or did not report women's functioning between morbidity and non-morbidity group statistically. When only summary measures are reported, sub-scales are coded as not clear. Self-reported general health status and sexual functioning were categorised as other domain.

FIQL=Faecal Incontinence Quality of Life Scale, FSFI=Female Sexual Function Index, GAF Scale = Global Assessment of Functioning, ICIQ=International Consultation on Incontinence Questonnaire, IIQ-7=Incontinence Impact Questionnaire, PFDI-20=Pelvic Floor Distress Inventory, PFIQ-7=Pelvic Floor Impact Questionnaire, PHQ-9=Patient Health Questionnaire, PISQ-12=Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire, PUQE=Pregnancy-unique quantification of emesis, VEINES-QOL = The Venous Insufficiency Epidemiological and Economic Study (VEINES)- QOL/Sym Questionnaire

refers to mixed results

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-8
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	8
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	8
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	9-10
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	8-9
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	10-11
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	10
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	10
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	NA
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	NA
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	NA

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	11
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	11-12
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Table 1&2
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	NA
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Appendix 2
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NA
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NA
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	20-25
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	23-24
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	24-25
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	25

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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Consequences of maternal morbidity on health-related functioning: a systematic scoping review

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Consequences of maternal morbidity on health-related functioning: a systematic scoping review

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ABSTRACT

Objectives: To assess the scope of the published literature on the consequences of maternal morbidity on health-related functioning at the global level and identify key substantive findings as well as research and methodological gaps.

Methods: We searched for articles published between 2005 and 2014 using Medline, Embase, Popline, CINAHAL Plus, and 3 regional bibliographic databases in January 2015.

Design: Systematic scoping review

Primary outcome: Health-related functioning

Results: After screening 17,706 studies, 136 articles were identified for inclusion. While a substantial number of papers have documented mostly negative effects of morbidity on health-related functioning and wellbeing, the body of evidence is not spread evenly across conditions, domains or geographical regions. Over 60% of the studies focus on indirect conditions such as depression, diabetes and incontinence. Health-related functioning is often assessed by instruments designed for the general population including the 36-item Short Form (SF-36), or disease-specific tools. The functioning domains most frequently documented are physical and mental; studies that examined physical, mental, social, economic, and specifically focused on marital, maternal and sexual functioning, are rare. Only 16 studies were conducted in Africa.

Conclusions: Many assessments have not been comprehensive and have paid little attention to important functioning domains for pregnant and postpartum women. The development of a comprehensive instrument specific to maternal health would greatly advance our understanding of burden of ill health associated with maternal morbidity and help to set priorities. The lack of attention to consequences on functioning associated with the main direct obstetric complications is of particular concern.

Review registration: CRD42015017774

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Comprehensive review which includes a full range of maternal morbidities during pregnancy, childbirth and postpartum, and assesses the impact on physical, mental, economic and social functioning.
- A quantitative meta-analysis could not be conducted given the wide range of conditions, tools, measures and timing of assessment of functioning.

KEYWORDS

Maternal health, Maternal morbidity, Functioning, Health status, Quality of life, International Classification of Functioning, Disability and Health, Systematic review, Questionnaires

INTRODUCTION

Maternal morbidity occurs frequently, but is poorly studied. At present, there are an estimated 27 million episodes of direct complications occur annually.[1] The burden of maternal morbidity is much larger than this estimate when indirect complications and long-term sequelae are added to the calculation, some of which can be particularly common.[1,2] For example, anaemia affects 32 million (a range of 28 to 36 million) pregnant women per year according to a model.[3] However, these estimates on the epidemiology of maternal morbidity are based upon varying criteria; which has prompted the establishment of the World Health Organization (WHO) Maternal Morbidity Working Group (MMWG) to develop a standard definition and measurement criteria.

By defining maternal morbidity as "any health condition attributed to and/or complicating pregnancy and childbirth that has a negative impact on the woman's wellbeing and/or functioning",[4] the WHO MMWG emphasizes the need for comprehensiveness in the evaluation of the maternal morbidity burden. Concurrently, global attention in policies such as the Strategies toward Ending Preventable Maternal Mortality (EPMM) is shifting from focusing on maternal mortality, which is decreasing, to focusing on women who survive and addressing their morbidities.[5] Indeed, while there is increased focus on describing the levels and patterns of maternal morbidity,[1,6-8] the extent to which this morbidity collectively impacts upon women's health-related functioning is poorly understood.[9,10]

Studies in the United States of America and Canada have demonstrated that pregnancy itself limits aspects of women's functioning.[11,12] Changes in physical functioning from first to second trimesters, and from second to third trimester have been observed among women with uncomplicated pregnancies.[11,13-15] While acute complications soon disappear after childbirth for most women, others may develop sequelae and experience certain health conditions, such as fatigue, sleep-related problems, pain and concerns about sexual activities, depression, anxiety,

haemorrhoids and constipation. These often last well over the six weeks of puerperium[16,17] and have even been documented to peak around six months after delivery before declining.[18] Therefore, the additional effects of maternal morbidity on women's functioning are important to comprehend, particularly with respect to differentials in patterns, duration, size and risk factors.[4]

The effects of maternal morbidity extend beyond the physical or the psychological to also social and economic. In Sri Lanka, 90% of pregnant women reported at least one episode of perceived ill health during pregnancy and 26% of them reported that they required another person to replace them in their routine activities because they were unwell.[19] One hypothesis is that the more severe the maternal morbidity experienced the more likely the negative consequences. A handful of recent cohort studies have shown that women diagnosed with severe obstetric complications (including 'near-miss') had a higher risk of health, social and economic adversities persisting well beyond pregnancy and the six-week postpartum period compared to women with uncomplicated childbirth.[20-28]

The most comprehensive source of summarised evidence to date on the consequences of maternal morbidity is a systematic review on health- related quality of life (HRQOL) after childbirth.[29] This review of 66 articles concentrated on the physical, social and psychological domains. While it did not focus specifically on the effects of maternal morbidity, the authors found that urinary incontinence and HIV were negatively correlated with quality of life, and that depression had an impact on health status scores such as those measured by the 36-item Short Form (SF-36).[29] More recently, Andreucci et al. reviewed the effects of maternal morbidity on sexual dysfunction. Despite the substantial methodological heterogeneity between studies they found an association between perineal injuries with increased dyspareunia and delayed resumption of sex after childbirth.[30] In contrast a recent cohort study shows sexual function 3 months after delivery, for women who had

severe maternal morbidity, was similar to the level of the control group.[31] The effects of other maternal morbidities on health-related functioning and quality of life have rarely been investigated in systematic reviews.[29] Additionally, studies such as those mentioned above, focus on the impact of a morbidity with a limited, anatomical interpretation (i.e. a perineal injury's impact on a woman's sexual life), rather than a more holistic view on how women's everyday abilities may be impacted (e.g. her overall relationship with her partner, not limited to sex, or her ability to care for the child or resume her economic activity).

Concepts and measurement of health-related functioning and quality of life/wellbeing

In practice, the difference between health-related functioning and health-related quality of life (HRQOL) may be ambigious, as there is overlap. Functioning and disability (the negative correlate of functioning) are conceptualised by the International Classification of Functioning, Disability and Health (ICF). The ICF classified functioning and disability into three levels: at the level of body or body part, the whole person, and the whole person in a social context. Disability is defined as "the outcome of the interaction between a person with an impairment and the environmental and attitudinal barriers he or she may face".[32] The concept of disability is not restricted to impairment of body function and structures. It encompasses loss or limited capacity to execute a task or action by individual (e.g. eating, standing, walking), and to be involved in a life situation in an environment (e.g. employment). The ICF is also the international classification and metrics for organising and reporting health and disability data which enables us to use common metrics over time and space.

Quality of life (QOL) and the more specific notion of HRQOL are also widely used to understand how diseases or the absence of disease influence the lives of individuals. It relates to the broader concept of wellbeing than the concept of health-related functioning, and encompasses perception of life satisfaction which is shaped by many factors including health.[33] Although there are many definitions, QOL has been defined by WHO as the "individual's perception of their position in life in

the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns".[33] As explicitly stated in the WHO's definition, QOL gives weight to individual's perception of the ability to lead a fulfilling life.[34] The concept of HRQOL encompasses aspects of QOL which can clearly affect health or be affected by health conditions, and is defined as "optimum levels of mental, physical role and social functioning, including relationships and perceptions of health, fitness, life satisfaction and wellbeing".[35] In contrast, health-related functioning does not focus on individual's perception or subjective wellbeing. It can be based on established comparable parameters such as the ICF, and provide more precise information on level of functioning than HRQOL.[36] Effective health care planning and management needs comparable data on level of functioning, which predict work performance, return to work potential, likelihood of social integration, or receipt of disability benefits.[32]

Health-related functioning and HRQOL are important patient-reported health outcomes which have been used in other sectors of public health to measure the effectiveness of intervention or to allocate resources.[37] However, most of the existing studies of maternal health focus on mortality and morbidity, and there is limited research that aims to assess women's quality of life as a primary outcome.[38] The guidelines on postnatal care up to 8 weeks after births developed by the British National Institute for Health and Care Excellence (NICE) recommends health professionals to check women's physical, emotional and social wellbeing.[39] More complete data on maternal morbidities and consequences would contribute to setting priorities for reducing the burden of maternal ill-health.

Nonetheless, measurement of health-related functioning and quality of life is complex. While these concepts are concerned with individual's perceptions of personal health, wellbeing and satisfaction with health status and life, pre-determined quantitative scales are often applied. There are a number of standardised generic instruments used to measure functioning and quality of life. For

instance, the SF-36 is one of the most commonly used tools for assessing functioning and wellbeing, and often employed to assess the performance of new instruments. The SF-36 has been validated among women in early pregnancy.[40] However, women during late pregnancy or postpartum were not taken into account during the instrument development process, and indeed, no generic tools assessed their reliability, validity or responsiveness for these specific populations in different settings.[41] Tools developed specifically for use in relation to maternal health include the Inventory of Functional Status After Childbirth (IFSAC), which focuses on social functioning,[42] the Mother Generated Index, which is self-created by each individual woman to assess the effect of having a new baby on her quality of life,[43] and the Maternal Postpartum Quality of Life tool (MAPP-QOL) with emphasis on women's satisfaction with various areas of their life during early postpartum.[44] All of these tools are concerned with events in the postpartum period in relation to the experience of childbirth, were validated in relatively homogenous and small study populations and have been applied infrequently [41].

As members of the MMWG, we conducted a systematic scoping review of the published literature on the short- and long-term consequences of maternal morbidity on health-related functioning to assess the scope of the literature at the global level, identify key substantive findings as well as research and methodological gaps.[45] In this paper, we critically appraise the available literature with particular interest in the type of conditions studied, the tools used, the range of domains considered, the timing of assessment, the study design and geographical coverage. We then qualitatively assess the range of domains studied and the effects of morbidity. Finally, we focus on two conditions, hyperemesis gravidarum and incontinence during pregnancy to illustrate characteristics of included studies and the impacts on health-related functioning.

METHODS

Data sources and search strategy

We adapted a WHO generic protocol used in all the systematic reviews conducted by members of the MMWG.[10,46] The protocol is registered in PROSPERO (CRD42015017774. http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015017774). We searched relevant articles published between 1st January 2005 and 31st December 2014 using a structured search strategy in four bibliographic electronic databases (Medline, Embase, Popline, CINAHAL Plus) and three WHO regional databases (Latin American and Caribbean Center on Health Sciences Information (LILACS), African Index Medicus (AIM) and the West Pacific Region Index Medicus (WPRIM)) in January 2015. We focused on the literature published in 2005 or later given the size of literature and because we expect to have more papers relevant to our aim in recent years in view of the fact that the ICF that provides a comprehensive framework of health-related functioning was introduced by WHO only in 2002.

A full search strategy for each database was developed using thesaurus (including MeSH) and free-text terms for maternal morbidity and health-related functioning. We added search terms relating to individual maternal health conditions based on the maternal morbidity matrix constructed by Chou et al.[4] The outcome for this review, health-related functioning, encompasses multiple dimensions, such as cognitive, physical, mental, social and economic functions, and the terms relating to each of these concepts were included in the search strategy. While the primary focus of the systematic scoping review is the negative impact of morbidity on health-related functioning, health-related quality of life findings (and other concepts capturing the consequences of morbidity) were added to make sure that we captured all of the relevant literature. This is also because the WHO maternal morbidity definition includes both the terms 'wellbeing' and 'functioning'. The search strategy is available in supplementary appendix 1.

Inclusion and exclusion criteria

All studies were eligible for inclusion if they met the following criteria: 1) the study population included at least 30 women who experienced maternal morbidity during pregnancy, childbirth or one year after delivery or spontaneous abortion; and 2) results included quantitative data on health-related functioning by maternal morbidity status. Thus, we included any studies which assessed outcome, i.e. health-related functioning, at any time after delivery because we aimed to examine long-term as well as short-term consequences of maternal morbidities. We excluded intervention studies if respondents were all treated and the primary objective of the study was comparisons of treatment. Studies with no primary data were excluded. All other study types were eligible. There were no language restrictions.

Induced abortion, stillbirth and preterm birth were excluded from this review when they were the only exposure in a study. While these outcomes may be associated with maternal complications, they are not exclusively maternal morbidities. Intimate partner violence, substance use, smoking, alcohol, female genital mutilation and multiple pregnancies were also not considered maternal morbidities for the purposes of this review, though these factors increase the risk of maternal morbidities. A number of studies assessed depression or depressive symptoms as consequences of maternal morbidities using screening tools such as the Edinburgh Postnatal Depression Scale (EPDS) or the 9-item Patient Health Questionnaire (PHQ-9). Although individual questionnaire items in some of these tools imply women with the condition have low level of functioning, we excluded studies that did not explicitly report on mental functioning as an outcome as it was not possible to separate characteristics and severity of depressive symptoms, and level of functioning. Studies which assessed any of the following: practice of breastfeeding, self-efficacy, locus of control, confidence, competence, self-esteem, life satisfaction and social support, as an outcome but did not assess this in the context of women's health-related functioning were not included. Although maternal-infant

interaction was sometimes chosen as an outcome in studies on depression, this review excluded studies if they did not explicitly examine woman's ability to care for her child as functioning.

Selection and data extraction

Four authors (KM, AH, JC, VF) with help from a research assistant (LP) screened title and abstracts. At the beginning of the screening, a pilot test of 100 papers by three reviewers (KM, AH, JC) was conducted to help achieve inter-rater reliability. Evaluation of full text reports was done by four authors (KM, AH, JC, VF), with reasons for exclusion recorded for excluded papers. Data extraction from the full-text report was conducted by a single author for each retained paper (KM, AH, JC, VF, MB, DC); information was extracted on: location of study, study dates, study design, study population, sampling, case definition of maternal morbidity, methods of measurement of health-related functioning and the timing of the assessment, and measures of functioning by morbidity status. When a study assessed multiple maternal morbidities or examined health-related function several times, data of functioning for each health condition and at each time point of observation were extracted. Throughout the reviewing and extraction processes, articles where uncertainty existed were discussed with another reviewer and consensuses reached. Finally, as it is not possible to summarise the results statistically across studies by morbidity because of their differences with respect to research questions, study designs, outcome measures, timing of measurement and control group, two authors (KM, VF) qualitatively assessed each paper to determine the impact of the morbidity on five domains: physical, mental, economic, social and other (see supplementary appendix 2). If there had been a set of articles that used a given tool to assess impacts of a clearly defined maternal health condition on a well-defined functioning (or dimension(s) of functioning) at a given period among women with similar characteristics, we could have combined the quantitative results and conduct a meta-analysis. Self-reported general health status, maternal, sexual or marital functioning were categorised as 'other' domain. The economic domain was interpreted broadly and included ability to conduct both paid and unpaid work. We relied on authors' interpretations of their

study findings when the studies did not have a control or comparison group, or did not provide a statistical test comparing women's functioning between morbid and non-morbid groups. Appraisal of the quality of studies was conducted based on definition of maternal morbidity and health-related functioning, inclusion of relevant controls, sampling methods and completeness of data. Despite a high proportion of poor quality of studies for the purpose of the study, we included all publications relevant to our study aim in this scoping review.

RESULTS

Our initial database search identified 17,706 relevant studies. After screening of titles and abstracts, 382 papers were retained. Of those, we excluded a total of 246 articles after full-text review and data extraction. The main reason for exclusion was lack of well-defined maternal morbidity or health functioning data. Finally, 136 papers were identified for inclusion (Fig. 1).

< Fig 1 insert here>

Fig 1. Study selection for inclusion in the systematic scoping review

Using the classification of maternal morbidity constructed by Chou et al.,[4] the vast majority of the included articles, 84 articles out of 136 (62%), addressed the consequences of indirect causes of morbidity on health-related functioning (see Table 1). The studies were concentrated in Europe and North America (56%, 76 studies), and only 12% (16 studies) were located in Africa. Health-related functioning in the immediate or extended postpartum period, especially within one year of delivery, was more commonly studied, compared to the antepartum period. Cohort study was a particularly common study design. Almost half of the included papers (46%, 63 studies) did not have a control group.

Table 1: Description of included studies

	Direct morbidity (N=52)	Indirect morbidity (N=84)	Total (N=136)
Region			
Africa	5.8%	15.5%	11.8%
Asia	15.4%	20.2%	18.4%
Europe	48.1%	26.2%	34.6%
Latin America and the Caribbean	3.8%	6.0%	5.1%
North America	13.5%	26.2%	21.3%
Oceania	7.7%	3.6%	5.1%
Multiple	5.8%	2.4%	3.7%
Timing of assessment of functioning			
Antepartum	19.2%	27.4%	24.3%
Antepartum and postpartum	11.5%	7.1%	8.8%
Postpartum (<=1 year)	26.9%	42.9%	36.8%
Postpartum (>1 year)	23.1%	6.0%	12.5%
Postpartum (both <=1 year and > 1 year)	7.7%	11.9%	10.3%
Postpartum (unknown)	1.9%	2.4%	2.2%
Not specified	9.6%	2.4%	5.1%
Study design			
Cohort	63.5%	40.5%	49.3%
Cross-sectional	23.1%	41.7%	34.6%
Trial	7.7%	15.5%	12.5%
Case-control	5.8%	2.4%	3.7%
Comparison (control) group relevant to maternal morbidity & functioning			
Yes	61.5%	48.8%	53.7%
No	38.5%	51.2%	46.3%
Total	**100%**	**100%**	**100%**

Table 2 presents distributions of 140 maternal health conditions which were studied as exposures in the 136 included articles. The three most frequent maternal morbidity diagnoses studied were mental disorders (33%, 45 studies), incontinence (12%, 17 studies) and perineal laceration (9%, 13 studies). Hyperemesis gravidarum, and nausea and vomiting of pregnancy were studied in 9 studies (6%) (See Box 1). The consequences on health-related functioning of potentially more severe direct obstetric conditions, such as obstetric haemorrhage or severe pre-eclampsia and eclampsia, were not frequently studied. There is limited data on the consequences of puerperal sepsis on health-related functioning except in 3 near-miss studies.

Health-related functioning and wellbeing were measured by applying a number of existing tools (Table 3). The SF-36 was the most common tool applied and used in 32 studies (22%). It was particularly common in studies of gestational diabetes and mental disorders. The Short Form 12 (SF-12), the World Health Organization Quality of Life tool (WHOQOL-BREF), and WHO Disability Assessment Scale (WHODAS) 2.0 were used in fewer than 10 studies each. Over 30 studies used disease-specific tools. Seventeen studies on incontinence were documented, and the International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form (ICIQ-UI-SF), the Incontinence Impact Questionnaire (IIQ-7), the Faecal Incontinence Quality of Life (FIQL) Score, and the King's Health Questionnaire and Manchester Health Questionnaire were commonly used. While these existing tools were often adopted, many studies applied other tools, especially in studies on mental disorders, including Female Sexual Function Index (6 studies), Global Assessment of Functioning (4 studies) and Pittsburgh Sleep Quality Index (2 studies).

Table 2: Distribution of maternal conditions

DIRECT MATERNAL MORBIDITY	Number of conditions	Percent
Delivery/Termination (N=7)		
Gestational Trophoblastic Disease	6	4.3
Obstructed Labour	1	0.7
Hypertensive Disorders (N=7)		
Gestational hypertension	2	1.4
Pre-eclampsia/eclampsia	5	3.6
Obstetric Haemorrhage (N=3)		
Postpartum Haemorrhage	3	2.1
Other obstetric complications (N=23)		
Gastrointestinal (N=9)		
Nausea and Vomiting of Pregnancy	3	2.1
Hyperemesis gravidarum	6	4.3
Endocrine(N=8)		
Diabetes Mellitus (Gestational Diabetes)	8	5.7
Others (N=6)		
Deep Vein Thrombosis	1	0.7
Near-miss[1]	3	2.1
Multiple obstetric conditions	2	1.4
Unanticipated complications (N=14)		
Perineal laceration	13	9.3
Spontaneous abortion	1	0.7
INDIRECT MATERNAL MORBIDITY		
Anaemia	3	2.1
Endocrine, nutritional and metabolic diseases (N=2)		
Type 1 diabetes	1	0.7
Cystic Fibrosis	1	0.7
Infection (N=5)		
HIV infection	5	3.6
Mental disorders (N=45)		
Depression	42	30.0
Obsessive Compulsive Disorder	1	0.7
Multiple	2	1.4
Diseases of the respiratory system complicating pregnancy, childbirth and the puerperium (N=1)		
Bronchial asthma	1	0.7
Diseases of the Genitourinary System (N=24)		
Urinary/Faecal/Anal incontinence	17	12.1
Fistula	7	5.0
Diseases of the Nervous System (N=2)		
Multiple Sclerosis	2	1.4
Diseases of the circulatory system (N=1)		
Heart disease	1	0.7
Diseases of the digestive system (N=3)		
Enteritis and colitis	1	0.7
Gastro-oesophageal reflux disease	1	0.7
Functional intestinal disorders	1	0.7

TOTAL	140	100.0

[1]includes an indirect cause, severe anaemia.

Table 3: Distribution of maternal conditions by type of tools used in the included studies to measure wellbeing and functioning

	Health-functioning tool							
	SF-36	SF-12	WHOQOL-BREF	WHODAS 2.0	Disease-specific	Own tool	Others	Total
DIRECT MATERNAL MORBIDITY								
Delivery/Termination	0	1	1	0	1	2	2	7
Hypertensive Disorders	3	1	1	0	1	1	0	7
Obstetric Haemorrhage	2	0	0	0	0	1	0	3
Other obstetric complications	7	0	2	0	4	6	5	24
Unanticipated complications	3	1	0	0	6	2	4	16
INDIRECT MATERNAL MORBIDITY								
Maternal infectious and parasitic diseases	1	0	1	0	0	2	1	5
Mental disorders	11	4	2	2	0	1	27	47
Diseases of the Genitourinary System	1	0	1	0	13	8	3	26
Other indirect courses	4	0	0	0	6	0	3	13
Total	32	7	8	2	31	23	45	148

Note: 12 studies used more than one type of tool.

A list of the included articles and the impact of the morbidity on five domains of functioning: physical, mental, economic, social and other, which we assessed for each article in supplementary appendix 2. Among the 136 papers, 116 studies reported negative consequences of maternal morbidity; only 20 articles found no negative impact. There is no maternal health condition for which studies consistently showed no impact on health-related functioning. Physical and mental functioning were frequently assessed, and economic function was rarely studied. Studies of fistulae were often concerned with social, marital and economic domains, and perineal laceration studies

often documented sexual functioning. Lastly, environmental factors (facilitators and barriers) of women's functioning were rarely reported in the included papers except for a handful papers such as those addressing fistulae[47-51] and near-miss.[23] Boxes 1 and 2 illustrate characteristics of studies of hyperemesis gravidarum and incontinence during pregnancy and the impacts on health-related functioning.

Box 1: Hyperemesis gravidarum

Hyperemesis gravidarum, a severe and persistent form of nausea and vomiting in pregnancy, affects up to 1.5% of pregnant women, with an onset at about the 5th week of pregnancy, peaking at 8-12 weeks and usually resolving before the 20th week.[52] Only five studies examined health-related functioning as a consequence of hyperemesis gravidarum during pregnancy. They were all conducted in high-income countries except for one conducted in Turkey. Existing generic tools were used in three of these studies (Perceived Stress Scale (PSS), Brief Disability Questionnaire (BDQ), and Social Functioning Questionnaire (SFQ)). A disease-specific tool, Hyperemesis Impact Symptoms Questionnaire, was used in one study; and one study did not use any existing tool and researchers created their own items. Despite the different tools used, there was evidence of a significant impact of morbidity on women's daily lives in four studies while one study reported no impact. In a prospective cohort study of pregnant women with and without hyperemesis gravidarum, McCarthy et al. applied the Perceived Stress Scale and a Behavioural Response to Pregnancy Scale comprising of two subscales: limiting / resting behaviour (referring to a tendency to curtail activities of daily living in response to symptoms by resting).[53] Limiting / resting response and Perceived Stress Scale scores were higher in women with hyperemesis gravidarum than women without hyperemesis gravidarum after adjusting for possible confounders, such as age, smoking and ethnicity. As the limiting behaviour score normalised several weeks after vomiting ceased, a causal association between hyperemesis gravidarum and deteriorated functioning was suggested in this study. Ezberci et al. used the 11-item Brief Disability Questionanire to assess physical and social disability and

showed that the score was higher in women with hyperemesis gravidarum than women without (11.2 vs 8.5).[54] Power et al. developed and validated the 10-item Hyperemesis Impact of Symptom (HIS) questionnaire to assess how symptoms of hyperemesis gravidarum were impacting women's lives.[55] The authors showed a significantly higher mean HIS score in women with hyperemesis gravidarum than those without it (16.3 vs 5.6). On the other hand, McCormack et al. (2011) used a short 8-item Social Functioning Questionnaire to assess social functioning in different situations (such as at home, work or in relationships) and showed no difference in the Social Functioning Questionanire scores between women with and without hyperemesis gravidarum, both at around the peak of symptoms and after 26th week when vomiting had ceased.[56] It was unclear whether the small sample size (32 with hyperemesis gravidarum and 41 without hyperemesis gravidarum) or difference in gestational weeks among the women (hyperemesis gravidarum: 9.66 weeks (95% CI: 8.69-10.63), non-hyperemesis gravidarum: 12.27 weeks (95% CI: 11.71-12.83)) might have been responsible for the lack of association between hyperemesis gravidarum and impaired social functioning, or whether hyperemesis gravidarum may not have impacted the women's daily functioning. Poursharif et al. (2008) presented the type of problems women reported to have experienced as a consequence of hyperemesis gravidarum in a spontaneous response to the question "how have your life or future plans changed after experiencing hyperemesis?" These included problems with job or school, marital or family relationships and social isolation.[57] However, while the paper documented the negative psychological and social impact of hyperemesis gravidarum, the study had important limitations. It did not specifically focus on health-related functioning nor did it use a comprehensive conceptual framework, the online recruitment survey relied on self-referral and self-diagnosis of hyperemesis gravidarum, the duration (since hyperemesis gravidarum onset was not explored) and there was no comparison group.

Hyperemesis gravidarum is an example of a condition for which there is no dominant condition-specific tool. While three studies used generic tools and one study used only its own questions, the condition-specific tool developed by Power et al. appears to capture well how hyperemesis gravidarum-associated morbidity impacts key aspects of women's daily life. However, other domains of health-related functioning considered in the review (e.g sexual functioning) were not part of the condition-specific tool.

Box 2: Faecal and urinary incontinence during pregnancy

Incontinence is an example of a condition for which there are existing health-related functioning or quality of life tools, developed in the 1990s, and sometimes applied in pregnant and postpartum populations. Faecal or urinary incontinence, i.e. involuntary leakage of stool or urine, is a common antenatal condition from which up to 60% of women suffer during pregnancy.[58,59] Anatomical changes such as enlargement of the uterus putting increased pressure on the bladder are responsible. Five studies examined the association between urinary incontinence and health-related functioning during pregnancy, one examined the association with faecal incontinence and another assessed both faecal and urinary incontinence. Three were conducted in high-income countries and four in middle-income countries. Three studies used the International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form (ICIQ-UI-SF), which is comprised of three questions relating to severity of urinary incontinence and one question regarding impact on daily life. However, the studies differ with respect to the research question, study designs, outcome measures and control group.

In a Brazilian study, the mean composite ICIQ score was just above 12. There is no cutoff in the ICIQ score, but a mean score of 12 is considered as severe impact on quality of life.[60] A Nigerian cross-sectional study, which used ICIQ-UI-SF, reported that in 17% of women, urinary incontinence

interfered with daily life. The mean score of ICIQ-UI-SF among 43 women in this study was much lower than in the Brazilian study (4.05).[61] In a cohort study conducted in Spain, the impact of urinary incontinence was measured using the ICIQ-UI-SF and the percentage of women reporting an impact on daily life was high in each trimester with an upward trend as pregnancies progressed. Similar results were reported in women with double (urinary and anal) incontinence in this study. Another study in Spain, which used Incontinence Impact Questionnaire (IIQ-7) reported no impact on daily life.[62] The 28-item, condition-specific Wagner's Quality of Life Scale was used in a cross-sectional study from Turkey and 71% of women with urinary incontinence reported that it had an impact on their quality of life.[63] Erbil et al. developed 23-item questionnaire based on existing literature to explore the aspects of daily life affected by urinary incontinence in Turkey.[58] The study found that a large proportion of women were affected by urinary incontinence in some areas of their lives. Particularly affected were: daily activities (75%), feeling of discomfort (73%), liquid avoidance (53%), sexual life (47%), and isolation from environment (36 %). Johannessen et al. studied faecal incontinence during pregnancy and used the 29-item Faecal Incontinence Quality of Life Score (FIQOL) which has 4 sub-scales.[64] One quarter of the women in Norway reported that faecal incontinence in late pregnancy affected their behaviour and increased embarrassment. These studies suggest that women's daily lives were negatively affected by incontinence to a great extent. However, because of the use of condition-specific tools in assessing health-related functioning and hence the lack of a comparison group, functioning of healthy counterparts were not used as a benchmark in the majority of these studies.

DISCUSSION

While a substantial number of studies (N=116) have documented mostly negative effects of morbidity on health-related functioning and wellbeing during pregnancy and after childbirth, the body of evidence is not spread evenly amongst conditions, domains of health-related functioning or

geographically. Most studies focus on indirect conditions such as depression, diabetes and incontinence. The effects of direct obstetric complications, including haemorrhage and pre-eclampsia have rarely been studied, except for obstetric fistulae linked to obstructed labour, despite their importance in low- and middle-income countries. The functioning domains studied were also limited, most frequently documenting physical and mental categories; studies of fistulae were often concerned with social, marital and economic domains; and perineal laceration studies often documented sexual functioning. Studies that comprehensively documented all domains, including physical, mental, social, economic, and specifically focused on marital, maternal and sexual limitations, were rare and used their own tools instead of tools previously validated by others. This overall narrow focus on the women's perspective highlights the need for a tool to address the women's health-related functioning more holistically. Furthermore, most of the instruments reviewed have no link with a common data standard such as ICF. This is another reason why the data gathered from the instruments are in data silos, and it is impossible to compare and aggregate data across the studies. Finally, the number of studies, conducted in Africa region, where the morbidity DALYS are the highest, is small, with only 16 studies. These mostly concentrated on the effects of fistulae, depression and near-miss complications.

The geographical imbalance in our findings may be due to research in low- and middle-income countries putting greater emphasis on reducing maternal mortality, which has been a central focus of the Millennium Development Goals (MDGs) [65]. Greater localised interest in mental health and other chronic conditions which affect women over many years, including into menopause, is another reason for the concentration of studies in high-income countries. The proportion of studies on depression is also related to its high prevalence among postpartum women (prevalence from 13% to 19%),[8] specialised interest by psychiatrists and psychologists and concerns over its impact on child development[66]. Urinary incontinence is a very prevalent condition (estimated prevalence of stress

urinary incontinence at 41%, ranging from 19% to 60%[67]) and widely studied. As shown in the current review, urinary incontinence has been found to has negative impact on physical and psychological quality of life, but also socio-economical and sexual wellbeing of women's lives.

A high proportion of papers were found to be of poor quality for the purpose of this review, as many (46%) did not have an appropriate control group. The lack of adequate comparison group (such as women without the morbidity of interest, women with uncomplicated childbirth or at the very least women of reproductive age) is problematic when assessing the effects of maternal morbidity. Several cohort studies attempted to circumvent this problem by using the normative findings for their chosen tools available for the general population. However, this is not fully appropriate as pregnant women and women with small babies may be different from the general population and have special circumstances, such as those related to physically carrying a pregnancy and breastfeeding their small babies. They may also experience cultural limitations including their ability to leave home and perform the 'normal' activities of healthy adults such as paid and unpaid work. Use of normative findings could also lead to an under-estimation of the impact of maternal morbidity, as women who become pregnant are mostly very healthy.[68] It is these differences from the general population that need further research and a tool based on standardised concepts to provide better, more scientifically sound comparsions among pregnant and postpartum women.

As found in the other systematic review of health related functioning,[29] the majority of papers used SF-36. WHOQOL-BREF is also applied to capture quality of life. SF-36 is widely used, in view of its longevity (it was created in 1992), its availability (having been translated for use in more than 40 countries) and the accumulated evidence on its psychometric properties for different populations. It allows researchers to compare the impact of a range of diagnoses and conditions, not just obstetric and gynaecological conditions. It is also comprehensive, as it documents general health, physical

functioning, mental health, bodily pain, vitality, role limitations because of physical and emotional problems, and social functioning. Several maternal morbidity studies that used SF-36 and WHODAS 2.0 showed a correlation with morbidity, indicating that they have discriminant or predictive validity. Similar correlation was observed with condition-specific tools such as those available for incontinence. However, these generic and condition-specific tools have not been validated among pregnant or postpartum women in different settings. They also do not include maternal functioning, and they do not provide sufficient emphasis on economic, marital and sexual functioning which are important domains for women of reproductive age. Several reviewed studies assessed the consequences of maternal morbidity on the ability to breastfeed and respond to the baby's needs, although they did not assess them in the context of women's functioning.[69,70] This is a particularly important aspect of maternal functioning to investigate.

Therefore, we believe that a health-related functioning tool specific to maternal health should be developed to measure the impact of additional maternal morbidity or pregnancy. The tool would contribute to addressing the evidence gap in our knowledge on consequences of maternal morbidity on woman's daily life, and will advocate for the importance in improving the health of women during pregnancy, childbirth and postpartum. The three currently available tools for postpartum populations discussed earlier have limitations as they are either quality of life tools with an emphasis on satisfaction or feeling (MAPP-QOL and Mother Generated Index) or have too narrow in scope (IFSAC). The MAPP-QOL tool includes the majority of relevant domains including physical, psychological, social, marital sexual, economic and maternal functioning, but its focus on satisfaction and areas such as physical appearance and environment makes it unsuitable for measurement of health-related functioning. Ideally, a health-related functioning tool specific to maternal health would be comprehensive (physical, mental, social, economic, marital, sexual and maternal functioning) and should be applicable to conditions that occur during both pregnancy and

postpartum periods and comparable across different populations. A new tool specific to maternal health needs to link existing and new functional status measurement instruments to/from a common data standard and the conceptual framework of the ICF to enable us to compare health-related functioning data across studies.

Inclusion of environmental factors (facilitators and barriers) of women's functioning should also be accounted for in the development of a new instrument specific to maternal health. As noted earlier, disability is the outcome of the interaction with a person with a impairment and the environment.[32] Level of functioning varies by environmental factors, such as health services, support and attitudes from family members and communities.[71] Interventions that address not only women's impairment and personal factors but also modify the environment in which women with maternal morbidities live could improve women's health-related functioning in their daily lives.

The main strength of our systematic scoping review is its comprehensive search strategy with 17,706 papers screened. However, there are also limitations. While most of the papers found reduced health-related functioning among unwell pregnant or delivered women, this finding could be due to publication bias. As we only considered the published literature and did not review grey literature, we were unable to access the extent to which this was the case. Although we assessed quality of the studies based on definition of maternal morbidity and health-related functioning, inclusion of relevant controls, sampling methods and completeness of data, all publications relevant to our study aim in this scoping review were included. We relied on authors' interpretations of their study results when the studies did not have a control or comparison group, or did not provide a statistical test comparing women's functioning between morbid and non-morbid groups. Therefore, a bias may have been introduced in reporting impact of maternal morbidity on health-related functioning in the studies of poor quality. In addition, we may have over-emphasised the degree to which existing tools

document economic functions as some of the tools do not specifically address functioning at work, but rather asked about any difficulty in performing work or other regular daily activities to appreciate economic function (e.g. SF-36 "During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems?"). On the other hand, we may have underestimated the number of depression studies documenting maternal dysfunction as we excluded studies of mother-child interactions which did not explicitly address the functionality element. Lastly, while our qualitative approach fit well the objective of our scoping review, a quantitative meta-analysis of the findings to summarise the effects was not possible for any condition, as studies did not use the same analytical approach, tools, measures or timing of assessment for the different conditions under consideration.

CONCLUSION

While we found ample evidence that maternal morbidity impacts health-related functioning, the available literature does not appear to be sufficiently comprehensive because not all relevant functioning domains are studied and not all complications are studied to the same extent. The development of a scale specifically for maternal health, to be used alongside expansion of exisiting generic or condition-specific scales, such as WHODAS 2.0, would greatly advance our understanding of the burden of ill health associated with maternal morbidity and facilitate priority setting in maternal health, particularly with respect to its global dimension.

In the transition from the MDG to the Sustainable Development Goal (SDG) framework, tremendous attention is rightfully being placed upon the need to understand the entire context of maternal health. As countries reduce maternal mortality and improve overall health systems, denominated as the "obstetric transition", demonstrates an increasing proportion of maternal morbidity events.[72] The UN Secretary General's Strategy for Women's, Children's, and Adolescent Health, and initiatives

such as the Ending Preventable Maternal Mortality (EPMM) consultations focus direct attention on this phenomenon and call for a holistic approach to improve the health and wellbeing of women, children, and adolescents.[5,73] The objective is to ensure that all "survive, thrive, and transform". With regard to maternal health, it is critical to holistically understand the socioeconomic and environmental determinants that contribute to pregnancy and the spectrum of maternal health-related functioning. To achieve this, we suggest the use of a frequently applied generic tool such as SF-36 and WHODAS 2.0 when comparability with other studies is needed. We also call for more research on the effects of direct complication on health-related functioning.

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CONTRIBUTORSHIP STATEMENT

Conceived and designed the experiments: VF, DC, LS, KM. Developed protocol: KM, VF, JC, AH. Performed the experiments: KM, AH, JC, VF, MB, DC. Wrote the paper: KM, VF, AH. Commented on and helped revised the manuscript: JC, DC, MB, NK, LS.

DISCLAIMER

The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated.

COMPETING INTERESTS

None declared.

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DATA SHARING STATEMENT

No additional data available.

SUPPLEMENTARY APPENDICES

Appendix 1: Search strategy for Medline

Appendix 2: A list of included papers

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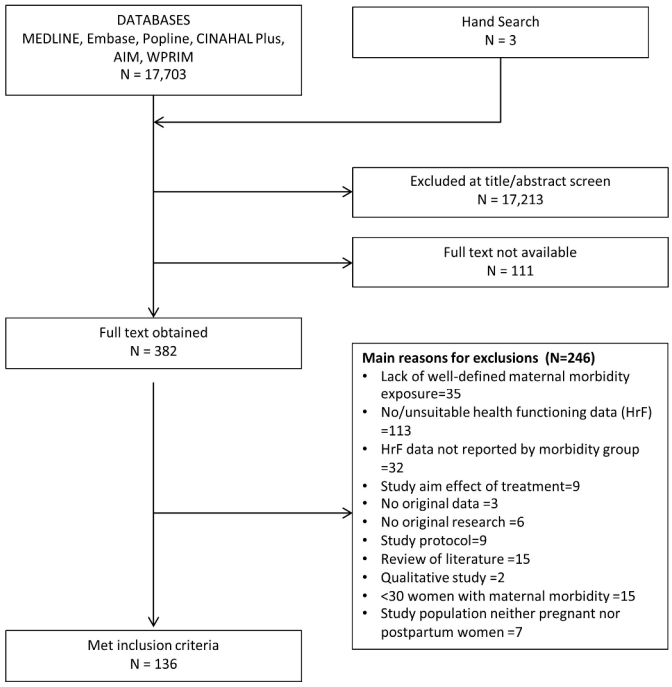

Fig 1. Study selection for inclusion in the systematic scoping review

254x190mm (300 x 300 DPI)

Supplementary Appendix 1: Search Strategy for Medline

1. (maternal or gestation$ or obstetric or labo$r or pregnan$ or partum or antepartum or intrapartum or postpartum or post partum or antenatal or postnatal or post partal or puerperal or puerperium).mp.
2. ((maternal or gestation$ or obstetric or labo$r or pregnan$ or partum or antepartum or intrapartum or postpartum or post partum or antenatal or postnatal or post partal or puerperal or puerperium) adj2 (health or well$being or morbid* or ill* or disorder$ or disease$ or disabilit* or impairment)).ab,ti.
3. exp obstetric labor complications/
4. exp pregnancy complications/

Insert Search StatementEdit Search Statement Delete Search Statement

5. ((pregnan$ or obstetric labo$r or maternal) and complication$).mp.
6. episiotomy/ or extraction, obstetrical/ or labor, induced/ or vaginal birth after cesarean/ or version, fetal/
7. or/3-6
8. ((ectopic or heterotopic or molar) and pregnancy).mp.
9. spontaneous abortion.mp.
10. or/8-9
11. 1 and (hyperten$ or eclampsia or pre-eclampsia or HELLP).mp.
12. (uter$ and (hemorrhage or haemorrhage or prolapse or inversion or rupture or trauma or damage or laceration or tear or dehiscence)).mp.
13. (placenta previa or placenta praevia).mp.
14. exp Hemorrhage/
15. (haemorrhage or hemorrhage).mp.
16. 1 and (or/12-15)
17. puerperal infection$.mp.
18. 1 and sepsis.mp.
19. exp Mastitis/
20. (amnionitis or chorioamnionitis or membranitis or placentitis or sepsis or endometritis or peritonitis or cervictis or vaginitis or trichomoniasis or Septic pelvic thrombosis or breast engorgement or ((breast or mammary or subareolar) and abscess)).mp.
21. ((breast or uter$ or genit$ or perineal or pelvic) and infection$).mp.
22. 1 and (or/17-21)
23. ((Hyperemesis or hyper-emesis) and gravidarum).mp.
24. 1 and exp "Wounds and Injuries"/
25. 1 and (trauma or damage or laceration or tear or dehiscence or rupture).mp.
26. or/23-25
27. exp Rectovaginal Fistula/ or exp urinary fistula/ or exp vesicovaginal fistula/ or exp vaginal fistula/
28. exp pelvic organ prolapse/
29. ((obstetric or vesico-vaginal or vesicovaginal or vaginal or rectovaginal or urinary) and fistula).mp.
30. exp Urinary Incontinence/
31. incontinence.mp.
32. 1 and (or/27-31)
33. exp depression/ or exp Depressive Disorder/ or exp Stress Disorders, Post-Traumatic/ or exp Mental disorders/ or exp Anxiety/ or exp Anxiety Disorders/ or exp Psychotic Disorders/ or exp mental health/ or exp panic/
34. (((Mental or psycho$) and (ill$ or disorder or health)) or psychosis or anxiety or phobi$ or panic).mp.

35. exp Suicide/
36. 1 and (or/33-35)
37. 1 and (exp bacterial infections/ or exp infection/ or exp virus diseases/ or exp parasitic diseases/)
38. 1 and (exp cardiovascular diseases/ or exp Respiratory Tract Diseases/)
39. 1 and exp skin diseases/
40. 1 and exp Endocrine System Diseases/
41. 1 and exp Digestive System Diseases/
42. 1 and exp Female Urogenital Diseases/
43. 1 and (exp Hematologic Diseases/ or exp Lymphatic Diseases/)
44. 1 and (exp Anemia/ or anemia.mp.)
45. 1 and exp Nervous System Diseases/
46. 1 and exp neoplasms/
47. 1 and exp Musculoskeletal Diseases/
48. 1 and (exp Metabolic Diseases/ or exp Nutrition Disorders/)
49. or/36-48
50. 2 or 7 or 10 or 11 or 16 or 22 or 26 or 32 or 49
51. (wellbeing or well-being).ab,ti.
52. exp Quality of life/
53. (quality of life or life qualit$).ab,ti.
54. exp "Activities of Daily Living"/
55. ((daily adj2 (work or activit$)) or activit$ of daily).ab,ti.
56. ((physical adj2 (health or function$ or ill$ problem$ or symptom$)) or mobility).ab,ti.
57. ((mental or psych$) adj2 (health or function$ or ill$ problem$ or symptom$ or distress)).ab,ti.
58. (depression or anxiety).ab,ti.
59. or/51-58
60. exp epidemiologic studies/
61. cohort studies/ or longitudinal studies/ or follow-up studies/ or prospective studies/ or retrospective studies/ or cohort.ti,ab. or longitudinal.ti,ab. or prospective.ti,ab. or retrospective.ti,ab.
62. Cross-Sectional Studies/ or cross-sectional.ti,ab. or ("prevalence study" or "incidence study" or "prevalence studies" or "incidence studies" or "transversal studies" or "transversal study").ti,ab.
63. Case-Control Studies/ or Control Groups/ or Matched-Pair Analysis/ or ((case* adj5 control*) or (case adj3 comparison*) or control group*).ti,ab.
64. Intervention Studies/ or evaluation studies/ or evaluation studies as topic/ or program evaluation/ or validation studies as topic/ or ((pre- adj5 post-) or (pretest adj5 posttest) or (program* adj6 evaluat*)).ti,ab. or (effectiveness or intervention*).ti,ab.
65. (((comprehensive* or systematic*) adj3 (bibliographic* or review* or literature)) or (meta-analy* or metaanaly* or "research synthesis" or ((information or data) adj3 synthesis) or (data adj2 extract*))).ti,ab.
66. or/60-65
67. 50 and 59 and 66
68. limit 67 to yr="1990-2014"
69. limit 68 to humans
70. limit 69 to female

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
Delivery/Termination													
1	1	Gestational Trophoblastic Disease	Cagayan	2008	Philippines	>1 year since remission	Own	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
2	2	Gestational Trophoblastic Disease	Quan	2010	China	>1 year since remission	Own tool based on SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
3	3	Gestational Trophoblastic Disease	Stafford	2011	Australia	>1 year since remission	FSFI	No	Not clear	Not assessed	Not clear	Not clear	Yes
4	4	Gestational Trophoblastic Disease	Ferreira	2009	Brazil	Antepartum	WHOQOL-BREF	No	No	Yes	Not assessed	No	No
5	5	Gestational Trophoblastic Disease	Cagayan	2010	Philippines	Not specified	SF-12	No	Yes	No	Not clear	Not clear	Not clear
6	6	Gestational Trophoblastic Disease	Ung	2005	Australia	Not specified	Sexual History Form-12 (SHF-12)	No	Not assessed	Not assessed	Not assessed	Not assessed	No
7	7	Obstructed labour	Badiou	2010	France	Postpartum (> 1 year)	FIQL	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
Hypertensive Disorders of Pregnancy													
8	8	Eclampsia	Wiegman	2012	The Netherlands	Postpartum (> 1 year)	the National Eye Institute Visual Function	Yes	Yes	No	No	Yes	Yes
9	9	Pre-eclampsia (Mild and severe)	Hoedjes	2011	The Netherlands	Postpartum (<=1 year) (6 wks)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
9	9	Pre-eclampsia (Mild and severe)	Hoedjes	2011	The Netherlands	Postpartum (<=1 year) (12 wks)	SF-36	No	No	Yes	Yes	Yes	Yes
10	10	Pre-eclampsia (Mild and severe)	Hoedjes	2012	The Netherlands	Postpartum (<=1 year)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear
11	11	Pre-eclampsia (Mile and severe)/Eclamp	Stern	2014	Austria	Postpartum (both <=1 and >6 year)	SF-12	Yes	No	Yes	Not clear	Not clear	Not clear
12	12	Pre-eclampsia (Severe)	Roes	2005	The Netherlands	Postpartum (both <=1 and >1 year)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Yes
13	13	Pregnancy-induced hypertension (PIH)	Kim	2005	USA	Antepartum	SF-36	Yes	Yes	No	Not assessed	Not assessed	No
14	14	Pregnancy-induced hypertension (PIH)	Mautner	2009	Austria	Antepartum	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
13	13	Pregnancy-induced hypertension (PIH)	Kim	2005	USA	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Not assessed	Not assessed	Yes
14	14	Pregnancy-induced hypertension (PIH)	Mautner	2009	Austria	Postpartum (<=1 year)	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
Obstetric haemorrhage													
15	15	Postpartum haemorrhage	Thompson Jane	2011	Australia&New Zealand	Postpartum (<=1 year) (2 mos)	SF-36	No	No	No	No	No	No
15	15	Postpartum haemorrhage	Thompson Jane	2011	Australia&New Zealand	Postpartum (<=1 year) (4 mos)	SF-36	No	No	No	No	No	No
16	16	Postpartum haemorrhage	Sentilhes	2011	France	Postpartum (> 1 year)	Own tool	No	Not assessed	Yes	Not assessed	Not assessed	Not clear
17	17	Postpartum haemorrhage	Prick	2014	Netherland	Postpartum (<=1 year)	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
Other obstetric complicatons													
18	18	Multiple	Iyengar	2012	India	Postpartum (<=1 year) (6-8 wks)	Own	Yes	Not assessed	Not assessed	Yes	Not assessed	No
18	18	Multiple	Iyengar	2012	India	Postpartum (<=1 year) (12 mos)	Own	Yes	Not assessed	No	Yes	Not assessed	Yes
19	19	Multiple	Leung	2010	Hong Kong	Postpartum (> 1 year)	SF-36	No	Yes	No	No	Yes	No
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (3 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Not assessed
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (6 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	Not assessed
20	20	Near-miss'	Filippi	2007	Burkina	Postpartum (<=1 year) (12 mos)	Own	Yes	No	Yes	Not assessed	Not assessed	Not assessed
21	21	Near-miss'	Filippi	2010	Benin	Postpartum (<=1 year) (6 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	No
21	21	Near-miss'	Filippi	2010	Benin	Postpartum (<=1 year) (12 mos)	Own	Yes	Yes	Yes	Not assessed	Not assessed	No

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
22	22	Near-miss'	Ilboudo	2013	Burkina Faso	Postpartum (> 1 year)	WHOQOL-BREF,Own tool	Yes	Yes	No	No	No	Yes
23	23	Gestational diabetes mellitus	Crowther	2005	Australia/UK	Postpartum (<=1 year)	SF-36	No	Yes	No	No	No	Yes
24	24	Gestational diabetes mellitus	Dalfrà	2012	Italy	Postpartum (<=1 year)	SF-36	Yes	No	No	No	No	Not assessed
23	23	Gestational diabetes mellitus	Crowther	2005	Australia/UK	Antepartum	SF-36	No	Yes	Yes	Yes	No	Yes
25	25	Gestational diabetes mellitus	Dalfrà	2009	Italy	Antepartum (mean 25wks)	SF-36	No	Yes	No	Yes	No	Not assessed
24	24	Gestational diabetes mellitus	Dalfrà	2012	Italy	Antepartum (3rd trimester)	SF-36	Yes	Yes	No	Yes	No	Not assessed
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (3-4 mos)	SF-36	No	No	No	No	No	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (4-5 mos)	SF-36	No	No	No	No	No	No
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (6-7 mos)	SF-36	No	Yes	Yes	Yes	No	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Antepartum (8-9 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
13	27	Gestational diabetes mellitus	Kim	2005	USA	Antepartum	SF-36	Yes	Yes	No	Not assessed	Not assessed	Yes
14	28	Gestational diabetes mellitus	Mautner	2009	Austria	Antepartum	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
27	29	Gestational diabetes mellitus	Souza	2013	Brazil	Antepartum	FSFI	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
25	25	Gestational diabetes mellitus	Dalfrà	2009	Italy	Postpartum (<=1 year)	SF-36	No	No	No	No	No	Not assessed
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Postpartum (<=1 year) (3 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
26	26	Gestational diabetes mellitus	Elnour	2008	UAE	Postpartum (<=1 year) (6 mos)	SF-36	No	Yes	Yes	Yes	Yes	Not clear
13	27	Gestational diabetes mellitus	Kim	2005	USA	Postpartum (<=1 year)	SF-36	Yes	No	No	Not assessed	Not assessed	Yes
14	28	Gestational diabetes mellitus	Mautner	2009	Austria	Postpartum (<=1 year)	WHOQOL-BREF	Yes	No	No	Not assessed	No	No
28	30	Gestational diabetes mellitus	Halkoaho	2010	Finland	Postpartum (> 1 year)	15D	Yes	No	No	No	No	No
29	31	Hyperemesis gravidarum	Ezberci	2014	Turkey	Antepartum	Brief Disability Questionnaire	Yes	Yes	Not assessed	Not assessed	Yes	Not assessed
30	32	Hyperemesis gravidarum	McCarthy	2011	Australia, New Zealand, Ireland, UK	Antepartum	Perceived Stress Scale, Behavioural Response to Pregnancy Scale	Yes	Not clear	Not assessed	Not assessed	Not assessed	Yes
31	33	Hyperemesis gravidarum	McCormack	2011	UK	Antepartum	Social Functioning Questionnaire	Yes	Not assessed	Not assessed	No	No	Not assessed
32	34	Hyperemesis gravidarum	Poursharif	2008	UK, Australia, Ireland, NZ	Antepartum	Own	No	Not clear	Yes	Not clear	Not clear	Not clear
33	35	Hyperemesis gravidarum	Power	2010	UK	Antepartum	Hyeremesis Impact Symptoms Questionnaire	Yes	Not clear	Not clear	Not clear	Not clear	Yes
34	36	Nausea and vomiting	Chan	2010	Hong Kong	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
35	37	Nausea and vomiting	Koren	2010	USA	Antepartum	PUQE	No	Not clear	Not clear	Not clear	Not clear	Yes
36	38	Nausea and vomiting	Lacasse	2008	Canada	Antepartum	Health-related quality of Life for Nausea and	Yes	Yes	Yes	Not clear	Not clear	Not clear
37	39	Hyperemesis gravidarum	Christodoulou-Smith	2011	USA	Postpartum (<=1 year)	Own	Yes	Not clear	Yes	Yes	Yes	Yes
38	40	Spontaneous abortion	Nansel	2005	USA	Postpartum (<=1 year)	SF-36R	No	Yes	Yes	Yes	Yes	Not clear
39	41	Perineal laceration	Andrews	2009	UK	Postpartum (<=1 year)	Manchester Health	No	No	No	Not assessed	No	No
40	42	Perineal laceration	Boij	2007	Sweden	Postpartum (> 1 year)	Own	Yes	No	Not assessed	Not assessed	Not assessed	Yes
41	43	Perineal laceration	Samarasekera	2008	UK	Postpartum (> 1 year)	FIQL	Yes	Not assessed	Yes	Not assessed	Yes	Yes
42	44	Perineal laceration	Scheer	2008	UK	Postpartum (<=1 year)	ICIQ-SF	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
43	45	Perineal laceration	Visscher	2014	Netherland	Postpartum (> 1 year)	SF-36, ICIQ-SF, FSFI	No	Not clear	Yes	Not clear	Not clear	Yes
44	46	Perineal laceration	Otero	2006	Switzerland	>5 year)	SF-12	Yes	No	No	Not clear	No	No
45	47	Perineal laceration	Sze	2005	USA	Postpartum (> 1 year)	Own tool	no	Not assessed	Not assessed	Not assessed	Not assessed	Not clear
46	48	Perineal laceration	Langley	2006	UK	Postpartum (<=1 year)	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
47	49	Perineal laceration	Andrews	2013	UK	Postpartum (<=1 year)	Manchester Health Questonnaire, ICIQ-SF	Yes	Not clear	Not clear	Not clear	Not clear	Not clear
48	50	Perineal laceration	Palm	2013	Sweden	Postpartum (> 1 year)	ICIQ-SF	Yes	Not assessed	Not assessed	No	No	No
49	51	Perineal laceration	Soerensen	2013	Denmark	Postpartum (> 1 year)	FIQL	Yes	Not assessed	No	Not assessed	No	No
50	52	Perineal laceration	Tin	2010	Canada	Postpartum (unknown)	Pelvic Floor Impact	Yes	Yes	Yes	Not assessed	Yes	Not assessed
51	53	Perineal laceration	Rikard-Bell	2014	Australia	Postpartum (<=1 year)	PISQ-12, PFDI-20	Yes	Not assessed	Not assessed	Not assessed	Not assessed	No
52	54	Deep vein thrombosis	Wik	2011	Norway	Postpartum (> 1 year)	VEINES-QOL/Sym		Not clear	Not clear	Not clear	Not clear	Yes
INDIRECT													
53	55	Functional intestinal disorders	Johnson	2014	USA	Antepartum	Irritable bowel Syndrome Quality of Life Measure	Yes	Yes	Yes	Yes	Yes	Yes
54	56	Gastro-oesophageal reflux disease (K21	Malfertheine	2009	Germany	Antepartum	Quality of Life in Reflux and Dyspepsia	Yes	Yes	Yes	Yes	Yes	Not clear
55	57	Heart disease	Meneguin	2013	Brazil	Antepartum	Ferrans and Powers Quality of Life Index	No	No	No	Not assessed	No	No
56	58	Cystic Fibrosis	Schechter	2013	USA, Canada	Postpartum (> 1 year)	Cystic Fibrosis Questionnaire-Revised (CFQR)	Yes	Yes	Yes	Yes	Not clear	Yes
24	59	Type 1 diabetes	Dalfrà	2012	Italy	Antepartum	SF-36	Yes	No	No	No	No	Yes
24	59	Type 1 diabetes	Dalfrà	2012	Italy	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	No	No	Yes
57	60	HIV	Fawzi	2007	Tanzania	Antepartum	SF-36	No	Not clear	Not clear	Not clear	Not clear	Not clear
58	61	HIV	Nuwagaba-Biribonwoha	2006	Uganda	Antepartum	Dartmouth COOP	Yes	No	Yes	Not assessed	No	Yes
59	62	HIV	Pereira	2012	Portugal	Antepartum	WHOQOL-BREF, Brief Symptom Inventory,the Emotional Assessment Scale	Yes	Yes	Yes	Not assessed	Yes	No
58	61	HIV	Nuwagaba-Biribonwoha	2006	Uganda	Postpartum (<=1 year)	Dartmouth COOP	Yes	Yes	Yes	Not assessed	Yes	Yes
60	63	HIV	Pakdewong	2006	Thailand	Postpartum (<=1 year)	Own	No	Not clear	Not assessed	Not assessed	Not assessed	Not assessed
59	62	HIV	Pereira	2012	Portugal	Postpartum (<=1 year)	WHOQOL-BREF, Brief Symptom Inventory,the Emotional Assessment Scale	Yes	No	Yes	Not assessed	Yes	Yes
61	64	HIV	Ross	2011	Thailand	Postpartum (<=1 year)	Own	No	Not clear	Yes	Not assessed	Not assessed	Not assessed
62	65	Depression	Chang	2012	Taiwan	Antepartum	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
63	66	Depression	Husain	2012	UK	Antepartum	Brief Disability	Yes	Yes	Yes	Not clear	Not clear	Not clear
64	67	Depression	Lara	2006	Mexico	Antepartum	Own	No	Not clear	Yes	Yes	Not assessed	Not assessed
65	68	Depression	Lau	2007	Hong-Kong	Antepartum	Dyadic Adjustment Scale	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
66	69	Depression	Li	2012	China	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
67	70	Depression	Nanzer	2012	Switzerland	Antepartum	GAF Scale, Parent-Infant Relationship Global Assessment Scale (PIR-GAS)	No	Not assessed	Yes	Yes	Yes	No
68	71	Depression	Nicholson	2006	USA	Antepartum	SF-36	Yes	Not clear	Yes	Yes	Yes	Yes
69	72	Depression	Pires	2014	Portugal	Antepartum	EuroHIS-QOL-8	No	Not clear	Not clear	Not clear	Not clear	Yes
70	73	Depression	Setse	2009	USA	Antepartum	SF-36	Yes	Yes	Yes	Yes	Yes	Not clear
71	74	Depression	Wilkins	2012	UK	Antepartum (13 wks)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
71	74	Depression	Wilkins	2012	UK	Antepartum (34 wks)	SF-36	Yes	No	Yes	Not clear	Not clear	Not clear
72	75	Depression	Abbasi	2014	Iran	Postpartum (<=1 year)	SF-36	No	Yes	Not clear	Not clear	Not clear	Not clear
73	76	Depression	Chang	2010	Taiwan	Postpartum (<=1 year) (3 days)	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	No
73	76	Depression	Chang	2010	Taiwan	Postpartum (<=1 year) (6 wks)	FSFI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
74	77	Depression	Chen	2011	Singapore	Postpartum (<=1 year) (2 wks)	GAF Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
74	77	Depression	Chen	2011	Singapore	Postpartum (<=1 year) (6mos)	GAF Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
75	78	Depression	Chen	2007	Singapore	Postpartum (<=1 year) (2 wks)	EuroQol (EQ5D)	No	Not clear	Not clear	Not clear	Not clear	Yes#
75	78	Depression	Chen	2007	Singapore	Postpartum (<=1 year) (6mos)	EuroQol (EQ5D)	No	Not clear	Not clear	Not clear	Not clear	Yes#
76	79	Depression	Cheng	2013	Taiwan & US	Postpartum (<=1 year)	Physical Health Condition checklist	Yes	Yes	Yes	Not assessed	Not assessed	Yes
77	80	Depression	Chivers	2011	Canada	Postpartum (<=1 year)	FSFI	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
78	81	Depression	Cho	2009	Korea	Postpartum (<=1 year)	Pittsburgh Sleep Quality Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
79	82	Depression	Class	2013	USA	Postpartum (<=1 year)	Own	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes#
80	83	Depression	Da Costa	2006	Canada	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
81	84	Depression	Darcy	2011	USA	Postpartum (<=1 year)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Not clear
82	85	Depression	Gjerdingen	2009	USA	Postpartum (<=1 year)	SF-36	Yes	Not clear	Yes	Yes	Not clear	Yes
83	86	Depression	Gjerdingen	2011	USA	Postpartum (<=1 year)	PHQ-9	Yes	Not assessed	Not assessed	Yes	Yes	Not assessed
84	87	Depression	Goutaudier	2014	unknown (France	Postpartum (<=1 year)	Dyadic Adjustment Scale, Quality of Life Scale	Yes	Not clear	Not assessed	Not clear	Not clear	Yes#
85	88	Depression	Hou	2014	China	Postpartum (<=1 year)	Pittsburgh Sleep Quality Index	No	Not assessed	Not assessed	Not assessed	Not assessed	Not clear
86	89	Depression	Howard	2011	UK	Postpartum (<=1 year)	SF-12	Yes	Not clear	Yes	Not clear	Not clear	Not clear
87	90	Depression	Howell	2006	USA	Postpartum (<=1 year)	SF-12	Yes	Yes	Not assessed	Not assessed	Not assessed	Not assessed
88	91	Depression	Logsdon	2011	US	Postpartum (<=1 year)	GAF Scale	No	Not clear	Yes	Yes	Yes	No
89	92	Depression	Meltzer-Brody	2014	US	Postpartum (<=1 year)	Work and Social	No	Not assessed	Not clear	Not clear	Not clear	Not assessed
90	93	Depression	Milgrom	2006	Australia	Postpartum (<=1 year) (6 mos)	Parenting Stress Index (PSI)	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
90	93	Depression	Milgrom	2006	Australia	Postpartum (<=1 year) (12 mos)	Parenting Stress Index (PSI)	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
91	94	Depression	Moayedoddin	2013	Switzerland	Postpartum (<=1 year)	Impression (CGI), Parent-Infant Relationship Global	No	Not clear	Yes	Yes	Yes	Yes
92	95	Depression	O'Mahen	2014	UK	Postpartum (<=1 year)	Work and Social Adjustment Scale (WSAS)	No	Not assessed	Not clear	Not clear	Not clear	Not assessed
93	96	Depression	Posmontier	2008	USA	Postpartum (<=1 year)	Inventory of Functional Status After Childbirth	Yes	Not clear	Not clear	Yes	Yes	Yes#
94	97	Depression	Rojas	2006	Chile	Postpartum (<=1 year)	SF-36	No	Yes	Yes	Yes	Yes	Yes
95	98	Depression	Sadat	2014	Iran	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
96	99	Depression	Sword	2011	Canada	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Not clear	Not clear	Not clear
71	74	Depression	Wilkins	2012	UK	Postpartum (<=1 year)	SF-36	Yes	No	No	Not clear	Not clear	Not clear
90	93	Depression	Milgrom	2006	Australia	Postpartum (> 1 year)	Parenting Stress Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
97	100	Depression	Moel	2010	USA	Postpartum (both <=1 and	Dyadic Adjustment Scale	Yes	Not clear	Not clear	Not clear	Not clear	Yes
98	101	Depression	Mulcahy	2010	Australia	Postpartum (both <=1 and	Dyadic Adjustment Scale	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
99	102	Depression	Paris	2009	USA (assumed)	Postpartum (both <=1 and >1 year)	Parenting Stress Index-Short form Maternal Self-Report Inventory-Short form Dyadic Adjustment Scale	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
100	103	Depression	Silver	2006	USA (assumed)	Postpartum (both <=1 and	Parenting Stress Index	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
81	84	Depression	Darcy	2011	USA	Postpartum (both <=1 and	SF-12	Yes	No	No	Not clear	Not clear	Not clear
101	104	Depression	Morrell	2009	UK	Postpartum (<=1 year) (6 wks)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Yes
101	104	Depression	Morrell	2009	UK	Postpartum (<=1 year) (6 mos)	SF-12	Yes	Yes	Yes	Not clear	Not clear	Yes
102	105	Depression	Paulson	2006	USA	Postpartum (unknown)	Own	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
103	107	Depression	De Tychey	2008	France	Postpartum (<=1 year)	SF-36	Yes	Yes	Yes	Yes	Yes	Yes
104	107	Multiple	Bindt	2012	Ghana & Côte d'Iv	Antepartum	WHODAS	no	Not clear	Not clear	Not clear	Not clear	Yes
105	108	Multiple	Senturk	2012	Ethiopia	Antepartum	WHODAS	Yes	Not clear	Not clear	Yes	Not clear	Not clear
105	108	Multiple	Senturk	2012	Ethiopia	Postpartum (<=1 year)	WHODAS	Yes	Not clear	Not clear	Yes	Not clear	Not clear
106	109	Obsessive-compulsive disorder	Gezginc	2008	Turkey	Antepartum	WHOQOL-BREF	Yes	Yes	Yes	Not assessed	Yes	Not assessed
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Antepartum (3rd trimester)	SF-36, Guy's neurological disability scale (GNDS); multiple sclerosis impact scale (MSIS-31); expanded disability status scale (EDSS)	Yes	No	No	No	No	No
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Antepartum (1st trimester)	SF-36, GNDS, MSIS-31, EDSS	No	No	No	No	No	No
108	111	Multiple sclerosis	Gulick	2007	USA	Postpartum (<=1 year)	Activities of Daily Living (ADL) scale for persons	No	Yes	Yes	Yes	Yes	Not assessed
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Postpartum (<=1 year) (4-8 wks)	SF-36, GNDS, MSIS-31, EDSS	Yes	No	No	No	No	No
107	110	Multiple sclerosis	Neuteboom	2012	Netherland	Postpartum (both <=1 and >1 year) (9 mos or more)	SF-36, GNDS, MSIS-31, EDSS	Yes	No	No	No	No	No
109	112	Anemia	Beard	2005	South Africa	Postpartum (<=1 year)	Digit Symbol Test, Perceived Stress Scale	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
110	113	Anemia	Perez	2005	South Africa	Postpartum (<=1 year)	Parent/Caregiver Involvement Scale	Yes	Not clear	Not clear	Not clear	Not clear	Yes
111	114	Anemia	Khalafallah	2012	Australia (Tasman	Postpartum (> 1 year)	SF-36	Yes	yes	Yes	Yes	yes	Not clear
112	115	Enteritis and colitis	Ananthakrishnan	2012	USA	Antepartum	Short inflammatory bowel disease questionnaire	No	Not clear	Not clear	Not assessed	Not clear	No
113	116	Bronchial asthma	Nickel	2006	Germany?	Antepartum	SF-36	No	No	Yes	Yes	Yes	Yes
114	117	Faecal incontinence	Espuna-Pons	2012	Spain	Antepartum	Wexner Faecal Continence Grading Scale	No	Not clear	Not clear	Not clear	Not clear	Yes#
115	118	Faecal incontinence	Johannessen	2014	Norway	Antepartum	FIQL	No	Not assessed	Yes	Not assessed	Yes	Yes
116	119	Faecal incontinence	Roos	2009	UK	Postpartum (<=1 year)	Manchester Health Questionanire	No	Yes	Yes	Yes	Yes	Yes
117	120	Faecal incontinence	Pla-Marti	2007	Spain	Postpartum (> 1 year)	FIQL	No	Not assessed	Yes	Not assessed	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (6 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (12 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes

Supplementary Appendix 2: A list of included papers

Study No	Condition No	ICD-10	First Author	Publication Year	Country	Timing of assessment of outcome	Type of tool	Control group in a study	Negative impact on health-related functioning				
									Physical functioning	Mental functioning	Ecoomic functioning	Social functioning	Other
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (18 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
118	121	Faecal incontinence	Lo	2010	USA	Postpartum (both <=1 and >4 year) (24 mos)	IIQ (modified)	No	Yes	Yes	Yes	Yes	Yes
119	122	Fistula	Browning	2008	Ethiopia	Not specified	Own	Yes	Yes	Not clear	Not clear	Yes	Yes
120	123	Fistula	Siddle	2012	Tanzania	Not specified	Own	No	Yes	Yes	Yes	Yes	Not assessed
121	124	Fistula	Muleta	2008	Ethiopia	Postpartum (> 1 year)	Own	No	Yes	Not assessed	Not assessed	Not assessed	Yes
122	125	Fistula	Bangser	2011	Uganda	Postpartum (both <=1 and >8 year)	Own	No	Yes	Yes	Yes	Yes	Yes
122	125	Fistula	Bangser	2011	Tanzania	Postpartum (both <=1 and >9 year)	Own	No	Yes	Yes	Yes	Yes	Yes
123	126	Fistula	Umoiyoho	2011	Nigeria	Postpartum (both <=1 and >9 year)	WHOQOL-BREF	Yes	No	Yes	No	Yes	Yes
124	127	Fistula	Landry	2013	Bangladesh, Guine	Postpartum (> 1 year)	Own	No	Not assessed	Not assessed	Yes	Yes	Yes
125	128	Fistula	Nielsen	2009	Ethiopia	Postpartum (> 1 year)			Not clear	Not clear	Not clear	Not clear	Yes
126	129	Urinary incontinence	Adaji	2010	Nigeria	Antepartum	ICIQ-UI	No	Not assessed	Not assessed	Not assessed	Not assessed	No
127	130	Urinary incontinence	Ruiz de Vinaspre H	2011	Spain	Antepartum	IIQ-7	No	Not assessed	Not assessed	Not assessed	Not assessed	No
128	131	Urinary incontinence	Erbil	2011	Turkey	Antepartum	Own	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
114	131	Urinary incontinence	Espuna-Pons	2012	Spain	Antepartum	ICIQ-SF	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
129	133	Urinary incontinence	Kocaoz	2010	Turkey	Antepartum	Wagner's Quality of Life	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
130	134	Urinary incontinence	Oliveira Claudia	2013	Brazil	Antepartum	ICIQ-SF	Yes	Not assessed	Not assessed	Not assessed	Not assessed	Yes
131	135	Urinary incontinence	Arrue	2010	Spain	Postpartum (<=1 year)	ICIQ–UI	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
132	136	Urinary incontinence	Hermansen	2010	Denmark	Postpartum (<=1 year)	IIQ-7	No	Yes	Yes	Yes	Yes	Yes
133	137	Urinary incontinence	Jeddi	2014	Iran	Postpartum (<=1 year)	IIQ-7	No	Yes	Yes	Not assessed	Yes	Yes
134	138	Urinary incontinence	Leroy	2005	Brazil	Postpartum (<=1 year)	SF-36, King's Health Questionnaire (KHQ), ICIQ-SF	Yes	Yes	Yes	Yes	Yes	Yes
135	139	Urinary incontinence	Torrisi	2011	Italy	Postpartum (<=1 year)	ICIQ-SF, King's Health Questionnaire	No	Not assessed	Not assessed	Not assessed	Not assessed	Yes
136	140	Urinary incontinence	Ege	2008	Turkey	Postpartum (<=1 year)	Own	No	Not assessed	Not assessed	Not assessed	Yes	Yes

Note 1: The impacts are determined based on authors' interpretations of their study findings when the studies did not have a control or comparison group, or did not report women's functioning between morbidity and non-morbidity group statistically. When only summary measures are reported, sub-scales are coded as not clear. Self-reported general health status and sexual functioning were categorised as other domain.

FIQL=Faecal Incontinence Quality of Life Scale, FSFI=Female Sexual Function Index, GAF Scale = Global Assessment of Functioning, ICIQ=International Consultation on Incontinence Questonnaire, IIQ-7=Incontinence Impact Questionnaire, PFDI-20=Pelvic Floor Distress Inventory, PFIQ-7=Pelvic Floor Impact Questionnaire, PHQ-9=Patient Health Questionnaire, PISQ-12=Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire, PUQE=Pregnancy-unique quantification of emesis, VEINES-QOL = The Venous Insufficiency Epidemiological and Economic Study (VEINES)- QOL/Sym Questionnaire

refers to mixed results

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-8
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	8
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	8
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	9-10
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	8-9
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	10-11
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	10
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	10
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	NA
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	NA
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	NA

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	11
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	11-12
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Table 1&2
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	NA
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Appendix 2
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	NA
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NA
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	20-25
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	23-24
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	24-25
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	25

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: www.prisma-statement.org.

Correction: *Consequences of maternal morbidity on health-related functioning: a systematic scoping review*

Machiyama K, Hirose A, Cresswell JA, *et al*. Consequences of maternal morbidity on health-related functioning: a systematic scoping review. *BMJ Open* 2017;**7**:e013903. doi: 10.1136/bmjopen-2016-013903

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