Maternal Morbidity and Co-morbidity During and After Pregnancy in Women in Low- and Middle-Income Countries: A Systematic Literature Review

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Abstract

Background
For every maternal death, it is estimated that 20 or 30 women have morbidity related to pregnancy or childbirth. The majority of this burden of disease is in women living in low and middle income countries. Maternal morbidity includes physical, psychological and social ill-health. There is limited data on the strength of association between these co-morbidities. In order to address all health needs that a woman may have when attending for maternity care, it is important to be able to identify all types of co-morbidities and understand how each co-morbidity influences other aspects of a woman’s health and wellbeing during and after pregnancy.

Methods
We systematically reviewed published literature, in English, describing measurement of two or more types of maternal morbidity, and/or associations between co-morbidities, during or after pregnancy and childbirth for women living in low- and middle-income countries. CINAHL plus, Global Health, Medline and Web of Science databases were searched from 2007-2018. Outcomes were descriptions, occurrence of maternal co-morbidities, and associations between these co-morbidities. Narrative analysis was conducted.

Results
38 papers reporting on 36 studies were included (71,229 women; 60,911 during and 10,318 after pregnancy from 17 countries). The majority of studies (26/36) were cross-sectional surveys. Self-reported physical ill-health was documented in 26 studies but there was no standardised data collection tool used. In total, physical morbidity was included in 28 studies; psychological morbidity in 32 studies and social morbidity in 27 studies; with 3 studies assessing association between all three types of morbidity and 30 studies assessing association between two types of morbidity. In four studies, clinical examination and/or basic laboratory investigations were also conducted. There is reported association between physical and psychological morbidity (four studies); and association between psychological and social morbidity (six studies). Domestic violence increases risk of physical ill-health (two studies).
Conclusions
There is a lack of standardised, comprehensive and routine measurements and tools used to assess the burden maternal morbidity and co-morbidity in women during and after pregnancy. There is emerging data to suggest strong associations between the different types of morbidity.

Background
Maternal morbidity affects millions of women during and after pregnancy and the burden of ill-health is expected to be highest in women living in low-and middle-income country (LMIC) settings. For every maternal death, it has been suggested that 20 or 30 women have morbidity related to pregnancy or childbirth. More recent studies using new and comprehensive assessment tools suggest that the magnitude of maternal morbidity is much larger than previously estimated. International targets and the Sustainable Development Goals have a new focus; in addition to preventing maternal mortality, improving health and well-being, and, “survive and thrive” are the new goals. There is international agreement that all women have the right to the highest attainable standard of health and well-being, including during and after pregnancy and childbirth. Estimates of morbidity have until now largely focused on acute and/or severe compilations such as haemorrhage, sepsis, and eclampsia. The current definition of health is “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity”. Regarding maternal ill-health or morbidity, a suggested definition is “any health condition attributed to and/or aggravated by pregnancy and childbirth that has a negative impact on the woman’s well-being”. This definition can include physical (such as medical, infectious, obstetric), mental (or psychological such as depression, suicidal ideation) and social co-morbidities (such as domestic violence, substance misuse); that are attributed to and/or aggravated by pregnancy. In order to address all health needs that a woman may have when attending for maternity care, it is important to be able to identify all types of co-morbidities and understand how each co-morbidity influences other aspects of a woman’s health and wellbeing during and after pregnancy. To date, there is a lack of data regarding the measurement and burden of disease described as “maternal morbidity” or “maternal co-morbidity”. Additionally, there is
a lack of understanding of how best different components of maternal ill-health are measured; the
descriptions of co-morbidities, and if and how co-morbidity are interlinked and associated.

Objective
A systematic review of the literature was conducted for studies from LMIC that measured different
types of maternal morbidity and/or associations between co-morbidities. We included studies which
assessed two or more types of maternal morbidity in women during and/or after pregnancy. We
assessed approaches and tools that were used to collect the data, including, self-reported subjective
measures and/or objective measures such as clinical examination and/or use of investigations for the
different types of maternal morbidities as reported by authors. We describe how and what different
types of maternal morbidity (physical, psychological, social) were measured and if there were any
reported associations between these.

Methods

Data sources and search strategy
This protocol is registered in PROSPERO (CRD42018079526). Relevant articles published between
January 2007 and December 2018 were identified using a structured search strategy in four electronic
databases: CINAHL Plus, Global Health, Medline and Web of Science. A search strategy was developed
using thesaurus (including MeSH) and free-text terms for “maternal morbidity” and associated
keywords, were used as main search terms. For each aspect of maternal morbidity (“physical”,
“psychological”, and “social”) search terms and related keywords were selected (Supplementary
Table 1). Reference lists and bibliographies of key topic articles were also searched and any
additional papers that met the inclusion criteria were obtained.

Inclusion and exclusion criteria
The study population was limited to women during pregnancy, childbirth or up to twelve weeks
postnatal. Studies were excluded if; (i) they reported one type of maternal morbidity only, (ii)
examined trend, risk factors or associations only with no estimates of prevalence of the type of
morbidity reported, or (iii) reported severe or life-threatening complications of pregnancy, that would
require emergency obstetric care. The review was limited to studies from LMIC as defined by the
World Bank. Language was limited to English.

**Selection and data extraction**

One researcher screened all titles and abstracts. A sub-sample (20%) were double screened by the second researcher. Evaluation of full-text papers was done independently by two researchers with reasons for exclusion recorded and any discrepancies were discussed with a third researcher. Information was extracted into a pre-designed summary table and included data on location of study, study dates, study design, study population, types of maternal morbidity reported, methods of measurement, timing (pregnancy phase) of the assessment and whether or not associations were reported (Supplementary Table 2). Throughout the reviewing and extraction processes, articles where uncertainty existed were discussed by all researchers to reach consensus.

**Quality assessment**

Appraisal of the quality of included studies was conducted based on descriptions of maternal morbidities, sampling methods and completeness of data reporting. The quality of evidence for each study was assessed using the Grading of Recommendations, Assessment Development and Evaluation (GRADE) tool adapted from the Critical Analysis Skills Programme (CASP) tool.\(^{12}\)

**Data synthesis**

A narrative synthesis approach was used to describe outcomes including: types of maternal morbidity measured which were categorised as physical (such as medical, infectious, obstetric), psychological (such as depression, suicidal ideation), and social (such as domestic violence, substance misuse); approaches used to collect data (self-reported or determined by a healthcare provider); data collection tools used (standardised validated tool, or study specific); measurements of maternal co-morbidities; and reported associations (if any) between different types of maternal co-morbidities.

**Results**

By combining the search terms, 2840 studies were identified from the four databases and after screening for relevance, 58 were retrieved for full text review (Figure 1). Upon applying the eligibility criteria, 38 articles met the inclusion criteria. Two studies were conducted by the same authors group.\(^{13-16}\) In these publications, the same methodology was reported in two papers, but there was a
different emphasis on the results and outcomes reported per publication. For the purposes of this review, the first publication is referenced in the methodology section. Both publications were included in the summary tables and the measurement and/or associations for each publication are described in the results section. The majority of studies (92%; 33/36) were considered to be of medium quality.

**Characteristics of studies included**

**Geographical spread**

The 36 studies were from 17 different countries, with the majority (15 studies) from Sub-Saharan Africa. Eleven were conducted in low-income countries and six in middle-income countries (four lower-middle and two upper-middle income countries).

**Study design, source of data and data collection method**

Twenty-six studies used a cross-sectional survey study design. Four studies were observational prospective cohort studies.\(^\text{13,17,18,19}\) One study was a case control study.\(^\text{20}\) All 25 studies used face-to-face interviews or consultations to collect self-reported primary data from women using questionnaires. Most of the studies that collected primary data, relied on women’s self-reported symptoms (n=28). In four studies, clinical examination and/or laboratory tests were also conducted.\(^\text{6,18,21,22}\) Three studies extracted data using secondary data analysis of large databases of hospital admissions, discharges or birth registers.\(^\text{23,24,25}\) In these secondary data analyses authors used their own data collection tool, with little details of the variables extracted. One study extracted data from medical case notes retrospectively (Supplementary Table 2).\(^\text{26}\)

**Sample size**

The total number of women assessed across the 36 studies was 71,229 (60,911 during and 10,318 after pregnancy). Nine studies assessed <500 women per study;\(^\text{22-34}\) thirteen studies assessed 500-999 women per study;\(^\text{13,16,18,19,35-42}\) Nine studies assessed 1000-1999 women per study;\(^\text{17,20,25,26,43-47}\) and five studies had a sample size of ≥2000 women (Supplementary Table 2).\(^\text{6,23,24,48,49}\)
Stages of pregnancy assessed

A total of 23 studies collected data from women during pregnancy: in the second trimester, in the third trimester, or at any time during pregnancy. In 11 of the 23 studies, the gestation was not given. Seven studies assessed women within 12 weeks of childbirth. In one study, data was collected at three stages after childbirth: at 4-12 weeks; at 12-24 weeks; and at 24-56 weeks. Zafar et al collected data at three different assessment stages, during (early and late antenatal) and after pregnancy (Supplementary Table 2).

Site of data collection

In studies that collected primary data (n=32), data collection took place during a visit for routine antenatal or postnatal care at the outpatient department of a healthcare facility: tertiary/provincial hospitals, secondary level or district hospital, and primary healthcare facility level. For four studies the site was unclear. In 12 studies, data collection took place in the community or home of women (Supplementary Table 2).

Data collection

Co-morbidities assessed

All three types of maternal morbidity including physical, psychological and social ill-health were assessed in 12 studies; psychological and social ill-health were assessed in nine studies; physical and psychological ill-health in 11 studies; and physical and social ill-health assessed in six studies (Supplementary Table 2). A variety of

Physical morbidity

Twenty-eight studies reported on different types of physical morbidity; three of which assessed a pre-selected population including women with HIV or women with gestational diabetes. A variety of
data collection tools were designed and used but these were generally not well described. The most commonly reported physical morbidities were anaemia in six studies (prevalence range 5.0-57.7%), and HIV in nine studies (prevalence range 3.0 - 16.0%).

There was a variety of other types of physical morbidities, with wide ranges of measurements for some conditions such as antepartum haemorrhage; nausea and vomiting; preterm labour; fever; malaria; reproductive or sexually transmitted infection; urinary tract infection (Supplementary Table 3). Some authors used summative aggregated measures, for example “gynaecological and obstetric problems” as occurring in 10-22% of women; “multiple morbidities” in 60% of women or “at least one reported symptom” (44% occurrence). One study used antenatal hospitalisation as a “proxy” for physical morbidity (55.4% of women) (Supplementary Table 3).

**Psychological morbidity**

Of the 32 studies that report psychological morbidity, the most commonly reported condition was depression with a prevalence range of 13.5-39.5% across 21 studies. Twelve studies described more than one condition. Some authors described aggregates or a summative psychological condition; for example, “common mental disorders” and “symptoms of any mental distress”. There was a range of other types of psychological morbidity described and reported, such as anxiety; suicidal ideation; distress; and stress (Supplementary Table 4). Fourteen different data collection tools were used either alone or in combination with other data collection tools (Table 1). The commonest tool used was the Edinburgh Postnatal Depression Score (EPDS) questionnaire used in fourteen studies. However, different studies used various cut-off scores (from ≥4 to ≥13) for the EPDS questionnaire and the Kessler scale (from >15 to >30).

**Social morbidity**

In total, 27 studies assessed social morbidity; the most commonly reported type of social morbidity was domestic violence in 14 studies. Substance misuse was
assessed in nine studies (Supplementary Table 4). Three studies assessed both domestic violence and substance misuse. Eight studies assessed other aspects of social health including husband’s alcohol intake, poor social support, food insecurity and unplanned pregnancy.

**Domestic violence**

Fourteen studies assessed domestic violence, and a variety of data collection tools were used. Most authors used their own definitions and questionnaires to screen for domestic violence. Four studies used all or part of internationally recognised questionnaires (Table 1). Different types of domestic violence assessed included: disrespect, forced sex, intimate partner violence, physical assault, severe psychological abuse and verbal abuse. Some authors used descriptions of domestic violence were aggregates or summative measures, for example, terms such as “multiple acts of physical violence” and “physical and/or sexual abuse”.

**Substance misuse**

Nine studies assessed one or more forms of substance misuse, and only two of these studies used validated questionnaires. In general, substance abuse related to alcohol use (9 studies; prevalence range 0-49.5%).

**Associations between different types of morbidity**

For physical morbidity, there was an association between increased psychological morbidity in women with obstetric complications (haemorrhage, infections, incontinence, prolonged labour, Caesarean delivery, low birth weight baby, stillbirth, neonatal death) (Table 2). In pre-selected populations, women with gestational diabetes were not more likely to have psychological morbidity (depression), but women with HIV were more likely to have social morbidity (domestic violence). Psychological morbidity was more common in younger women and amongst women with social morbidities such as domestic violence or trauma (unwanted pregnancy, and poor social support (Table 2). For social morbidity, there was an association between women with substance
misuse (alcohol) and domestic violence$^{47}$, and domestic violence was also associated with neonatal death$^{47}$ and maternal complications (*Table 2*).$^{45}$ Due to the heterogeneity of the studies, meta-analysis of the strength of associations were not possible.

**Discussion**

**Main findings**

There is emerging evidence of a high burden of morbidity and co-morbidity in women during and after pregnancy, living in LMIC, as well as emerging evidence of associations between physical, psychological and social morbidity, suggesting that maternal morbidities are inter-linked. However, there is still limited data on the strength and direction of the associations between the different types of morbidity.

There was an apparent lack of standardisation of definitions and data collection tools used to measure different types of maternal morbidity. The EPDS was the most common validated data collection tool used to assess psychological morbidity in the included studies, but with different cut-off scores used to determine the risk of “depression” (ranging from 4-13). Similarly, a variety of different validated data collection tools were used to assess domestic violence and/or substance misuse as components of social morbidity. Physical, psychological and social morbidities were often described as aggregates or summative measures, limiting comparability of findings.

**Strengths and Limitations**

To the best of our knowledge, this is the first systematic review to assess maternal co-morbidities and the type and level of association between these. Many studies relied on recall of experience of morbidity and much of the primary data collected was symptom-based rather than “diagnosed”. In this review, only four studies triangulated self-reported symptoms with findings from clinical examination and/or basic laboratory investigations. Assessments of measurements of ill-health based on self-reporting may be valid with regard to the experienced ill-health by women but do not provide accurate burden of disease estimates. No study described or used an internationally recognised disease classification to assess physical morbidity. Internationally recognised data collection tools were used to assess psychological and social morbidity, but these often used different cut-off scores.
Interpretation
Valid comparable measurements of maternal morbidity and co-morbidity to date are limited, and this confirms the need for a new approach and focus.\textsuperscript{68,69,70} It will be important for future healthcare practice and research to agree and apply: (a) common identification criteria for different types of physical, psychological, and social morbidity; (b) standardised and validated data collection tools that can be used in different languages and at all levels of healthcare; with, (c) validation of self-reported measurements of maternal morbidity (experienced by women themselves) compared to clinical assessment, investigations and diagnosis determined by a healthcare provider.\textsuperscript{6,68,69,70} More recognition must be given that maternal morbidity is often not a single disease condition in isolation but more complex with important associations between different morbidities. This has implications for screening and management of ill-health during and after pregnancy.

Conclusions
To date a range of methods and tools have been used to assess maternal morbidity and co-morbidity. The maternal morbidity estimates generated using these methodologies and tools, while useful as a guide, cannot be considered truly representative of the burden and range of maternal morbidity conditions that have a negative impact on a woman’s wellbeing during and after pregnancy. The suggested World Health Organization (WHO) definition of maternal morbidity in principle, provides such a framework, but challenges remain to map out comprehensive, feasible and acceptable assessment stages, approaches and tools.\textsuperscript{11} Comprehensive and routine measurements of maternal morbidity and co-morbidity are necessary to inform policy and program decisions and for resource allocation for antenatal and postnatal care.\textsuperscript{5} Improved measurement of maternal morbidity and co-morbidity will also allow for comparison of the burden of disease across settings within and between countries. There is need for a sustainable way to provide good baseline maternity care for all, and targeted individualised care for women who need extra care, to prevent the development and progression of maternal morbidity and associated co-morbidities.

List Of Abbreviations
EPDS Edinburgh Postnatal Depression Score
CASP Critical Analysis Skills Programme
GRADE Grading of Recommendations, Assessment, Development and Evaluation
LMIC Low- and middle-income countries
MeSH Medical Subject Headings
PRISMA Preferred Reporting Items for Systematic Reviews and Meta-Analyses
WHO World Health Organization

Declarations

**Ethics approval and consent to participate**

This systematic review did not involve contact with any human participants, and therefore no ethical approval was needed. This study was conducted in compliance with the established ethical guidelines of the Declaration of Helsinki.

**Consent to publish**

Not applicable.

**Availability of data and materials**

All the sources of data are publicly available and referenced in the document.

**Competing interests**

The authors have no competing interests to declare.

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**Authors’ contributions**

MMc and NvdB were responsible for the study inception and design. MMc and SZ performed the data extraction. MMc and NvdB interpreted the data and wrote the manuscript. All authors have read, critiqued and approved the final manuscript.

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References
1. Graham W, Woodd S, Byass P, Filippi V, Gon G, Virgo S, et al. Diversity and divergence: the dynamic burden of poor maternal health. Lancet. 2016;388(10056):2164-75. doi:10.1016/S0140-6736(16)31533-1

2. Ashford L. Hidden suffering: disabilities from pregnancy and childbirth in less developed countries. Washington, DC: Population Reference Bureau, MEASURE Communication; 2002.

3. Datta KK, Sharma RS, Razack PMA, Ghosh TK, Arora RR. Morbidity pattern among rural women in Alwar-Rajasthan - a cohort study. Health Popul Perspect Issues. 1980;3(4):282–92.

4. Barreix M, Barbour K, McCaw-Binns A, Chou D, Petzold M, Gichuhi G, et al. Standardizing the measurement of maternal morbidity: Pilot study results. Int J Gynecol Obstet. 2018;141(Supp 1):10-19. doi:10.1002/ijgo.12464

5. McCauley M, Madaj B, White SA, Dickinson F, Bar-Zeev S, Aminu M, et al. Burden of physical, psychological and social ill-health during and after pregnancy among women in India, Pakistan, Kenya and Malawi. BMJ Glob Health. 2018;3(3):e000625. doi:10.1136/bmjgh-2017-000625

6. Zafar S, Jean-Baptiste R, Rahman A, Neilson JP, van den Broek NR. Non-Life Threatening Maternal Morbidity: Cross Sectional Surveys from Malawi and Pakistan. PLoS ONE. 2015;10(9):e0138026.

7. United Nations. Transforming our world: the 2030 Agenda for Sustainable Development. New York: World Health Organization; 2015. Accessed 17th November 2017. Available from: https://sustainabledevelopment.un.org/post2015/transformingourworld

8. United Nations. Every Woman, Every Child: Global Strategy; 2015. Accessed 17th
9. Vos T, Barber RM, Bell B, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2015;386:743- doi: 10.1016/S0140-6736(15)60692-4

10. World Health Organization. Constitution of the World Health Organization. Geneva: World Health Organization; 1948.

11. Firoz T, Chou D, von Dadelszen P, Agrawal P, Vanderkruik R, Tunçalp Ö, et al. Measuring maternal health: focus on maternal morbidity. *Bull World Health Organ.* 2013;91(10):794-6.

12. Atkins D, Eccles M, Flottorp S, Guyatt GH, Henry D, Hill S, et al. Systems for grading the quality of evidence and the strength of recommendations I: critical appraisal of existing approaches. The GRADE Working Group. *BMC Health Serv Res.* 2004;4(1):38.

13. Faisal-Cury A, Araya R, Marcelo Z, Menezes P. Common mental disorders during pregnancy and adverse obstetric outcomes *J Psychosom Obstet Gynecol.* 2010;31(4):229-35.

14. Faisal-Cury A, Menezes P, Araya R, Zugaib M. Common mental disorders during pregnancy: prevalence and associated factors among low-income women in São Paulo, Brazil. *Arch Womens Ment Health.* 2009;12(5):335.

15. Shamu S, Zarowsky C, Roelens K, Temmerman M, Abrahams K. High-frequency intimate partner violence during pregnancy, postnatal depression and suicidal tendencies in Harare, Zimbabwe. *Gen Hosp Psychiatry.* 2016;38(Jan-Feb):109-14.

16. Shamu S, Zarowsky C, Shefer T, Temmerman M, Abrahams N. Intimate Partner Violence after Disclosure of HIV Test Results among Pregnant Women in Harare,
17. Karmaliani R, Asad N, Bann CM, Moss N, McClure EM, Pasha O, et al. Prevalence of Anxiety, Depression and Associated Factors among Pregnant Women of Hyderabad, Pakistan. Int J Soc Psychiatry. 2009;55(5):10.

18. Tran TD, Biggs B-A, Tran T, Casey GJ, Hanieh S, Simpson JA, et al. Psychological and social factors associated with late pregnancy iron deficiency anaemia in rural Viet Nam: A population-based prospective study. PLoS One. 2013;8(10):e78162.

19. Wado YD, Afework MF, Hindin MJ. Effects of Maternal Pregnancy Intention, Depressive Symptoms and Social Support on Risk of Low Birth Weight: A Prospective Study from Southwestern Ethiopia. PLOS One. 2014;9(5):e96304.

20. Assarag B, Dubourg D, Maaroufi A, Dujardin B, De Brouwere V. Maternal postpartum morbidity in Marrakech: what women feel what doctors diagnose? BMC Pregnancy Childbirth. 2013;13:225.

21. Chersich MF, Kley N, Luchters SMF, Njeru C, Yard E, Othigo MJ, et al. Maternal morbidity in the first year after childbirth in Mombasa Kenya; a needs assessment. BMC Pregnancy Childbirth. 2009;9:51.

22. Rahman A, Bunn J, Lovel H, Creed F. Association between antenatal depression and low birthweight in a developing country. Acta Psychiatr Scand. 2007;115(6): 481-6.

23. Isaksen AB, Østbye T, Mmbaga BT, Daltveit AK. Alcohol consumption among pregnant women in Northern Tanzania 2000–2010: a registry-based study. BMC Pregnancy Childbirth. 2015;15:205.

24. Surkan PJ, Sakyi KS, Christian P, Mehra S, Labrique A, Ali H, et al. Risk of Depressive Symptoms Associated with Morbidity in Postpartum Women in Rural Bangladesh. Matern Child Health J.2017;21(10):1890-1900.

25. Tsai AC, Tomlinson M, Comulada WS, Rotheram-Borus MJ. Intimate Partner Violence
and Depression Symptom Severity among South African Women during Pregnancy and Postpartum: Population-Based Prospective Cohort Study. PLOS Med. 2016;13(1):e1001943.

26. Ukachukwu V, Unger H, Onoka C, Nduka C, Maina S, Ngugi N. Maternal morbidity and mortality in peri-urban Kenya-assessing progress in improving maternal healthcare. East Afr J Public Health. 2009;6(2):112-8.

27. Chibanda D, Mangezi W, Tshimanga M, Woelk G, Rusakaniko S, Stranix-Chibanda L, et al. Postnatal depression by HIV status among women in Zimbabwe. J Womens Health. 2010;19(11):2071-7.

28. Dewing S, Tomlinson M, Le Roux IM, Chopra M, Tsai AC. Food insecurity and its association with co-occurring postnatal depression, hazardous drinking, and suicidality among women in peri-urban South Africa. J Affect Disord. 2013;150(2):460-5.

29. Khalifa, DS, Glavin, K, Bjertness, E, Lien, L. Determinants of postnatal depression in Sudanese women at 3 months postpartum: a cross-sectional study. BMJ Open. 2016;6:

30. Lukose A, Ramthal A, Thomas T, Bosch R, Kurpad AV, Duggan C, et al. Nutritional factors associated with antenatal depressive symptoms in the early stage of pregnancy among urban South Indian women. Matern Child Health J. 2014;18(1):161-70.

31. Natamba BK, Achan J, Arbach A, Oyok TO, Ghosh S, Mehta S, et al. Reliability and Validity of the Center for Epidemiologic Studies Depression Scale in Screening for Depression among HIV-Infected and Uninfected Pregnant Women Attending Antenatal Services in Northern Uganda: A Cross-Sectional Study. BMC Psychiatr. 2014;14:2197.

32. Rwakarema M, Premji SS, Nyanza EC, Riziki P, Palacios-Derflingher L. Antenatal
depression is associated with pregnancy-related anxiety, partner relations, and wealth in women in Northern Tanzania: a cross-sectional study. BMC Womens Health. 2015;15:68.

33. Vythilingum B, Roos A, Faure SC, Geerts L, Stein DJ. Risk factors for substance use in pregnant women in South Africa. S Afr Med J. 2012;102(11 Pt 1):851-4.

34. Yator O, Mathai M, Vander Stoep A, Rao D, Kumar M. Risk factors for postpartum depression for women living with HIV attending the prevention of mother to child transmission clinic at Kenyatta National Hospital at Nairobi, Kenya. AIDS Care. 2016;28(7):884-9.

35. Brittain K, Mellins CA, Phillips T, Zerbe A, Abrams EJ, Myer L, et al. Social support, stigma and antenatal depression among HIV-Infected pregnant women in South Africa. AIDS Behavior. 2017;21(1):274-82.

36. Nasreen HE, Kabir ZN, Forsell Y, Edhborg M. Prevalence and associated factors of depressive and anxiety symptoms during pregnancy: A population based study in rural Bangladesh. BMC Womens Health. 2011;11:22.

37. Natasha K, Hussain A, Khan AKA. Prevalence of depression among subjects with and without gestational diabetes mellitus in Bangladesh: a hospital based study. J Diabetes Metab Disord. 2015;14:64.

38. Ntaganira J, Muula AS, Masaisa F, Dusabeyezu F, Siziya S, Rudatsikira E. Intimate partner violence among pregnant women in Rwanda. BMC Womens Health 2008;8:17.

39. Tran TD, Tran T, Wynter K, Fisher J. Interactions among alcohol dependence, perinatal common mental disorders and violence in couples in rural Vietnam: A cross-sectional study using structural equation modeling. BMC Psychiatry. 2012;12:148.

40. Waqas A, Raza N, Lodhi HW, Muhammad Z, Jamal M, Rehman A. Psychosocial Factors of Antenatal Anxiety and Depression in Pakistan: Is Social Support a Mediator? PLoS
41. Wong M, Myer L, Zerbe A, Phillips T, Petro G, Mellins CA, et al. Depression, alcohol use, and stigma in younger versus older HIV-infected pregnant women initiating antiretroviral therapy in Cape Town, South Africa. Arch Womens Ment Health, 2017;20(1):149-59.

42. Stewart RC, Umar E, Tomenson B, Creed F. A cross-sectional study of antenatal depression and associated factors in Malawi. Arch Womens Ment Health. 2014;17(2):145-54.

43. Hassan M, Kashanian M, Hassan M, Roohi M, Yousefi H. Maternal outcomes of intimate partner violence during pregnancy: Study in Iran. Public Health. 2014;128(5):410-5.

44. Hanlon C, Medhin G, Alem A, Tesfaye F, Lakew Z, Worku B, et al. Impact of antenatal common mental disorders upon perinatal outcomes in Ethiopia: The P-MaMiE population-based cohort study. Trop Med Int Health. 2009;14:156-66.

45. Romero-Gutiérrez G, Cruz-Arvizu VH, Regalado-Cedillo CA, Ponce-Ponce de Leon AL. Prevalence of violence against pregnant women and associated maternal and neonatal complications in Leon, Mexico. 2011;27(5):750-3.

46. Rees SJ, Tol W, Mohammad M, Tay AK, Tam N, dos Reis N, et al. A high-risk group of pregnant women with elevated levels of conflict-related trauma, intimate partner violence, symptoms of depression and other forms of mental distress in post-conflict Timor-Leste. Transl Psychiatry. 2016;6:e725.

47. Stöckl H, Watts C, Kilonzo Mbwambo JK. Physical violence by a partner during pregnancy in Tanzania: prevalence and risk factors. Reprod Health Matters. 2010;18(36):171-80.

48. Hamadani, JD, Tofail, F, Hilaly A, Mehrin F, Shiraji S, Banu S, et al. An Association of
postpartum maternal morbidities with children's mental, psychomotor and language development in rural Bangladesh. J Health Popul Nutr. 2012;30(2):193-204.

49. Prost A, Lakshminarayana R, Nair N, Tripathy P, Copas A, Mahapatra R, et al. Predictors of maternal psychological distress in rural India: A cross-sectional community-based study. J Affect Disord. 2012;138(3):277-86.

50. Ali BS, Reza H, Khan MM, Jehan I. Development of an indigenous screening instrument in Pakistan: the Aga Khan University Anxiety and Depression Scale. J Pak Med Assoc. 1998;48(9):261-5.

51. Lewis G, Pelosi AJ, Araya R, Dunn G. Measuring psychiatric disorder in the community: a standardized assessment for use by lay interviewers. Psychol Med. 1992;22(2):465-86.

52. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. Brit J Psychiatry. 1987;150(6):782-6.

53. Mollica RF1, Caspi-Yavin Y, Bollini P, Truong T, Tor S, Lavelle J. The Harvard Trauma Questionnaire. Validating a cross-cultural instrument for measuring torture, trauma, and posttraumatic stress disorder in Indochinese refugees. J Nerv Ment Dis. 1992;180(2):111-6.

54. Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, et al. Short screening scales to monitor population prevalence and trends in non-specific psychological distress. Psychol Med. 2002;32(6):959-76.

55. Brugha T, Bebbington P, Tennant C, Hurry J. The List of Threatening Experiences: a subset of 12 life event categories with considerable long-term contextual threat. Psychol Med. 1985;15(1):189-94.

56. Montgomery SA, Asberg M. A new depression scale designed to be sensitive to
change. Brit J Psychiatry. 1979;134:382-9.

57. Spitzer RL, Williams JBW, Gibbon M, First MB. The structured clinical interview for DSM-III-R (SCID). Arch Gen Psychiatry. 1992;49:624-9.

58. Beusenberg M, Orley JH. A User's guide to the self-reporting questionnaire Geneva: World Health Organization, Division of Mental Health; 1994. Available from: http://www.who.int/iris/handle/10665/61113

59. Spielberger CD. State-Trait Anxiety Inventory STAI. Palo Alto: Consulting Psychologists Press; 1983.

60. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders 4. Washington, DC: American Psychiatric Association; 1994.

61. Radloff LS. The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. Appl Psychol Meas. 1977;1(3):385-401.

62. Sheehan DV, Lecrubier Y, Sheehan KH, Anorm P, Janavs J, Weiller E, et al. The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. J Clin Psychiatry. 1998;59(Supp 20):22-57.

63. Babor TF, Biddle-Higgins JC, Saunders JB, Monteiro MG. AUDIT: The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Health Care. Geneva: World Health Organization; 2001.

64. Ewing J, Rouse BA. Identifying the hidden alcoholic. Paper presented at: the 29th International Congress on Alcohol and Drug Dependence, 1970; Sydney Australia, February 3, 1970.

65. Pascoe JM, Ialongo NS, Horn WF, Reinhart MA, Perradatto D. The reliability and validity of the maternal social support index. Fam Med. 1988;20(4):271-6.

66. Cutrona CE, Russell DW. The provisions of social relationships and adaptation to
stress In: Jones WH, Perlman D. Advances in Personal Relationships. Greenwich, CT: JAI Press;1987. pp. 37-67.

67. Holzemer WL, Uys LR, Chirwa ML, Greeff M, Makoae LN, Kohi TW. Validation of the HIV/AIDS Stigma Instrument - PLWA (HASI-P). AIDS Care. 2007;19(8):1002-12

68. Chou D, Tunçalp Ö, Firoz T, Barreix M, Filippi V, von Dadelszen P, et al. Constructing maternal morbidity – towards a standard tool to measure and monitor maternal health beyond mortality. BMC Pregnancy Childbirth 2016;16:45.

69. Say, L, Chou D, Barbour K, Barreix M, Cecatti J, Costa M, et al. Maternal morbidity: Time for reflection, recognition, and action. Int J Gynecol Obstet. 2018;141(S1):1-3.

70. Vanderkruik RC, Tunçalp Ö, Chou D, Say L. Framing maternal morbidity: WHO scoping exercise. BMC Pregnancy Childbirth. 2013;13:213.

Tables

**Table 1:** Description of data collection tools used in included studies to assess psychological and social morbidity
| No. | Data collection tool to assess psychological morbidity | International abbreviation | Original country, author and date |
|-----|-------------------------------------------------------|----------------------------|----------------------------------|
| 1.  | Aga Khan University Anxiety and Depression Scale     | AKUADS                     | Pakistan, Ali 1988<sup>50</sup>  |
| 2.  | Clinical Interview Schedule-Revised                   | CIS-R                      | USA, Lewis 1992<sup>51</sup>    |
| 3.  | Edinburgh Postnatal Depression Scale                  | EPDS                       | UK, Cox 1987<sup>52</sup>       |
| 4.  | Harvard Trauma Questionnaire                          | HTQ                        | USA, Mollica 1992<sup>53</sup>  |
| 5.  | Kessler-10 item psychological distress scale          | K-10                       | USA, Kessler 2002<sup>54</sup>  |
| 6.  | List of Threatening Experiences questionnaire          | LTE-Q                      | UK, Brugha 1985<sup>55</sup>    |
| 7.  | Montgomery-Åsberg Depression Rating scale             | MADRA                      | UK, Montgomery 1979<sup>56</sup>|
| 8.  | Patient Health Questionnaire                          | PHQ-9                      | USA, Spitzer 1992<sup>57</sup>  |
| 9.  | Self-Reporting Questionnaire-(20 Items)               | SRQ-20                     | WHO, Switzerland, Beusenbeh 1994<sup>58</sup> |
| 10. | State-Trait Anxiety Inventory                         | STAI                       | USA, Spielberger 1983<sup>59</sup> |
| 11. | Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition | SCI- DSM IV                | USA, American Psychiatric Association 1994<sup>60</sup> |
| 12. | WHO version of the Centre for Epidemiological Studies Depression scale | CES-DR                     | USA, Radloff 1977<sup>61</sup> |
| 13. | Mini-intentional neuropsychological                   | MINI                       | USA, Sheehan, 1998<sup>62</sup> |

| No. | Data collection tool to assess social morbidity       | International abbreviation | Original country, author and date |
|-----|-------------------------------------------------------|----------------------------|----------------------------------|
| 1.  | Alcohol Use Disorders Identification Test             | AUDIT                      | WHO, Babor 2001<sup>63</sup>    |
| 2.  | CAGE (Cut-annoyed-guilty-eye) Questionnaire           | CAGE                       | USA, Ewing 1970<sup>64</sup>    |
| 3.  | Maternity Social Support Index                        | MSSI                       | USA, Pascoe 1988<sup>65</sup>   |
| 4.  | Social Provisions Scale                               | SPS                        | USA, Cutrona 1987<sup>66</sup>  |
| 5.  | HIV-AIDS Stigma Instrumental PHWHA                    | HASI-P                     | WHO, Babor 2001<sup>67</sup>    |

**Table 2:** Reported associations between types of maternal co-morbidity and reported strength of these associations
| Main type of morbidity | Author, date | Associations between different types of morbidity and strength of the association |
|------------------------|-------------|---------------------------------------------------------------------------------|
| Physical morbidity     | Shamu 2014<sup>16</sup> | Positive HIV status was associated with intimate partner violence: partially adjusted |
|                        | Surkan 2017<sup>24</sup> | In models adjusted for sociodemographic factors and co-morbidities, all postpartum depressive symptoms by 6 months postpartum. These morbidities included uterine 1.24, 95% CI 1.11–1.38), stress related incontinence (RR 1.49, 95% CI 1.33–1.67), urine (RR 1.60–2.96), headache [RR 1.20 (95% CI 1.12–1.28)], convulsions (RR 1.38, 95% CI 1.31–1.46), pneumonia (RR 1.24, 95% CI 1.12–1.37), g (RR 2.10, 96% CI 1.69–2.60). |
|                        | Zafar 2015<sup>6</sup> | Multivariate logistic regression showed that for Malawi, after controlling for parity psychological morbidity 5-fold (OR: 5.01; 95% CI 1.60, 15.70; p=0.006). Infective than 2.5-fold increase in the odds of having psychological morbidity (OR: 2.51) in odds of psychological morbidity due to increasing burden of infectious increased odds due to increasing burden of non-infective morbidity (OR: 1.78; complication during a previous pregnancy. Complications during a previous haemorrhage (p<0.02) were associated with psychological morbidity in both settings. |
| Psychological morbidity | Faisal-Cury 2009<sup>14</sup> | Obstetric complications were independently associated with common mental disorders. |
|                        | Faisal-Cury 2010<sup>13</sup> | Common mental disorders during pregnancy was not associated with risk of prel (adjusted OR:1.09, 95% CI: 0.62-1.91) |
|                        | Karmaliana 2009<sup>17</sup> | Psychological distress was associated with husband unemployment (p = 0.032) formal education (p = 0.002), a first (p = 0.002) and an unwanted pregnancy (p < 0.001). |
|                        | Hanlon 2009<sup>44</sup> | Increasing levels of antenatal common mental disorders symptoms were associated SRQ >or= 6: RR 1.6; 95% CI 1.0-2.6). |
|                        | Nasreen 2011<sup>36</sup> | Women’s literacy, poor household economy, poor relationship with husbands, and anxiety. |
|                        | Natasha 2015<sup>37</sup> | No association with depression and gestational diabetes mellitus or other obstetric complications. |
|                        | Prost 2012<sup>49</sup> | Unwanted pregnancy for the mother, small perceived infant size and a stillbirth increased risk of psychological distress. The loss of an infant or an unwanted pregnancy was associated with a 2.5-fold increase in the odds of having psychological morbidity (OR: 2.58; 95% CI: 1.92, 3.47; p=0.000). For Pakistan, results show a 56% increase in the odds of having psychological morbidity (OR: 5.01; 95% CI: 1.60, 15.70; p=0.006). |
|                        | Rees 2016<sup>46</sup> | For any mental distress, the adjusted odds ratios for four or more traumatic events were 7.03 (95% CI 3.23-15.29); for physical abuse the adjusted OR was 10.45 (95% CI 6.06-18.01). Of women who alone or in combination with severe psychological abuse, there was a 10-fold increase in the odds of having psychological morbidity (OR: 10.45; 95% CI: 6.06-18.01). |
|                        | Tsai 2016<sup>25</sup> | After multivariable adjustment, intimate partner violence intensity had a strong severity, regardless of the specification. |
|                        | Wado 2014<sup>19</sup> | Results of unadjusted log-binomial regression showed that unwanted pregnancy and birth weight The relationship between antenatal depressive symptoms and low birth weight and unwanted pregnancy remained after multivariable adjustment. |
|                        | Waqas 2015<sup>40</sup> | Inferential analysis revealed that higher HADS scores were significantly associated with harassment, abortion, Caesarean delivery and unplanned pregnancies (P <.05). Number of children, gender of previous children and HADS score. |
| Social morbidity    | Wong 2017\textsuperscript{41} | Report of self-harming thoughts was 11 % in younger and 4 % in older women (p |  |
|---------------------|-------------------------------|---------------------------------------------------------------------------------|  |
|                     | Hassan 2014\textsuperscript{43} | A significant association was found between intimate partner violence and preterm (CI) 1.16-2.03), Caesarean section (adjOR 11.84, 95% CI 6.37-22.02), antenatal \textit{r} (adjOR 1.51, 95% CI 0.9-2.3). |  |
|                     | Romero-Gutiérrez 2011\textsuperscript{45} | Maternal complications were higher in women who experienced violence (30.2% more maternal complications (43.2%), and women who experienced psychological |  |
|                     | Stöckl 2010\textsuperscript{47} | Women's odds of drinking during their last pregnancy were significantly increased pregnancy was also associated with having had a child or infant that died. |  |
Citations from database searches 2840

Initial screening by titles 1498

Initial screening by abstract 248

Citations excluded based on screening of title 1250

Main causes of exclusion:
No primary data reported
Severe acute maternal morbidity described

Citations excluded based on full text review 22

Main causes of exclusion:
Gynaecology conditions/non-pregnancy or postnatal population n=12
Single morbidity described n=5
Severe acute morbidity described n=2
Outcome related to the health system n=1
Neonatal morbidity only n=2

Included publications 38
(Reporting on 36 separate studies)
Figure 1

PRISMA diagram for article selection process

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