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A Scoping Review Protocol on Maternal, Newborn, and Child Health Research in Ethiopia

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September 13, 2019

Dear Editor of BMJ Open,

We are submitting a manuscript on “A Scoping Review Protocol on Maternal, Newborn, and Child Health Research in Ethiopia.” Ethiopia is one of the ten countries in the world that contributes to over 50% of global maternal and child mortality. There is growing interest from global funders and from the Ethiopian Federal Ministry of Health to prioritize maternal and child health research questions. The scoping review protocol presents a systematic process to assess the landscape of maternal, newborn, and child health (MNCH) research in Ethiopia and to identify gaps for research prioritization. The protocol is ongoing: we conducted our search strategy in January 7, 2019 and anticipate the study will be completed by November 2019.

This protocol is closely aligned with BMJ Open’s research priorities. We hope you are interested in publishing this manuscript in the *BMJ Open*. We are grateful for your time and consideration.

Sincerely yours,

Grace Chan, MD MPH PHD
Harvard Medical School and Harvard School of Public Health

Title: A Scoping Review Protocol on Maternal, Newborn, and Child Health Research in Ethiopia

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Key words: maternal, child, health, scoping review, Ethiopia

ABSTRACT:

Introduction There has been tremendous reduction in maternal and child mortality in the last decade. However, a significant number of deaths still occur disproportionately in low-income country settings. Ethiopia is the second most populous nation in sub-Saharan Africa with a high maternal mortality rate of 412 deaths per 100,000 live births and under-five mortality rate of 55 per 1000 live births. This study presents a scoping review to describe the current knowledge of maternal and child health in Ethiopia to identify gaps for prioritization of future maternal, newborn, and child health (MNCH) research.

Methods and analyses A search strategy will be conducted in PubMed/MEDLINE, EMBASE, and the WHO African Index Medicus. Researchers will independently screen title and abstracts followed by full-texts for inclusion. Study characteristics, research topics, exposures and outcomes will be abstracted from articles meeting inclusion criteria using standardized forms. Descriptive analysis of abstracted data will be conducted.

Ethics and dissemination Data will be abstracted from published manuscripts and no additional ethical approval is required. The results of the review will be shared with maternal and child health experts in Ethiopia through stakeholder meetings to prioritize research questions. Findings will be submitted to a peer-reviewed journal for publication, in addition to national and global level dissemination.

Conclusions The scoping review protocol will generate evidence on existing MNCH research in Ethiopia. Results will support prioritization of additional research questions that can be answered through systematic reviews, meta-analysis and primary data collection.

Strengths and limitations of this study:

- To our knowledge, this will be the first scoping review describing the landscape of MNCH research in Ethiopia.
- Findings from the review will be shared with stakeholders in-country for decision making and priority setting.
- The scoping review will be limited to published data which will affect publication bias.
- The scoping review covers a broad search strategy to present an overview of MNCH research in Ethiopia. To answer specific research questions, further work can be conducted through systematic reviews and meta-analyses.

INTRODUCTION:

Globally, there have been significant improvements in reducing maternal and under-five mortality.[1] Since 2000, there has been a 37 percent reduction in the maternal mortality and under-five mortality has reduced almost by half.[1] However, of the estimated 300,000 maternal deaths that occurred worldwide in 2015, approximately 99% occurred in developing countries.[2] With 11,000 maternal deaths each year and a maternal mortality rate of 412/100,000 live births,[2, 3] Ethiopia is one of six countries which has contributed to more than half of global maternal deaths.[4] With an estimated 80,000 newborns deaths each year in Ethiopia (neonatal mortality rate 30/1000).[5] Ethiopia is one of ten countries accounting for more than half of global neonatal deaths.[6]

These figures highlight the work that remains to improve MNCH in countries which account for the greatest number of maternal and child deaths. In Africa's second most populous nation, Ethiopia, many women still die from preventable causes such as maternal hemorrhage and infection. Ethiopia was successful in achieving Millennium Development Goal 4 for a two-thirds reduction in under-five mortality through a combination of efforts in health, nutrition, and non-health sectors.[7-9] However, newborn mortality remains one of the highest in the world at 30 deaths per 1,000 live births.[5]

To determine research priorities, more information is needed to describe what is currently known and what are the gaps in the maternal and child health in countries like Ethiopia. To describe the broad, heterogeneous, and complex nature of MNCH research, a scoping review was conducted in Ethiopia.

Study objectives:

The main aims of this scoping review are:

1. To determine the study characteristics, study types and designs (e.g. cohort, randomized control trial), and content (exposures, outcomes, interventions) during the pre-conception period, pregnancy, birth, postpartum, motherhood, and childhood for MNCH research in Ethiopia.
2. To identify gaps in the existing literature on MNCH research in Ethiopia.
3. To inform on priority research questions for primary data collection related to MNCH in Ethiopia.

METHODS AND ANALYSIS:

For the scoping review, the HaSET ("happiness") for Mothers and Children Research Program will review all published literature using the framework proposed by Arksey and O'Malley and expanded upon by Levac et al., and the Joanna Briggs Institution (JBI).[10-12] The review will be conducted in the following stages: 1) identification of the research question, 2) identification of relevant studies, 3) study selection, 4) data charting, 5) collation, summarization, and report of results, and 6) consultation with key stakeholders to communicate and discuss findings from the review. This scoping review will use the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist as a guide.[13]

Stage 1: Identifying a research question

The research team, in consultation with in-country stakeholders, identified a broad, comprehensive research question through an iterative process. The following questions will be addressed by this study: What types of studies, study questions, and data on exposures, outcomes, and interventions have been studied in maternal, newborn, and child health research in Ethiopia?

Stage 2: Identifying relevant studies

To identify relevant literature, the study team developed a comprehensive, iterative search strategy (Appendix 1). Studies published in English or Amharic will be included. The team will search PubMed/MEDLINE, EMBASE, and the African Index Medicus via the Global Index Medicus platform of the World Health Organization. The search will not be restricted by time to describe the volume of literature published on MNCH in Ethiopia over time. References will be downloaded and imported into a reference library using Endnote.

Inclusion criteria will use the population, concepts, and context framework (PCC) described by JBI, shown in Table 1.[12]

Table 1: Inclusion criteria using PCC framework

Population	• Women of reproductive age (all women aged 15-49) • Pregnant women regardless of age • Postpartum women (birth to 42 days postpartum) • Mothers of children aged 5 years or less • Newborns (individuals aged 28 days or less) • Infants (29 days to under 1 year) • Children (1 year to under 10 years)[a]
Concepts	• Preconception care defined by WHO as "the provision of biomedical, behavioral, and social health interventions before conception occurs."[14] • Reproductive health defined by National Library of Medicine (NLM) definition as the state of optimal female reproductive system functioning in the absence of disease, disorders, or deficiencies • Maternal health defined by NLM as the health of women during pregnancy, childbirth, and the postpartum period • Newborn health defined as the physical and mental wellness of individuals under 28 days of age • Infant health defined as the physical and mental wellness of individuals under 1 year of age • Child health defined as the physical and mental wellness of individuals under 10 years of age
Context	• Ethiopian studies[b] • Time - since 1946[c]

[a] The WHO definition of adolescence is individuals aged 10-19. Children are considered less than 10 for the purposes of this review.
[b] Ethiopian studies will be defined as studies conducted in-country and non-refugee populations.
[c] 1946 is the earliest date of coverage across all databases used in the review.

On study type, we plan to include all evidence-based studies or studies that apply "principles of scientific reasoning, including systematic uses of data and information systems, and appropriate use of behavioral science theory and program planning models",[15] in published literature. Such studies could include randomized trials, observational studies, physiologic studies, case studies, laboratory studies, systematic reviews, and meta-analyses.[16-19] Review of gray literature was outside the scope of this review.

Non-English or non-Amharic, non-human, personal opinion pieces, non-systematic literature reviews, non-journal articles will be excluded. To maintain focused, we excluded sex workers, non-Ethiopian refugee populations, and children greater than the age of 10. We will screen for these articles and count the number of studies related to these populations to understand potential biases associated with excluding these populations.

Stage 3: Study selection

Study selection tools will be developed and piloted on a random sample of references derived from search by two independent reviewers. Kappa statistic will be used to determine agreement between reviewers. Disagreement will be discussed between reviewers and refinement of screening form will be made based on discussion. Changes to the forms will be made in an iterative process on a random sample of references until reviewer agreement of 0.8 or greater (as determined by Kappa statistic) is achieved and disagreement due to different applications of form criteria is minimized.

Once forms are finalized, two research assistants will independently screen references for relevance to research question using the inclusion and exclusion criteria described in Stage 2. Study selection will be conducted in two phases: title and abstract screen and full-text review.

Title and abstract screen

After removal of duplicates, titles and abstracts will be screened for full-text review by two independent reviewers. During the title and abstract screen, each study will be classified as: 'yes', 'no', or 'unclear'. Any disagreements will be resolved by consensus between reviewers. If consensus cannot be reached, a third reviewer will serve as a tie-breaker. All studies marked as 'yes' or 'unclear' will be included for full text review. For excluded studies, basis of exclusion will be documented in review.

Full text review

Articles selected for full text review in which the full text is unavailable will be documented. All available full text articles will be screened for inclusion by two independent reviewers. Screening at this stage will use the same inclusion and exclusion criteria used for the title and abstract screen. Disagreement will be resolved by consensus between the two reviewers. If consensus

cannot be reached by two reviewers, a third reviewer will resolve the disagreement. Should any questions/concerns arise about a particular study, an attempt will be made to contact the authors of the study.

Stage 4: Data charting

Per Arksey and O'Malley, data charting "describes a technique for synthesizing and interpreting qualitative data by sifting, charting, and sorting material according to key issues and themes."[10] Once screening is complete, a data extraction tool will be developed in Qualtrics to chart results of review. The tool will be piloted and refined.

Data will be extracted from full-text papers that meet inclusion criteria. Information to be retrieved includes: author(s), publication year, journal of publication, study population, sample size (if available/applicable), type of study/study design,[16-19] length (in months) of study (if available), type of study question, region of study (e.g. rural vs urban, specific district if provided), setting of study (e.g. academic, community-based, laboratory-based), country of corresponding author, funding source (if available). For epidemiologic studies, the following additional information will be extracted: categories of intervention type, categories of exposure type, and categories of outcome. These categories are further described in Appendix 2.[14, 20-26] For other studies, the study aim will be extracted to be thematically coded for subject area after extraction.

Data will be extracted independently by two reviewers and reconciled between the reviewer pairs. Any discrepancies in extraction will be resolved by consensus between the reviewers. If consensus cannot be reached by two reviewers, a third reviewer will resolve the disagreement. The quality of extraction will be quantified by kappa statistic. Agreement between reviewer pairs will be documented. To ensure inter-reviewer reliability, the team coordinator will review a random sample of articles and provide feedback to improve standardization across reviewer pairs.

Stage 5: Collation, summarization, and report of results

Studies will be collated and summarized by years of publication, journals of publication, the number of relevant studies overall, the number of relevant studies by MNCH population, the number of relevant studies by question posed and type of study, the types of interventions, exposures, and outcomes studied overall and within specific MNCH populations. An assessment of quality will not be conducted.

Summary of results will be reported in descriptive tables. Histograms will be used to display number of publications per year for all studies. Histograms and/or bubble charts will be used to display the number of publications per year by population and/or by topic theme. Adjustment to data reporting scheme will be made as needed based on findings. This scoping review will be validated against PRISMA-ScR checklist.[13]

ETHICS AND DISSEMINATION:

Throughout the process of this review, we intend to involve key stakeholders in-country such that the final conclusions are reflective of the MNCH work being done in Ethiopia. Furthermore, MNCH experts and researchers at Ethiopian academic institutions, research institutions, and NGOs will be actively involved in identifying which published studies have been translated into national policy. References selected for inclusion into the scoping review will be shared with experts, who will identify pertinent MNCH policy documents and the studies used to inform these policy decisions. Based on consultation with experts, the proportion of references in the scoping review that resulted in policy development will be quantified.

Data from the review will be summarized and presented during stakeholder meetings with collaborators in Ethiopia to prioritize MNCH research questions. A final report will be developed and disseminated through a peer-reviewed journal.

CONCLUSIONS:
We have described a protocol for a scoping review on MNCH research in Ethiopia. This scoping review will contribute to the MNCH field by examining literature to map study topics, describe study characteristics and populations, and identify research gaps. In particular, the review will identify understudied populations and MNCH research topics to develop future research questions. Depending on the availability of data and potential for impact, systematic reviews and meta-analyses can be conducted to further summarize findings on specific research questions. To our knowledge, this review is the first of its kind to be done on the subject. By providing a broad overview of the MNCH literature, this review will prioritize research questions to improve maternal and child health in Ethiopia.

REFERENCES:

1. United Nations. The Sustainable Development Goals Report 2018. 2018.
2. Trends in maternal mortality: 1990 to 2015: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva, Switzerland: World Health Organization.
3. Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia and Calverton, Maryland: Central Statistical Authority and ORC Macro, 2017.
4. Hogan MC, Foreman KJ, Naghavi M, et al. Maternal mortality for 181 countries, 1980-2008: a systematic analysis of progress towards Millennium Development Goal 5. *Lancet* 2010;375(9726):1609-23. doi: 10.1016/S0140-6736(10)60518-1 [published Online First: 2010/04/13]
5. Mini-Demographic and Health Survey. Addis Ababa: Ethiopian Public Health Institute, Federal Ministry of Health, The DHS Program ICF, 2019.
6. Joy Lawn PM, Simon Cousen. Africa's newborns–counting them and making them count [Available from: https://www.who.int/pmnch/media/publications/aonsection_I.pdf accessed August 21, 2019.
7. Assefa Y, Damme WV, Williams OD, et al. Successes and challenges of the millennium development goals in Ethiopia: lessons for the sustainable development goals. *BMJ Global Health* 2017;2(2):e000318. doi: 10.1136/bmjgh-2017-000318
8. Moucheraud C, Owen H, Singh NS, et al. Countdown to 2015 country case studies: what have we learned about processes and progress towards MDGs 4 and 5? *BMC Public Health* 2016;16(2):794. doi: 10.1186/s12889-016-3401-6
9. Ruducha J, Mann C, Singh NS, et al. How Ethiopia achieved Millennium Development Goal 4 through multisectoral interventions: a Countdown to 2015 case study. *The Lancet Global Health* 2017;5(11):e1142-e51. doi: 10.1016/S2214-109X(17)30331-5
10. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology* 2005;8(1):19-32. doi: 10.1080/1364557032000119616
11. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implementation Science* 2010;5(1):69. doi: 10.1186/1748-5908-5-69
12. Peters MDJ, Godfrey CM, Khalil H, et al. Guidance for conducting systematic scoping reviews. *International Journal of Evidence-Based Healthcare* 2015;13(3)
13. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of internal medicine* 2018;169(7):467-73.
14. World Health Organization. Meeting to develop a global consensus on preconception care to reduce maternal and childhood mortality and morbidity: World Health Organization Headquarters, Geneva, 6–7 February 2012: Meeting report. 2013.
15. Brownson RC, Baker EA, Deshpande AD, et al. Evidence-based public health: Oxford University Press 2017.
16. Creswell JW, Clark VLP. Designing and conducting mixed methods research: Sage publications 2017.
17. Berg BL. Qualitative research methods for the social sciences. 2001
18. Rothman KJ, Greenland S, Lash TL. Modern epidemiology: Wolters Kluwer Health/Lippincott Williams & Wilkins Philadelphia 2012.
19. George Washington University. Study Design 101 2019 [Available from: https://himmelfarb.gwu.edu/tutorials/studydesign101.
20. Health People 2020. Social determinants of health [Available from: https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health.

21. Institute for Health Metrics and Evaluation. GBD Compare Data Visualization Seattle, WA: IHME, University of Washington; 2018 [Available from: http://vizhub.healthdata.org/gbd-compare.
22. Hunegnaw B. Top maternal conditions based on HMIS ranking data for Ethiopia Addis Ababa, Ethiopia, 2018.
23. Hunegnaw B. Top pediatric conditions based on HMIS ranking data for Ethiopia Addis Ababa, Ethiopia, 2018.
24. World Health Organization. The WHO Application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD-MM: World Health Organization 2012.
25. World Health Organization. The WHO application of ICD-10 to deaths during the perinatal period: ICD-PM. 2016.
26. The Partnership for Maternal, Newborn, & Child Health. A global review of the key interventions related to reproductive, maternal, newborn and child health (RMNCH). Geneva, Switzerland: PMNCH, 2011.

Authors' contributions:

All authors contributed to the preparation of the manuscript. The specific contributions are listed
below:

Conceptualized of the study and first drafting of the manuscript: Grace J Chan, Misrak Getnet, Ronke Olowojesiku

Subsequent revisions of manuscript drafts, completion of information on study settings and methods: Grace J Chan, Misrak Getnet, Thein Min-Swe, Bezawit Hunegnaw, Delayehu Bekele

All authors read and approved the final manuscript.

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Competing interests: None of the authors have any competing interests to declare.

Patients and public were not involved in the development of the protocol.

Appendix 1: Detailed search strategy for Ethiopian MNCH research scoping review

PubMed

Population	(("Mothers"[Mesh] OR mother*[tiab] OR matern*[tiab] OR women*[tiab] OR "reproductive age"[tiab] OR "Pregnant Women"[Mesh] OR "Pregnancy"[Mesh] OR pregnan*[tiab] OR gravid*[tiab] OR prenatal[tiab] OR antenatal[tiab] OR pre natal[tiab] OR ante natal[tiab] OR perinatal[tiab] OR postnatal[tiab] OR post natal[tiab] OR postpartum[tiab] OR "Peripartum period"[Mesh] OR "Postpartum period"[Mesh])
	OR
	("Infant"[Mesh] OR infant*[tiab] OR newborn[tiab] OR neonat*[tiab] OR fetal[tiab] OR fetus[tiab] OR feotal[tiab] OR feotus[tiab] OR "Child"[Mesh] OR child*[tiab] OR boy[tiab] OR boys[tiab] OR girl[tiab] OR girls[tiab] OR toddler*[tiab] OR "Adolescent"[Mesh] OR teen*[tiab] OR adolescen*[tiab] OR youth[tiab])
OR	
Concepts	("Reproductive Health"[Mesh] OR "Reproductive Behavior"[Mesh] OR "Reproductive History"[Mesh] OR "Contraception"[Mesh] OR "Family Planning Services"[Mesh] OR "family planning"[tiab] OR "birth control"[tiab] OR contraception[tiab] OR "Birth Intervals"[Mesh] OR "Reproductive Health Services"[Mesh] OR "Maternal Health Services"[Mesh] OR "Child Health Services"[Mesh] OR "Maternal-Child Health Centers"[Mesh] OR "Maternal-Child Nursing"[Mesh] OR "Obstetric Nursing"[Mesh] OR "Pediatric Nursing"[Mesh] OR "Doulas"[Mesh] OR "Midwifery"[Mesh] OR "Nurse Midwives"[Mesh] OR doula*[tiab] OR midwife*[tiab] OR "Obstetric Surgical Procedures"[Mesh] OR "Prenatal Care"[Mesh] OR "Prenatal Education"[Mesh] OR "Hospitals, Maternity"[Mesh] OR "Diagnostic Techniques, Obstetrical and Gynecological"[Mesh] OR "Maternal Exposure"[Mesh] OR "Maternal Age"[Mesh] OR "Infectious Disease Transmission, Vertical"[Mesh] OR "Postnatal Care"[Mesh] OR "Kangaroo-Mother Care Method"[Mesh] OR "Intensive Care Units, Pediatric"[Mesh] OR "Intensive Care, Neonatal"[Mesh] OR "Maternal Nutritional Physiological Phenomena"[Mesh] OR "Prenatal Nutritional Physiological Phenomena"[Mesh] OR "Child Nutritional Physiological Phenomena"[Mesh] OR "Infant Nutritional Physiological Phenomena"[Mesh]) OR ("Maternal Health"[Mesh] OR "maternal health"[tiab] OR "Maternal Welfare"[Mesh] OR "mother-child"[tiab] OR "Mother-Child

	Relations"[Mesh] OR "Maternal Behavior"[Mesh] OR "Maternal Mortality"[Mesh] OR "Parturition"[Mesh] OR birth[tiab] OR "Pregnancy Complications"[Mesh] OR "Genital Diseases, Female"[Mesh] OR "Pelvic Floor Disorders"[Mesh] OR "Gestational Weight Gain"[Mesh] OR "Birth Weight"[Mesh] OR "childbirth"[tiab] OR "childbirth complications"[tiab] OR "Depression, Postpartum"[Mesh] OR "Postpartum Hemorrhage"[Mesh] OR "Infertility, Female"[Mesh] OR "Fertility"[Mesh] OR abortion*[tiab] OR miscarriage*[tiab] OR stillbirth*[tiab] OR "Congenital, Hereditary, and Neonatal Diseases and Abnormalities"[Mesh] OR "Infant Health"[Mesh] OR "Infant Mortality"[Mesh] OR "Child Mortality"[Mesh] OR "Neurodevelopmental Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Behavior"[Mesh] OR "Child Development"[Mesh] OR "Child Welfare"[Mesh] OR "Child Health"[Mesh] OR "Adolescent Health"[Mesh] OR "Adolescent Development"[Mesh]))
AND	
Context	("Ethiopia"[Mesh] OR ethiopia[tiab])
Filters	English, Amharic, Human

EMBASE

Population	(('adolescent mother'/de OR 'expectant mother'/de OR 'surrogate mother'/exp OR 'mother*':ab,ti OR 'matern*':ab,ti OR 'women*':ab,ti OR 'reproductive age':ab,ti OR 'named groups by pregnancy'/exp OR 'pregnancy'/exp OR 'pregnan*':ab,ti OR 'gravid*':ab,ti OR 'prenatal':ab,ti OR 'antenatal':ab,ti OR 'pre natal':ab,ti OR 'ante natal':ab,ti OR 'perinatal':ab,ti OR 'postnatal':ab,ti OR 'post natal':ab,ti OR 'postpartum':ab,ti OR 'perinatal period'/de OR 'puerperium'/de)
	OR
	('infant'/exp OR 'infant*':ab,ti OR 'newborn':ab,ti OR 'neonat*':ab,ti OR 'fetal':ab,ti OR 'fetus':ab,ti OR 'feotal':ab,ti OR 'feotus':ab,ti OR 'child'/exp OR 'child*':ab,ti OR 'boy':ab,ti OR 'boys':ab,ti OR 'girl':ab,ti OR 'girls':ab,ti OR 'toddler*':ab,ti OR 'adolescent'/exp OR 'teen':ab,ti OR 'adolescen*':ab,ti OR 'youth':ab,ti)
OR	
Concepts	('reproductive health'/de OR 'reproductive behavior'/de OR 'reproductive history'/de OR 'contraception'/exp OR 'family planning'/de OR 'family planning':ab,ti OR 'birth control':ab,ti OR 'contraception':ab,ti OR 'maternal health service'/de OR 'maternal child health care'/de OR

	'child health care'/exp OR 'newborn nursing'/exp OR 'nurse midwifery'/de OR 'obstetrical nursing'/de OR 'pediatric nursing'/exp OR 'perinatal nursing'/de OR 'midwife'/de OR 'doula'/de OR 'traditional birth attendant'/de OR 'doula*':ab,ti OR 'midwife*':ab,ti OR 'obstetric operation'/exp OR 'prenatal care'/exp OR 'childbirth education'/exp OR 'prepregnancy care'/de OR 'perinatal care'/exp OR 'intrapartum care'/de OR 'maternal exposure'/de OR 'maternal age'/de OR 'vertical transmission'/de OR 'postnatal care'/exp OR 'kangaroo care'/de OR 'pediatric intensive care unit'/de OR 'neonatal intensive care unit'/de OR 'newborn intensive care'/de OR 'maternal nutrition'/de OR 'child nutrition'/exp OR 'adolescent nutrition'/de) OR ('maternal welfare'/de OR 'maternal health':ab,ti OR 'mother-child':ab,ti OR 'mother child relation'/de OR 'maternal behavior'/de OR 'maternal mortality'/de OR 'birth'/de OR 'birth':ab,ti OR 'pregnancy complication'/exp OR 'gynecologic disease'/exp OR 'gestational weight gain'/de OR 'birth weight'/exp OR 'childbirth':ab,ti OR 'childbirth complications':ab,ti OR 'postnatal depression'/de OR 'postpartum hemorrhage'/de OR 'female infertility'/exp OR 'female fertility'/de OR 'abortion*':ab,ti OR 'miscarriage*':ab,ti OR 'stillbirth*':ab,ti OR 'newborn disease'/exp OR 'infant disease'/exp OR 'child health'/de OR 'infant mortality'/de OR 'developmental disorder'/exp OR 'child behavior'/exp OR 'child development'/de OR 'motor development'/de OR 'child welfare'/exp OR 'adolescent health'/de OR 'adolescent development'/de OR (('adolescent mother'/de OR 'expectant mother'/de OR 'surrogate mother'/exp OR 'mother*':ab,ti OR 'matern*':ab,ti OR 'women*':ab,ti OR 'reproductive age':ab,ti OR 'named groups by pregnancy'/exp OR 'pregnancy'/exp OR 'pregnan*':ab,ti OR 'gravid*':ab,ti OR 'postnatal':ab,ti OR 'post natal':ab,ti OR 'postpartum':ab,ti OR 'perinatal period'/de OR 'puerperium'/de OR 'infant'/exp OR 'infant*':ab,ti OR 'newborn':ab,ti OR 'neonat*':ab,ti OR 'fetal':ab,ti OR 'fetus':ab,ti OR 'feotal':ab,ti OR 'feotus':ab,ti OR 'child'/exp OR 'child*':ab,ti OR 'boy':ab,ti OR 'boys':ab,ti OR 'girl':ab,ti OR 'girls':ab,ti OR 'toddler*':ab,ti OR 'adolescent'/exp OR 'teen*':ab,ti OR 'adolescen*':ab,ti OR 'youth':ab,ti) AND ('mental disease'/exp OR 'behavior disorder'/exp))))
AND	
Context	('Ethiopia'/de OR 'ethiopia':ab,ti)
Filters	[humans]/lim AND [english] AND [amharic]/lim NOT [medline]/lim

WHO African Index Medicus *(via WHO Global Index Medicus)*

Maternal health search

(mother* OR matern* OR women* OR "reproductive age" OR pregnan* OR gravid* OR prenatal OR antenatal OR “pre natal” OR “ante natal” OR perinatal OR postnatal OR “post natal” OR postpartum OR peripartum OR “maternal health” OR “reproductive health”) AND (Ethiopia)

Limit: English

Newborn and Infant Health
(infant* OR newborn OR neonat* OR fetal OR fetus OR feotal OR feotus OR “infant health” OR “newborn health” OR birth) AND (Ethiopia)

Limit: English

Child and Adolescent Health
(child* OR boy OR boys OR girl OR girls OR toddler* OR adolescent OR teen* OR adolescen* OR youth) AND (Ethiopia)

Limit: English

Appendix 2: Categories of interventions, exposures, outcomes, and research questions

1. Interventions

1.1. Maternal interventions [14, 26]

Among women of reproductive age 15-49 and pregnant women, interventions addressing pre-conception care areas, including

- Prevention and management of STIs including HIV
- Iron, folic acid, and calcium supplementation
- Vaccination, including tetanus and rubella
- Malaria prevention and management
- Treatment related to female genital mutilation
- Interpersonal violence
- Pregnancy spacing
- Substance use cessation (describe)
- Smoking cessation programs
- Family planning services
- General access to adequate antenatal care
- Other, specify:

Among postpartum women

- Family planning
- Prevention and management of postpartum hemorrhage
- Maternal nutrition
- General access to adequate postnatal care
- Other, specify:

1.2. Newborn interventions[26]

- Newborn resuscitation
- Early initiation of breastfeeding
- Hygienic cord and skin care
- CPAP use for management of respiratory distress
- Surfactant use for prevention of respiratory distress
- Management of neonatal jaundice
- Thermal care
- Kangaroo-mother care
- Antiretroviral prophylaxis for HIV exposure
- Antibiotic prophylaxis/treatment
- Other, specify:

1.3. Infant and child interventions[26]

- Exclusive breastfeeding for 6 months
- Management of malnutrition
- Management of childhood pneumonia
- Management of childhood diarrhea

- Management of children infected with or exposed to HIV
- Management of other childhood infection
- Vitamin A supplementation aged 6 months and above
- Other nutrient supplementation
- Prevention and management of childhood malaria
- Routine immunizations
- Other, specify:

2. Exposures

Exposures will be categorized as:

Accidents and injuries[3]
- Road injuries
- Other, specify:

Domestic violence[22, 23]
- Intimate partner violence
- Spousal abuse
- Infant abuse
- Child abuse
- Other, specify:

Environmental exposure[22, 23]
- Aflatoxin exposure
- Air pollution (indoor/outdoor)
- Heavy metal exposure
- Water pollution
- Other toxic exposure, specify:

Infections
Top ten infectious causes in Ethiopia based on DALYs from Global Burden of Disease Data[21]
- Diarrheal
- HIV
- Other STI
- Lower respiratory infection
- Tuberculosis
- Malaria
- Schistosomiasis
- Other infectious/neglected diseases, specify:

Nutrition[22, 23]
Categories for common nutrition concerns in these populations:

- Anemia
- Vitamin A deficiency
- Calcium deficiency
- Folate deficiency
- Iron deficiency
- Food insecurity
- Acute malnutrition (wasting)
- Chronic malnutrition (stunting)
- Other micronutrient deficiency
- Other macronutrient deficiency
- Breastfeeding
- Other, specify:

Psychosocial[22, 23]

- Mental health conditions (anxiety, depression, psychosis)
- Substance use and abuse
- Stress
- Other, specify:

Demographics[3]

- Age
- Gender
- Birth spacing
- Gestational age
- Gravidity/Parity/Abortion (GTPAL)
- Other, specify:

Social determinants of health[20]
Based on Healthy People 2020 framework:

- Economic stability (e.g. employment, food security, housing security)
- Education (e.g. language and literacy, participation in primary, secondary, and higher education)
- Social and community context (e.g. civic participation, discrimination, incarceration, social cohesion)
- Health and healthcare (e.g. access to care, health literacy)
- Neighborhood and built environment (e.g. access to food to support health, crime and violence, housing quality, environment conditions)

3. Outcomes

Outcomes will be categorized by population: maternal, newborn, infant, and child. Population categories will be further classified by causes of morbidity and mortality. Categories were derived from in-country documents (Health Management Information Systems - HMIS reports) and WHO documents on MNCH outcomes.[22-25]

3.1. Maternal outcomes (applied for pregnant women and women of reproductive age where appropriate)

Pregnancy with abortive outcome
- Spontaneous abortion/miscarriage
- Medical abortion
- Non-medical abortion
- Other, specify:

Coincidental outcomes during pregnancy
- Domestic violence
- Intimate partner violence
- Road accidents
- Other, specify:

Nutrition
- Anemia
- Malnutrition/undernutrition
- Other, specify:

Pregnancy-related complications, non-infectious
- Gestational diabetes
- Gestational hypertension without proteinuria
- Obstructed labor
- Pre-eclampsia
- Eclampsia
- Other, specify:

Pregnancy-related complications, infectious
- Sexually transmitted infections during pregnancy
- Reproductive tract infections during pregnancy
- Puerperal sepsis
- Other, specify:

Psychosocial
- Postpartum depression
- Other, specify:

Other outcomes
- Mortality
- Morbidity
- Health service utilization
- Family planning
- Other, specify:

3.2. Newborn (birth) outcomes

- Mortality
- Morbidity
- Health service utilization
- Birth asphyxia/Intrapartum hypoxia
- Birth injury
- Birth weight
- Congenital malformations, deformations and chromosome abnormalities
- Fetal growth and malnutrition
- Hyperbilirubinemia/Jaundice
- Neonatal sepsis
- Preterm Birth
- Stillbirth (specify fresh or macerated if applicable)
- TORCH infections
- Other, specify:

3.3. Infant and child outcomes

Infectious

- Diarrheal disease (specify if applicable)
- HIV
- Malaria
- Measles
- Meningitis
- Parasitic infections
- Respiratory disease (not tuberculosis)
- Septicemia
- Tetanus
- TORCH infections
- Trachoma
- Tuberculosis
- Urinary tract infections
- Other, specify:

Nutrition

- Anemia
- Anthropometric measurements
- Acute malnutrition (wasting)
- Chronic malnutrition (stunting)
- Underweight
- Malnutrition, not specified
- Other, specify:

Violence and injuries
- Violence (e.g. child abuse)
- Road accidents and injury
- Burns and corrosions
- Poisoning
- Other, specify:

Psychosocial
- Anxiety
- Depression
- Psychosis
- Other, specify:

Other outcomes
- Mortality
- Morbidity
- Health service utilization
- Other, specify:

4. Research questions

Evidence-based studies will be charted by types of research questions, categorized as, including but not limited to,

- Cost-effectiveness: What is the cost of this intervention? How does it compare to the benefits of the intervention?
- Association/Etiology: What causes the problem?
- Evaluation: How well does this intervention work?
- Descriptive: What are the characteristics of this population or phenomenon?
- Incidence: What proportion of individuals are newly diagnosed/present with the problem?
- Prevalence: What proportion of the population is living with this problem at a given time?
- Intervention: What should be done to treat the problem?
- Perceptions: What are perceptions around the problem?
- Prevention: What can be done to prevent the problem?
- Diagnosis: How can we identify those with the problem and those without the problem?
- Prognosis: What is the likely outcome of the problem?
- Screening: Will detecting this problem early, before symptoms, make differences in outcomes?

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A Scoping Review Protocol on Maternal, Newborn, and Child Health Research in Ethiopia

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Title: A Scoping Review Protocol on Maternal, Newborn, and Child Health Research in Ethiopia

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ABSTRACT:

Introduction There has been tremendous reduction in maternal and child mortality in the last decade. However, a significant number of deaths still occur disproportionately in low-income country settings. Ethiopia is the second most populous nation in sub-Saharan Africa with a high maternal mortality rate of 412 deaths per 100,000 live births and under-five mortality rate of 55 per 1000 live births. This study presents a scoping review to describe the current knowledge of maternal and child health in Ethiopia to identify gaps for prioritization of future maternal, newborn, and child health (MNCH) research.

Methods and analyses A search strategy will be conducted in PubMed/MEDLINE, EMBASE, and the WHO African Index Medicus. Researchers will independently screen title and abstracts followed by full-texts for inclusion. Study characteristics, research topics, exposures and outcomes will be abstracted from articles meeting inclusion criteria using standardized forms. Descriptive analysis of abstracted data will be conducted.

Ethics and dissemination Data will be abstracted from published manuscripts and no additional ethical approval is required. The results of the review will be shared with maternal and child health experts in Ethiopia through stakeholder meetings to prioritize research questions. Findings will be submitted to a peer-reviewed journal for publication, in addition to national and global level dissemination.

Strengths and limitations of this study:

- To our knowledge, this will be the first scoping review describing the landscape of MNCH research in Ethiopia.
- Findings from the review will be shared with stakeholders in-country for decision making and priority setting.
- The scoping review will be limited to published data which will affect publication bias.
- The scoping review covers a broad search strategy to present an overview of MNCH research in Ethiopia. To answer specific research questions, further work can be conducted through systematic reviews and meta-analyses.

INTRODUCTION:

Globally, there have been significant improvements in reducing maternal and under-five mortality.[1] Since 2000, there has been a 37 percent reduction in the maternal mortality and under-five mortality has reduced almost by half.[1] However, of the estimated 300,000 maternal deaths that occurred worldwide in 2015, approximately 99% occurred in developing countries.[2] With 11,000 maternal deaths each year and a maternal mortality rate of 412/100,000 live births,[2, 3] Ethiopia is one of six countries which has contributed to more than half of global maternal deaths.[4] With an estimated 80,000 newborns deaths each year in Ethiopia (neonatal mortality rate 30/1000 live births).[5] Ethiopia is one of ten countries accounting for more than half of global neonatal deaths.[6]

These figures highlight the work that remains to improve MNCH in countries which account for the greatest number of maternal and child deaths. In Africa's second most populous nation, Ethiopia, many women still die from preventable causes such as maternal hemorrhage and infection. Ethiopia was successful in achieving Millennium Development Goal 4 for a two-thirds reduction in under-five mortality through a combination of efforts in health, nutrition, and non-health sectors.[7-9] Under-five mortality improved from 166/1000 live births in 2000 to 55/1000 live births in 2019.[3, 5] However, newborn mortality remains one of the highest in the world at 30 deaths per 1,000 live births.[5] Data on stillbirths remains limited.

To determine research priorities, more information is needed to describe what is currently known and what are the gaps in the maternal and child health in countries like Ethiopia. This will be the first scoping review in Ethiopia describing the broad, heterogeneous, and complex nature of MNCH research.

Study objectives:

The main aims of this scoping review are:

1. To determine the study characteristics, study types and designs (e.g. cohort, randomized control trial), and content (exposures, outcomes, interventions) during the pre-conception period, pregnancy, birth, postpartum, motherhood, and childhood for MNCH research in Ethiopia.
2. To identify gaps in the existing literature on MNCH research in Ethiopia.
3. To inform on priority research questions for primary data collection related to MNCH in Ethiopia.

METHODS AND ANALYSIS:

We will conduct a scoping review of all published literature using the framework proposed by Arksey and O'Malley and expanded upon by Levac et al., and the Joanna Briggs Institution (JBI).[10-12] following stages: 1) identification of the research question, 2) identification of relevant studies, 3) study selection, 4) data charting, 5) collation, summarization, and report of results, and 6) consultation with key stakeholders to communicate and discuss findings from the review. This scoping review will use the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist as a guide.[13]

Patient and Public Involvement

Patients and public were not involved in the development of the protocol.

Stage 1: Identifying a research question

The research team, in consultation with in-country stakeholders, identified a broad, comprehensive research question through an iterative process. The following questions will be addressed by this study: What types of studies, study questions, and data on exposures, outcomes, and interventions have been studied in maternal, newborn, and child health research in Ethiopia?

Stage 2: Identifying relevant studies

To identify relevant literature, the study team developed a comprehensive, iterative search strategy (Appendix 1). Studies published in English or Amharic will be included. The team will search PubMed/MEDLINE, EMBASE, and the African Index Medicus via the Global Index Medicus platform of the World Health Organization. The search will not be restricted by time (e.g. starting in 1946 when articles were indexed) to describe the volume of literature published on MNCH in Ethiopia over time through January 2019. References will be downloaded and imported into a reference library using Endnote.

Inclusion criteria will use the population, concepts, and context framework (PCC) described by JBI, shown in Table 1.[12]

Table 1: Inclusion criteria using PCC framework

Population	• Women of reproductive age (all women aged 15-49) • Pregnant women regardless of age • Postpartum women (birth to 42 days postpartum) • Mothers of children aged 5 years or less • Newborns (individuals aged 28 days or less) • Infants (29 days to under 1 year) • Children (1 year to under 10 years)[a]
Concepts	• Preconception care defined by WHO as "the provision of biomedical, behavioral, and social health interventions before conception occurs."[14] • Reproductive health defined by National Library of Medicine (NLM) definition as the state of optimal female reproductive system functioning in the absence of disease, disorders, or deficiencies • Maternal health defined by NLM as the health of women during pregnancy, childbirth, and the postpartum period • Newborn health defined as the physical and mental wellness of individuals under 28 days of age • Infant health defined as the physical and mental wellness of individuals under 1 year of age

	• Child health defined as the physical and mental wellness of individuals under 10 years of age
Context	• Ethiopian studies[b] • Time - since 1946[c]

[a] The WHO definition of adolescence is individuals aged 10-19. Children are considered less than 10 for the purposes of this review.
[b] Ethiopian studies will be defined as studies conducted in-country and non-refugee populations.
[c] 1946 is the earliest date of coverage across all databases used in the review.

On study type, we plan to include all evidence-based studies or studies that apply "principles of scientific reasoning, including systematic uses of data and information systems, and appropriate use of behavioral science theory and program planning models",[15] in peer-reviewed published literature that are accessible online and through interlibrary requests. Such studies could include randomized trials, observational studies, physiologic studies, case studies, laboratory studies, systematic reviews, and meta-analyses.[16-19] Review of gray literature is outside the scope of this review.

Non-English or non-Amharic, non-human, personal opinion pieces, non-systematic literature reviews, non-journal articles will be excluded. To maintain focused, we excluded sex workers, non-Ethiopian refugee populations, and children greater than the age of 10. We will screen for these articles and count the number of studies related to these populations to understand potential biases associated with excluding these populations.

Stage 3: Study selection

Study selection tools will be developed and piloted on a random sample of references derived from search by two independent reviewers. Kappa statistic will be used to determine agreement between reviewers. Disagreement will be discussed between reviewers and refinement of screening form will be made based on discussion. Changes to the forms will be made in an iterative process on a random sample of references until reviewer agreement of 0.8 or greater (as determined by Kappa statistic) is achieved and disagreement due to different applications of form criteria is minimized.

Once forms are finalized, two research assistants will independently screen references for relevance to research question using the inclusion and exclusion criteria described in Stage 2. Study selection will be conducted in two phases: title and abstract screen and full-text review.

Title and abstract screen

After removal of duplicates, titles and abstracts will be screened for full-text review by two independent reviewers. During the title and abstract screen, each study will be classified as: 'yes', 'no', or 'unclear'. Any disagreements will be resolved by consensus between reviewers. If consensus cannot be reached, a third reviewer will serve as a tie-breaker. All studies marked as 'yes' or 'unclear' will be included for full text review. For excluded studies, basis of exclusion will be documented in review.

Full text review
Articles selected for full text review in which the full text is unavailable will be documented. All available full text articles will be screened for inclusion by two independent reviewers. Screening at this stage will use the same inclusion and exclusion criteria used for the title and abstract screen. Disagreement will be resolved by consensus between the two reviewers. If consensus cannot be reached by two reviewers, a third reviewer will resolve the disagreement. Should any questions/concerns arise about a particular study, an attempt will be made to contact the authors of the study.

Stage 4: Data charting
Per Arksey and O'Malley, data charting "describes a technique for synthesizing and interpreting qualitative data by sifting, charting, and sorting material according to key issues and themes."[10] Once screening is complete, a data extraction tool will be developed in Qualtrics to chart results of review. The tool will be piloted and refined.

Data will be extracted from full-text papers that meet inclusion criteria. Information to be retrieved includes: author(s), publication year, journal of publication, study population, sample size (if available/applicable), type of study/study design,[16-19] length (in months) of study (if available), type of study question, region of study (e.g. rural vs urban, specific district if provided), setting of study (e.g. academic, community-based, laboratory-based), country of corresponding author, funding source (if available). For epidemiologic studies, the following additional information will be extracted: categories of intervention type, categories of exposure type, and categories of outcome. These categories are further described in Appendix 2.[14, 20-26] For other studies, the study aim will be extracted to be thematically coded for subject area after extraction.

Data will be extracted independently by two reviewers and reconciled between the reviewer pairs. Any discrepancies in extraction will be resolved by consensus between the reviewers. If consensus cannot be reached by two reviewers, a third reviewer will resolve the disagreement. The quality of extraction will be quantified by kappa statistic. Agreement between reviewer pairs will be documented. To ensure inter-reviewer reliability, the team coordinator will review a random sample of articles and provide feedback to improve standardization across reviewer pairs.

Stage 5: Collation, summarization, and report of results
Studies will be collated and summarized by years of publication, journals of publication, the number of relevant studies overall, the number of relevant studies by MNCH population, the number of relevant studies by question posed and type of study, the types of interventions, exposures, and outcomes studied overall and within specific MNCH populations. An assessment of quality will not be conducted.

Summary of results will be reported in descriptive tables. Histograms will be used to display number of publications per year for all studies. Histograms and/or bubble charts will be used to

display the number of publications per year by population and/or by topic theme. Adjustment to data reporting scheme will be made as needed based on findings. This scoping review will be validated against PRISMA-ScR checklist.[13]

ETHICS AND DISSEMINATION:

Throughout the process of this review, we intend to involve key stakeholders in-country such that the final conclusions are reflective of the MNCH work being done in Ethiopia. The scoping review is conducted with the Ethiopian Public Health Institute, Federal Ministry of Health and St. Paul's Hospital Millennium Medical College. Authors have an established long-term working relationship on completed and ongoing maternal and child health studies. Data from the review will be summarized and presented during stakeholder meetings with collaborators in Ethiopia to prioritize MNCH research questions. A final report will be developed and disseminated through a peer-reviewed journal.

CONCLUSIONS:

We have described a protocol for a scoping review on MNCH research in Ethiopia. This scoping review will contribute to the MNCH field by examining literature to map study topics, describe study characteristics and populations, and identify research gaps. In particular, the review will identify understudied populations and MNCH research topics to develop future research questions. Depending on the availability of data and potential for impact, systematic reviews and meta-analyses can be conducted to further summarize findings on specific research questions. To our knowledge, this review is the first of its kind to be done on the subject. By providing a broad overview of the MNCH literature, this review will prioritize research questions to improve maternal and child health in Ethiopia.

REFERENCES:

1. Nations U. The Sustainable Development Goals Report 2018. 2018
2. Trends in maternal mortality: 1990 to 2015: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva, Switzerland: World Health Organization
3. Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia and Calverton, Maryland: Central Statistical Authority and ORC Macro, 2017.
4. Hogan MC, Foreman KJ, Naghavi M, et al. Maternal mortality for 181 countries, 1980-2008: a systematic analysis of progress towards Millennium Development Goal 5. *Lancet* 2010;375(9726):1609-23. doi: 10.1016/S0140-6736(10)60518-1 [published Online First: 2010/04/13]
5. Mini-Demographic and Health Survey. Addis Ababa: Ethiopian Public Health Institute, Federal Ministry of Health, The DHS Program ICF, 2019.
6. Joy Lawn PM, Simon Cousen. Africa's newborns–counting them and making them count [Available from: https://www.who.int/pmnch/media/publications/aonsection_I.pdf accessed August 21, 2019 2019.
7. Assefa Y, Damme WV, Williams OD, et al. Successes and challenges of the millennium development goals in Ethiopia: lessons for the sustainable development goals. *BMJ Global Health* 2017;2(2):e000318. doi: 10.1136/bmjgh-2017-000318
8. Moucheraud C, Owen H, Singh NS, et al. Countdown to 2015 country case studies: what have we learned about processes and progress towards MDGs 4 and 5? *BMC Public Health* 2016;16(2):794. doi: 10.1186/s12889-016-3401-6
9. Ruducha J, Mann C, Singh NS, et al. How Ethiopia achieved Millennium Development Goal 4 through multisectoral interventions: a Countdown to 2015 case study. *The Lancet Global Health* 2017;5(11):e1142-e51. doi: 10.1016/S2214-109X(17)30331-5
10. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology* 2005;8(1):19-32. doi: 10.1080/1364557032000119616
11. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implementation Science* 2010;5(1):69. doi: 10.1186/1748-5908-5-69
12. Peters MDJ, Godfrey CM, Khalil H, et al. Guidance for conducting systematic scoping reviews. *International Journal of Evidence-Based Healthcare* 2015;13(3)
13. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of internal medicine* 2018;169(7):467-73.
14. Organization WH. Meeting to develop a global consensus on preconception care to reduce maternal and childhood mortality and morbidity: World Health Organization Headquarters, Geneva, 6–7 February 2012: Meeting report. 2013
15. Brownson RC, Baker EA, Deshpande AD, et al. Evidence-based public health: Oxford University Press 2017.
16. Creswell JW, Clark VLP. Designing and conducting mixed methods research: Sage publications 2017.
17. L Berg B. Qualitative research methods for the social sciences. 2001
18. Rothman KJ, Greenland S, Lash TL. Modern epidemiology: Wolters Kluwer Health/Lippincott Williams & Wilkins Philadelphia 2012.
19. University GW. Study Design 101 2019 [Available from: https://himmelfarb.gwu.edu/tutorials/studydesign101.
20. 2020 HP. Social determinants of health [Available from: https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health.
21. (IHME) IfHMaE. GBD Compare Data Visualization Seattle, WA: IHME, University of Washington; 2018 [Available from: http://vizhub.healthdata.org/gbd-compare.

22. Hunegnaw B. Top maternal conditions based on HMIS ranking data for Ethiopia Addis Ababa, Ethiopia, 2018.
23. Hunegnaw B. Top pediatric conditions based on HMIS ranking data for Ethiopia Addis Ababa, Ethiopia, 2018.
24. Organization WH. The WHO Application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD-MM: World Health Organization 2012.
25. Organization WH. The WHO application of ICD-10 to deaths during the perinatal period: ICD-PM. 2016
26. The Partnership for Maternal N, & Child Health. A global review of the key interventions related to reproductive, maternal, newborn and child health (RMNCH). Geneva, Switzerland: PMNCH, 2011.

Authors' contributions:

All authors contributed to the preparation of the manuscript. The specific contributions are listed below:

Conceptualized of the study and first drafting of the manuscript: Grace J Chan, Misrak Getnet, Ronke Olowojesiku

Subsequent revisions of manuscript drafts, completion of information on study settings and methods: Grace J Chan, Misrak Getnet, Thein Min-Swe, Bezawit Hunegnaw, Delayehu Bekele

All authors read and approved the final manuscript.

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Competing interests: None of the authors have any competing interests to declare.

Appendix 1. Detailed search strategy for Ethiopian MNCH research scoping review

PubMed

Population	(("Mothers"[Mesh] OR mother*[tiab] OR matern*[tiab] OR women*[tiab] OR "reproductive age"[tiab] OR "Pregnant Women"[Mesh] OR "Pregnancy"[Mesh] OR pregnan*[tiab] OR gravid*[tiab] OR prenatal[tiab] OR antenatal[tiab] OR pre natal[tiab] OR ante natal[tiab] OR perinatal[tiab] OR postnatal[tiab] OR post natal[tiab] OR postpartum[tiab] OR "Peripartum period"[Mesh] OR "Postpartum period"[Mesh])
	OR
	("Infant"[Mesh] OR infant*[tiab] OR newborn[tiab] OR neonat*[tiab] OR fetal[tiab] OR fetus[tiab] OR feotal[tiab] OR feotus[tiab] OR "Child"[Mesh] OR child*[tiab] OR boy[tiab] OR boys[tiab] OR girl[tiab] OR girls[tiab] OR toddler*[tiab] OR "Adolescent"[Mesh] OR teen*[tiab] OR adolescen*[tiab] OR youth[tiab])
OR	
Concepts	("Reproductive Health"[Mesh] OR "Reproductive Behavior"[Mesh] OR "Reproductive History"[Mesh] OR "Contraception"[Mesh] OR "Family Planning Services"[Mesh] OR "family planning"[tiab] OR "birth control"[tiab] OR contraception[tiab] OR "Birth Intervals"[Mesh] OR "Reproductive Health Services"[Mesh] OR "Maternal Health Services"[Mesh] OR "Child Health Services"[Mesh] OR "Maternal-Child Health Centers"[Mesh] OR "Maternal-Child Nursing"[Mesh] OR "Obstetric Nursing"[Mesh] OR "Pediatric Nursing"[Mesh] OR "Doulas"[Mesh] OR "Midwifery"[Mesh] OR "Nurse Midwives"[Mesh] OR doula*[tiab] OR midwife*[tiab] OR "Obstetric Surgical Procedures"[Mesh] OR "Prenatal Care"[Mesh] OR "Prenatal Education"[Mesh] OR "Hospitals, Maternity"[Mesh] OR "Diagnostic Techniques, Obstetrical and Gynecological"[Mesh] OR "Maternal Exposure"[Mesh] OR "Maternal Age"[Mesh] OR "Infectious Disease Transmission, Vertical"[Mesh] OR "Postnatal Care"[Mesh] OR "Kangaroo-Mother Care Method"[Mesh] OR "Intensive Care Units, Pediatric"[Mesh] OR "Intensive Care, Neonatal"[Mesh] OR "Maternal Nutritional Physiological Phenomena"[Mesh] OR "Prenatal Nutritional Physiological Phenomena"[Mesh] OR "Child Nutritional Physiological Phenomena"[Mesh] OR "Infant Nutritional Physiological Phenomena"[Mesh]) OR ("Maternal Health"[Mesh] OR "maternal health"[tiab] OR "Maternal Welfare"[Mesh] OR "mother-child"[tiab] OR "Mother-Child

	Relations"[Mesh] OR "Maternal Behavior"[Mesh] OR "Maternal Mortality"[Mesh] OR "Parturition"[Mesh] OR birth[tiab] OR "Pregnancy Complications"[Mesh] OR "Genital Diseases, Female"[Mesh] OR "Pelvic Floor Disorders"[Mesh] OR "Gestational Weight Gain"[Mesh] OR "Birth Weight"[Mesh] OR "childbirth"[tiab] OR "childbirth complications"[tiab] OR "Depression, Postpartum"[Mesh] OR "Postpartum Hemorrhage"[Mesh] OR "Infertility, Female"[Mesh] OR "Fertility"[Mesh] OR abortion*[tiab] OR miscarriage*[tiab] OR stillbirth*[tiab] OR "Congenital, Hereditary, and Neonatal Diseases and Abnormalities"[Mesh] OR "Infant Health"[Mesh] OR "Infant Mortality"[Mesh] OR "Child Mortality"[Mesh] OR "Neurodevelopmental Disorders"[Mesh] OR "Child Behavior Disorders"[Mesh] OR "Child Behavior"[Mesh] OR "Child Development"[Mesh] OR "Child Welfare"[Mesh] OR "Child Health"[Mesh] OR "Adolescent Health"[Mesh] OR "Adolescent Development"[Mesh]))
AND	
Context	("Ethiopia"[Mesh] OR ethiopia[tiab])
Filters	English, Amharic, Human

EMBASE

Population	(('adolescent mother'/de OR 'expectant mother'/de OR 'surrogate mother'/exp OR 'mother*':ab,ti OR 'matern*':ab,ti OR 'women*':ab,ti OR 'reproductive age':ab,ti OR 'named groups by pregnancy'/exp OR 'pregnancy'/exp OR 'pregnan*':ab,ti OR 'gravid*':ab,ti OR 'prenatal':ab,ti OR 'antenatal':ab,ti OR 'pre natal':ab,ti OR 'ante natal':ab,ti OR 'perinatal':ab,ti OR 'postnatal':ab,ti OR 'post natal':ab,ti OR 'postpartum':ab,ti OR 'perinatal period'/de OR 'puerperium'/de)
	OR
	('infant'/exp OR 'infant*':ab,ti OR 'newborn':ab,ti OR 'neonat*':ab,ti OR 'fetal':ab,ti OR 'fetus':ab,ti OR 'feotal':ab,ti OR 'feotus':ab,ti OR 'child'/exp OR 'child*':ab,ti OR 'boy':ab,ti OR 'boys':ab,ti OR 'girl':ab,ti OR 'girls':ab,ti OR 'toddler*':ab,ti OR 'adolescent'/exp OR 'teen':ab,ti OR 'adolescen*':ab,ti OR 'youth':ab,ti)
OR	
Concepts	('reproductive health'/de OR 'reproductive behavior'/de OR 'reproductive history'/de OR 'contraception'/exp OR 'family planning'/de OR 'family planning':ab,ti OR 'birth control':ab,ti OR 'contraception':ab,ti OR 'maternal health service'/de OR 'maternal child health care'/de OR

	'child health care'/exp OR 'newborn nursing'/exp OR 'nurse midwifery'/de OR 'obstetrical nursing'/de OR 'pediatric nursing'/exp OR 'perinatal nursing'/de OR 'midwife'/de OR 'doula'/de OR 'traditional birth attendant'/de OR 'doula*':ab,ti OR 'midwife*':ab,ti OR 'obstetric operation'/exp OR 'prenatal care'/exp OR 'childbirth education'/exp OR 'prepregnancy care'/de OR 'perinatal care'/exp OR 'intrapartum care'/de OR 'maternal exposure'/de OR 'maternal age'/de OR 'vertical transmission'/de OR 'postnatal care'/exp OR 'kangaroo care'/de OR 'pediatric intensive care unit'/de OR 'neonatal intensive care unit'/de OR 'newborn intensive care'/de OR 'maternal nutrition'/de OR 'child nutrition'/exp OR 'adolescent nutrition'/de) OR ('maternal welfare'/de OR 'maternal health':ab,ti OR 'mother-child':ab,ti OR 'mother child relation'/de OR 'maternal behavior'/de OR 'maternal mortality'/de OR 'birth'/de OR 'birth':ab,ti OR 'pregnancy complication'/exp OR 'gynecologic disease'/exp OR 'gestational weight gain'/de OR 'birth weight'/exp OR 'childbirth':ab,ti OR 'childbirth complications':ab,ti OR 'postnatal depression'/de OR 'postpartum hemorrhage'/de OR 'female infertility'/exp OR 'female fertility'/de OR 'abortion*':ab,ti OR 'miscarriage*':ab,ti OR 'stillbirth*':ab,ti OR 'newborn disease'/exp OR 'infant disease'/exp OR 'child health'/de OR 'infant mortality'/de OR 'developmental disorder'/exp OR 'child behavior'/exp OR 'child development'/de OR 'motor development'/de OR 'child welfare'/exp OR 'adolescent health'/de OR 'adolescent development'/de OR (('adolescent mother'/de OR 'expectant mother'/de OR 'surrogate mother'/exp OR 'mother*':ab,ti OR 'matern*':ab,ti OR 'women*':ab,ti OR 'reproductive age':ab,ti OR 'named groups by pregnancy'/exp OR 'pregnancy'/exp OR 'pregnan*':ab,ti OR 'gravid*':ab,ti OR 'postnatal':ab,ti OR 'post natal':ab,ti OR 'postpartum':ab,ti OR 'perinatal period'/de OR 'puerperium'/de OR 'infant'/exp OR 'infant*':ab,ti OR 'newborn':ab,ti OR 'neonat*':ab,ti OR 'fetal':ab,ti OR 'fetus':ab,ti OR 'feotal':ab,ti OR 'feotus':ab,ti OR 'child'/exp OR 'child*':ab,ti OR 'boy':ab,ti OR 'boys':ab,ti OR 'girl':ab,ti OR 'girls':ab,ti OR 'toddler*':ab,ti OR 'adolescent'/exp OR 'teen*':ab,ti OR 'adolescen*':ab,ti OR 'youth':ab,ti) AND ('mental disease'/exp OR 'behavior disorder'/exp))))
AND	
Context	('Ethiopia'/de OR 'ethiopia':ab,ti)
Filters	[humans]/lim AND [english] AND [amharic]/lim NOT [medline]/lim

<u>WHO African Index Medicus</u> *(via WHO Global Index Medicus)*

Maternal health search

(mother* OR matern* OR women* OR "reproductive age" OR pregnan* OR gravid* OR prenatal OR antenatal OR “pre natal” OR “ante natal” OR perinatal OR postnatal OR “post natal” OR postpartum OR peripartum OR “maternal health” OR “reproductive health”) AND (Ethiopia)

Limit: English

Newborn and Infant Health
(infant* OR newborn OR neonat* OR fetal OR fetus OR feotal OR feotus OR “infant health” OR “newborn health” OR birth) AND (Ethiopia)

Limit: English

Child and Adolescent Health
(child* OR boy OR boys OR girl OR girls OR toddler* OR adolescent OR teen* OR adolescen* OR youth) AND (Ethiopia)

Limit: English

Appendix 2: Categories of interventions, exposures, outcomes, and research questions

1. Interventions

1.1. Maternal interventions [14, 26]

Among women of reproductive age 15-49 and pregnant women, interventions addressing pre-conception care areas, including

- Prevention and management of STIs including HIV
- Iron, folic acid, and calcium supplementation
- Vaccination, including tetanus and rubella
- Malaria prevention and management
- Treatment related to female genital mutilation
- Interpersonal violence
- Pregnancy spacing
- Substance use cessation (describe)
- Smoking cessation programs
- Family planning services
- General access to adequate antenatal care
- Other, specify:

Among postpartum women

- Family planning
- Prevention and management of postpartum hemorrhage
- Maternal nutrition
- General access to adequate postnatal care
- Other, specify:

1.2. Newborn interventions[26]

- Newborn resuscitation
- Early initiation of breastfeeding
- Hygienic cord and skin care
- CPAP use for management of respiratory distress
- Surfactant use for prevention of respiratory distress
- Management of neonatal jaundice
- Thermal care
- Kangaroo-mother care
- Antiretroviral prophylaxis for HIV exposure
- Antibiotic prophylaxis/treatment
- Other, specify:

1.3. Infant and child interventions[26]

- Exclusive breastfeeding for 6 months
- Management of malnutrition
- Management of childhood pneumonia
- Management of childhood diarrhea

- Management of children infected with or exposed to HIV
- Management of other childhood infection
- Vitamin A supplementation aged 6 months and above
- Other nutrient supplementation
- Prevention and management of childhood malaria
- Routine immunizations
- Other, specify:

2. Exposures

Exposures will be categorized as:

Accidents and injuries[3]
- Road injuries
- Other, specify:

Domestic violence[22, 23]
- Intimate partner violence
- Spousal abuse
- Infant abuse
- Child abuse
- Other, specify:

Environmental exposure[22, 23]
- Aflatoxin exposure
- Air pollution (indoor/outdoor)
- Heavy metal exposure
- Water pollution
- Other toxic exposure, specify:

Infections
Top ten infectious causes in Ethiopia based on DALYs from Global Burden of Disease Data[21]
- Diarrheal
- HIV
- Other STI
- Lower respiratory infection
- Tuberculosis
- Malaria
- Schistosomiasis
- Other infectious/neglected diseases, specify:

Nutrition[22, 23]
Categories for common nutrition concerns in these populations:

- Anemia
- Vitamin A deficiency
- Calcium deficiency
- Folate deficiency
- Iron deficiency
- Food insecurity
- Acute malnutrition (wasting)
- Chronic malnutrition (stunting)
- Other micronutrient deficiency
- Other macronutrient deficiency
- Breastfeeding
- Other, specify:

Psychosocial[22, 23]

- Mental health conditions (anxiety, depression, psychosis)
- Substance use and abuse
- Stress
- Other, specify:

Demographics[3]

- Age
- Gender
- Birth spacing
- Gestational age
- Gravidity/Parity/Abortion (GTPAL)
- Other, specify:

Social determinants of health[20]
Based on Healthy People 2020 framework:

- Economic stability (e.g. employment, food security, housing security)
- Education (e.g. language and literacy, participation in primary, secondary, and higher education)
- Social and community context (e.g. civic participation, discrimination, incarceration, social cohesion)
- Health and healthcare (e.g. access to care, health literacy)
- Neighborhood and built environment (e.g. access to food to support health, crime and violence, housing quality, environment conditions)

3. Outcomes
Outcomes will be categorized by population: maternal, newborn, infant, and child. Population categories will be further classified by causes of morbidity and mortality. Categories will be derived from in-country documents (Health Management Information Systems - HMIS reports) and WHO documents on MNCH outcomes.[22-25]

3.1. Maternal outcomes (applied for pregnant women and women of reproductive age where appropriate)

Pregnancy with abortive outcome
- Spontaneous abortion/miscarriage
- Medical abortion
- Non-medical abortion
- Other, specify:

Coincidental outcomes during pregnancy
- Domestic violence
- Intimate partner violence
- Road accidents
- Other, specify:

Nutrition
- Anemia
- Malnutrition/undernutrition
- Other, specify:

Pregnancy-related complications, non-infectious
- Gestational diabetes
- Gestational hypertension without proteinuria
- Obstructed labor
- Pre-eclampsia
- Eclampsia
- Other, specify:

Pregnancy-related complications, infectious
- Sexually transmitted infections during pregnancy
- Reproductive tract infections during pregnancy
- Puerperal sepsis
- Other, specify:

Psychosocial
- Postpartum depression
- Other, specify:

Other outcomes
- Mortality
- Morbidity
- Health service utilization
- Family planning
- Other, specify:

3.2. Newborn (birth) outcomes

- Mortality
- Morbidity
- Health service utilization
- Birth asphyxia/Intrapartum hypoxia
- Birth injury
- Birth weight
- Congenital malformations, deformations and chromosome abnormalities
- Fetal growth and malnutrition
- Hyperbilirubinemia/Jaundice
- Neonatal sepsis
- Preterm Birth
- Stillbirth (specify fresh or macerated if applicable)
- TORCH infections
- Other, specify:

3.3. Infant and child outcomes

Infectious

- Diarrheal disease (specify if applicable)
- HIV
- Malaria
- Measles
- Meningitis
- Parasitic infections
- Respiratory disease (not tuberculosis)
- Septicemia
- Tetanus
- TORCH infections
- Trachoma
- Tuberculosis
- Urinary tract infections
- Other, specify:

Nutrition

- Anemia
- Anthropometric measurements
- Acute malnutrition (wasting)
- Chronic malnutrition (stunting)
- Underweight
- Malnutrition, not specified
- Other, specify:

Violence and injuries

- Violence (e.g. child abuse)
- Road accidents and injury
- Burns and corrosions
- Poisoning
- Other, specify:

Psychosocial

- Anxiety
- Depression
- Psychosis
- Other, specify:

Other outcomes

- Mortality
- Morbidity
- Health service utilization
- Other, specify:

4. Research questions

Evidence-based studies will be charted by types of research questions, categorized as, including but not limited to,

- Cost-effectiveness: What is the cost of this intervention? How does it compare to the benefits of the intervention?
- Association/Etiology: What causes the problem?
- Evaluation: How well does this intervention work?
- Descriptive: What are the characteristics of this population or phenomenon?
- Incidence: What proportion of individuals are newly diagnosed/present with the problem?
- Prevalence: What proportion of the population is living with this problem at a given time?
- Intervention: What should be done to treat the problem?
- Perceptions: What are perceptions around the problem?
- Prevention: What can be done to prevent the problem?
- Diagnosis: How can we identify those with the problem and those without the problem?
- Prognosis: What is the likely outcome of the problem?
- Screening: Will detecting this problem early, before symptoms, make differences in outcomes?