Core outcome sets in women's and newborn health: A review, methodological and reporting quality assessment informing recommendations for core outcome set developers and wider stakeholders

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Abstract

Background: Methodological and reporting assessment tools have been developed which allow us to investigate the core outcome set development process Objective: To characterise core outcome sets relevant to women's and newborn health and assess methodological and reporting quality. Search Strategy: Systematic search using the Core Outcome Measures in Effectiveness Trials (COMET) and the Core Outcomes in Women's and Newborn Health (CROWN) Initiative databases from inception to March 2020. Selection Criteria: Registered, progressing, and completed core outcome sets. Data Collection and analysis: Descriptive summaries of characteristics and results. Published protocols were assessed using the Core Outcome Set-STAndardised Protocol Items (COS-STAP). Completed core outcome sets were evaluated using COS-STAD (standards for development) and COS-STAR (standards for reporting). Main Results: Eighty studies were identified. Twenty-four studies had published a protocol; four (17%) met all COS-STAP criteria. This was primarily due to poorly defined steering groups and lack of discussion around the potential impact of attrition. Thirty-nine systematic reviews characterized inconsistency in outcome reporting. Twenty studies published a core outcome set development process with four (20%) and three (15%) meeting COS-STAD and COS-STAR recommendations respectively, largely due to variation in patient involvement, outcome selection and the Delphi process Conclusions: Future core outcome set developers should actively engage with the methodological and reporting criteria to enhance the quality of their studies. Clarity is also required within the assessment guidelines as to how these issues should be adequately addressed. We have identified 5 key areas for improvement for future core outcome set developers and wider stakeholders

INTRODUCTION

Clinical trials are undertaken in a range of settings and populations to support evidence-based practice.(1) The reporting of standardised outcome measures facilitates comparisons between trials.(2) Outcome selection however varies widely between trials and few outcomes reflect the perspectives of and are directly relevant to trial participants.(3) The development of Core Outcome Sets (COS) has been encouraged to address these issues, identifying minimum outcomes recommended for routine measurement and reporting in clinical trials and systematic reviews in shared areas, whilst allowing researchers to add further outcomes to address specific questions.(2) Core outcome sets include outcomes, or domains, to be measured in clinical trials, and recommendations for which instruments should be used, and when, to quantify domains.(4, 5)

The Core Outcome Measures for Effectiveness Trials (COMET) initiative, established in 2010, supports COS developers by providing methodological guidelines and hosting a repository of COS studies.(6-8) Guidelines recommend consensus science methods engaging diverse stakeholders including health professionals, researchers and patients, aiming to improve the inclusion of patient centred outcomes, reduce selective outcome reporting and facilitate prospective analysis.(2, 9, 10) The process typically involves 6 stages: (1) defining COS scope (2) COMET registration, avoiding duplication (3) protocol development (4) systematic review of outcome measures followed by Delphi process to refine core outcomes (5) implementation.

Over 80 specialty journals, including *BJOG: An InternationalJournal of Obstetrics and Gynaecology* , have come together within the Core Outcomes in Women's and Newborn Health (CROWN) initiative to support researchers to develop, disseminate, and implement COS.(11, 12) As interest has grown in this area, variable quality has been noted in the development and reporting of COS.(9) In response, standards have been developed through Delphi processes with COS developers, journal editors and patient and public representatives. These propose minimum expectations for methodological and reporting quality for COS, promoting research integrity and transparency.(13) The Core Outcome Set-STAndardised Protocol (COS-STAP) specify protocol methods,(13) the Core Outcome Set STAndards for Development (COS-STAD) identifies methodological standards,(14) and the Core Outcome Set STAndards for Reporting (COS-STAR) identifies reporting standards of completed COS.(15)

A review of the COMET and CROWN databases in 2017 identified COS development studies relevant to women's and newborn health.(11) Since then, there has been rapid expansion of the COMET database and the introduction of quality standards.(13-15) The aim of this study was to review women's and newborn health COS registered with the COMET or CROWN initiative, evaluate methodological and reporting quality and consider how COS development may be improved.

METHODS

Sources

We reviewed all studies registered with the COMET and CROWN initiatives from inception (2010) through to March 2020 (figure 1). COMET is a registry of COS studies, including citations to relevant protocols, systematic reviews, and completed core outcome sets. Studies are categorised by pre-defined 'disease categories' or 'disease names.' We included all disease categories to identify all studies related to women's and neonatal health. The register is maintained by searches of the Cochrane Methodology Register, MEDLINE, and Scopus, with core outcome developers also encouraged to register prospectively.(7, 12) The CROWN initiative maintains an informal database which encourages core outcome developers to register their study.(12)

Study selection

Inclusion criteria for the study required studies to be relevant to women's or newborn health (defined as the first 28 days after birth). All stages of COS development were eligible, including registered entries, protocols, systematic reviews or published COS. In the COMET database, studies can be registered either as a COS development process or as a standalone systematic review, exploring outcome reporting across systematic reviews, randomized trials, observational studies, or qualitative studies. These systematic reviews may or may not be part of an overall core outcome study. We included all studies registered as part of a COS or systematic review. Entries from the previous systematic review(11) were identified and progression from their status was explored from protocol to systematic review to core outcome set publication.

Two authors (KG & BD) independently screened all eligible records based on title and summary in the general information section of the COMET database and the title and description on the CROWN database. Any discrepancies were resolved through discussion between authors and retrieval of the full text article if the summary or discussion were unclear. For all studies meeting the inclusion criteria, full text articles were retrieved, where available.

Data extraction and quality assessment

Two authors independently screened all entries (KG and BD). Where protocols had been published, study characteristics, proposed methodology and consensus methods were recorded. The quality of published COS protocols was assessed using the COS-STAP.(13) Where authors had published systematic reviews, the study characteristics, methodology and results were collated. If a COS was published, study characteristics, methodology for potential core outcome identification, consensus methods used to determine final COS were collated. The methodological and reporting quality of the COS development process was assessed using the COS-STAD and the COS-STAR.(14, 15). A green rating was given when all criteria in the specific domain were achieved, red where they were not fulfilled and yellow if fulfilment was unclear. Emails were sent to registered authors if no publications could be found to identify potential grey literature, or if the milestones proposed by the authors during the COMET initiative registration process had passed.

Descriptive analysis

Descriptive statistics were performed to characterize registry entries, protocols, systematic reviews, and COS development studies, mapping their characteristics, methods, results, and reporting quality. The review was reported in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis).(16)

RESULTS

Eighty COS development studies were identified (table S1). Of these, all were registered with COMET and 43 (54%) had parallel registrations with CROWN (figure 1). Two further systematic reviews were registered with CROWN only.

Forty-three (54%) of the registrations represented areas of pregnancy and childbirth, 15 (19%) benign gynaecology and subfertility, 11 (14%) newborn and neonatal health, and 11 (14%) oncology.

Since the previous systematic review(11), 17 protocols, 19 systematic reviews and 16 COS had been published. Of seven previously identified protocols, four had published a COS development study.(17-20) Overall publications had increased in all areas of women's, newborn and neonatal health (figure 2).

Published protocols

Twenty-four protocols outlining COS development studies were identified (table S2)(21-44) including: 14 (58%) in pregnancy and childbirth, 3 (13%) benign gynaecology and subfertility, 6 (25%) newborn and neonatal health and 1 (4%) in oncology (table S2). The scope of the proposed COS including the health condition, population, intervention and setting was clearly specified in 20 (83%). Ten (42%) identified the steering group for the protocol. Twenty-one (87%) described their intention to carry out a systematic review of published research to identify potential core outcomes; three (13%) referred to already completed systematic reviews. Eight (33%) described the use of qualitative methods to identify potential core outcomes: 6 described interviews or focus groups alongside qualitative reviews and 2 proposed only qualitative reviews. Eleven (46%) protocols discussed the impact of missing data and/or attrition bias. All intended to identify core outcomes using a modified Delphi method and 23 proposed a consensus development meeting (96%). Overall, only four protocols (17%) completely fulfilled COS-STAP criteria (table S3).

Systematic reviews characterizing the inconsistency in outcome reporting

Thirty-nine systematic reviews characterizing the inconsistency in outcome reporting were identified (table S4)(45-83) including: 16 (41%) in benign gynaecology and subfertility, 12 (31%) in pregnancy and childbirth, 6 (15%) in newborn and neonatal health and five (13%) in oncology. Of these, 25 (64%) were included as part of COS development and the remaining 14 registered as standalone reviews (table S5). The variation in outcome reporting was considerable: for example, a review of intrauterine growth restriction trials identified 238 outcomes and a review of bladder pain syndrome trials identified only five.(46, 58)

Published core outcome sets

Twenty completed COS development studies were identified (table S6) (17-20, 84-99) including: 13 (65%)

in pregnancy and childbirth, 3 (15%) in newborn and neonatal health, 2 (10%) in benign gynaecology and subfertility and 2 (10%) in oncology. Sixteen studies (80%) were developed in an international context. All used the modified Delphi method to identify core outcomes. Delphi survey participants included healthcare professionals (range 34–154 participants), researchers (range 0-53), and patients (range 0–244 participants). Total number of participants included in the Delphi process ranged from 24 to 412. Twelve (60%) studies discussed the limitation of attrition bias, 2 comparing the mean results of non/responders between rounds to determine effect and 1 performed an attrition analysis to determine effect. Seventeen (85%) arranged consensus development meetings to finalize the core outcome set. Consensus meeting participants included healthcare professionals (range 5–17 participants), researchers (range 2-10), and patients (range 2–10 participants). All publications identified the study as a COS development process; the COMET registration number allowing researchers to identify the study within the database was stated in 15 (75%). Fifteen (75%) clearly defined their scope, including the health condition, intervention and setting for which the core outcome set was applied. Thirteen (65%) adequately described their methods identifying potential core outcomes; deviations from the protocol were reported in six (30%). Eighteen (90%) involved patients and or patient representatives as stakeholders in the consensus process. Four (20%) used qualitative research methods (interviews or systematic reviews) to explore the views of patients when generating the initial list of outcomes for inclusion in the consensus process. The number of outcomes entered into the Delphi process ranged from 15 to 263, with final number of core outcomes ranging from six to 48. Overall four COS (20%) fulfilled full criteria for COS-STAD and three (15%) for COS-STAR. (table S3)

DISCUSSION

Main findings

Eighty COS studies have been registered covering a wide range of clinical issues in women's and neonatal health. Only a minority (30%) had published a protocol and of these only 17% were assessed to meet all COS-STAP criteria. Twenty COS have been completed; only four and three met the COS-STAD and COST-STAR recommendations respectively. Studies where criteria were not met were primarily due to variation in patient engagement, outcome selection and the Delphi process.

Strengths and limitations

The strengths of this systematic review include its comprehensive search strategy and design ensuring the study selection, data extraction, and methodological and reporting quality assessment were conducted independently by two authors. It is limited however by restricting the search strategy to two databases. We contacted all registered study authors and found no additional publications. There are no established criteria to assess the usability of completed outcome sets. No decisions about the usability, feasibility, and applicability can therefore be made.

Interpretation

Women's and newborn health research often involves the engagement of women, partners, and families in challenging circumstances. Care is required to ensure that core outcomes have relevance to the lived experience of patients and families involved, alongside the key scientific questions posed. As clinical trials do not always capture and / or publish these patient important outcomes, the use of systematic reviews alone cannot be solely relied upon to generate potential outcomes for the Delphi process.(100) Qualitative methods are therefore recommended to capture these outcomes and enhance research quality and the prospect of implementation success.(7, 14, 101-103) In our review only four of the identified studies used qualitative methods alongside systematic reviews of trial outcomes to explore patient and family perspectives when generating outcomes to consider. Despite this, the majority of studies included patients and representatives in the Delphi process. Only initiating involvement at this point, however, risks missing the relevance to the lived experience of participants, suggesting that researchers are uncertain how to optimise engagement so they can constructively contribute to the COS.(104) Funding limitations may also influence researchers use of interviews in COS development, as can be time and resource intensive.(103) Whilst the use of qualitative methods is strongly advocated, there is currently also minimal evidence to support any impact upon final

core outcome selection. Research is required to explore this impact and provide clarity around the use of patient and public involvement in core outcome set development and encourage researchers to engage with this process.

Less than half of the studies identified in our review clarified stakeholder involvement in the core outcome development process.(14) We also observed that all consensus processes were undertaken in English, despite representation from international participants in the Delphi process. The involvement of global stakeholders, including patient and public as research partners, has potential implications for increased global participation and subsequent uptake in non-English speaking countries. The feasibility and of global acceptability of COS needs further exploration, however, to develop guidance for researchers which inform stakeholder selection and expectations regarding geographical representation.

Wide variation was also found in the number of outcomes selected for the Delphi process (15 - 263) the number of participants involved (24 - 412). and the resulting number of outcomes in the final core outcome set (6 - 48). The range of outcomes/statements entered into the consensus process may affect attrition; long and complex rounds may deter participation however reducing statements to minimise attrition may introduce bias to the study.(105, 106) Too large or small panel size may also result in smaller response rates or few participants in the final rounds; previous reviews of Delphi studies have shown that increasing panel size does not improve results .(106-109) Arguably a more effective approach is to consider balanced stakeholder representation to ensure all views are captured and considered.(110)

The majority of protocols did not address attrition bias or panel size. Published COS development studies shared little information regarding which stakeholder groups had the highest attrition levels or the effect of attrition bias.(111). Published standards for protocol development and COS reporting suggest attrition bias is discussed as a potential limitation where relevant, however clearer examples of the impact of attrition bias upon the degree of consensus and the reasons for participant withdrawal would be valuable.(13, 15)

The number of outcomes contributing to the final core outcome set will vary, which may impact on implementation. A balance has to be struck between larger outcome sets and the use of broad domains to summate areas, particularly when definitions may vary between populations or settings. There is also a risk that broad domains may be unhelpful in meta-analysis. The uptake of COS may provide insight into the impact of the wide variation in outcome set size on both clinical and research implementation. Where COS include a large number of outcomes or when outcome domains are included, further refinement is required to ensure they can be implemented within future research.

Whilst this review has not specifically addressed implementation or on-going clinical relevance, they are important considerations when examining COS success. Discussion on implementation was limited and no study discussed the assessment of on-going clinical relevance of the COS. These aspects could be explored through engagement with colleagues and routine re-examination of and citation in published protocols, randomised trials, systematic reviews and prospective registry records. Objectively demonstrating the uptake of COS in this way can quantify their contribution to improving the value of future research, and researchers should commit to supporting this implementation as part of the core outcome development process.

CONCLUSION

Methodological and reporting quality of COS studies remains subject to variation. This is most frequent in the involvement of patients as research partners, outcome selection and the Delphi process. There is a clear need for further methodological research within COS development studies to determine the impact of qualitative research, the feasibility and acceptability of global COS, and attrition bias upon the degree on consensus. Clarification on these issues will help to promote the research integrity of COS development studies. The importance of implementation of COS also requires attention, including the impact and on-going relevance of the final number of core outcomes on uptake in clinical practice. Clarification on these areas will allow future core outcome set developers to actively engage with published methodological and reporting criteria and enhance the quality and ultimate success of their studies.

Recommendations for future core outcome set developers and wider stakeholders

1. Core outcome set developers should integrate methodological research into their studies to help determine the impact of qualitative methods upon final core outcome set development
2. The feasibility and of global acceptability of core outcome sets needs further exploration to develop guidance for researchers which inform stakeholder selection and expectations regarding geographical representation.
3. When discussing the Delphi survey, attrition should be clearly reported for individual stakeholder groups, the reasons for participant withdrawal described, and the impact of attrition bias upon the degree of consensus considered
4. Where core outcome sets include a large number of outcomes or when outcome domains are included, further refinement is required to ensure they can be implemented within future research.
5. Core outcome set developers should commit to supporting the implementation of their core outcome sets, including engaging with research funding organizations, individual researchers, and systematically examining prospective registry records, protocols, and published research.

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Disclosure of interests

None declared

Contribution to Authorship

KG aided in developing the research question, developed the research methodology, performed the systematic review and contributed meaningfully to the drafting and editing of the final manuscript. BD aided in developing the research question, performed the systematic review and contributed meaningfully to the drafting and editing of the final manuscript. NM contributed meaningfully to the drafting and editing of the final manuscript. ALD contributed meaningfully to the drafting and editing of the final manuscript. SO contributed meaningfully to the drafting and editing of the final manuscript. JMND conceived the idea, aided in developing the research question, developed the research methodology, performed the systematic review and contributed meaningfully to the drafting and editing of the final manuscript.

Ethical Approval

As the review consists of collecting and reviewing publicly available data, ethical review was not required

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References

1. Brunton G, Webbe J, Oliver S, Gale C. Adding value to core outcome set development using multimethod systematic reviews. Research Synthesis Methods. 2020;11(2):248-59.

2. Clarke M. Standardising outcomes for clinical trials and systematic reviews. Trials. 2007;8:39.

3. Duffy J, Hirsch M, Kawsar A, Gale C, Pealing L, Plana MN, et al. Outcome reporting across randomised controlled trials evaluating therapeutic interventions for pre-eclampsia. BJOG. 2017;124(12):1829-39.

4. Boers M, Beaton DE, Shea BJ, Maxwell LJ, Bartlett SJ, Bingham CO, et al. OMERACT Filter 2.1: Elaboration of the Conceptual Framework for Outcome Measurement in Health Intervention Studies. The Journal of Rheumatology. 2019;46(8):1021.

5. Chevance A, Tran V-T, Ravaud P. Improving the generalizability and credibility of core outcome sets (COSs) by a large and international participation of diverse stakeholders. Journal of Clinical Epidemiology. 2020.

6. Wuytack F, Smith V, Clarke M, Williamson P, Gargon E. Towards core outcome set (COS) development: a follow-up descriptive survey of outcomes in Cochrane reviews. Syst Rev. 2015;4:73.

7. Williamson PR, Altman DG, Bagley H, Barnes KL, Blazeby JM, Brookes ST, et al. The COMET Handbook: version 1.0. Trials. 2017;18(3):280.

8. Core Outcome Measures in Effectiness Trials initiative [Internet]. Available from: http://www.comet-initiative.org.

9. Gargon E, Gurung B, Medley N, Altman DG, Blazeby JM, Clarke M, et al. Choosing important health outcomes for comparative effectiveness research: a systematic review. PLoS One. 2014;9(6):e99111.

10. Gorst SL, Gargon E, Clarke M, Blazeby JM, Altman DG, Williamson PR. Choosing Important Health Outcomes for Comparative Effectiveness Research: An Updated Review and User Survey. PLoS One. 2016;11(1):e0146444.

11. Duffy J, Rolph R, Gale C, Hirsch M, Khan KS, Ziebland S, et al. Core outcome sets in women's and newborn health: a systematic review. BJOG. 2017;124(10):1481-9.

12. Core Outcomes in Womens and Newborn Health. CROWN initiative [Available from: http://www.crown-initiative.org.

13. Kirkham JJ, Gorst S, Altman DG, Blazeby JM, Clarke M, Tunis S, et al. Core Outcome Set-STAndardised Protocol Items: the COS-STAP Statement. Trials. 2019;20(1):116.

14. Kirkham JJ, Davis K, Altman DG, Blazeby JM, Clarke M, Tunis S, et al. Core Outcome Set-STAndards for Development: The COS-STAD recommendations. PLoS Med. 2017;14(11):e1002447.

15. Kirkham JJ, Gorst S, Altman DG, Blazeby JM, Clarke M, Devane D, et al. Core Outcome Set-STAndards for Reporting: The COS-STAR Statement. PLoS Med. 2016;13(10):e1002148.

16. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gotzsche PC, Ioannidis JP, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. BMJ. 2009;339:b2700.

17. Duffy JMN, Hirsch M, Vercoe M, Abbott J, Barker C, Collura B, et al. A core outcome set for future endometriosis research: an international consensus development study. BJOG: An International Journal of Obstetrics & Gynaecology. 2020;n/a(n/a).

18. Egan AM, Bogdanet D, Griffin TP, Kgosidialwa O, Cervar-Zivkovic M, Dempsey E, et al. A core outcome set for studies of gestational diabetes mellitus prevention and treatment. Diabetologia. 2020;63(6):1120-7.

19. Allin BSR, Hall NJ, Ross AR, Marven SS, Kurinczuk JJ, Knight M, et al. Development of a gastroschisis core outcome set. Arch Dis Child Fetal Neonatal Ed. 2019;104(1):F76-F82.

20. Agha RA, Pidgeon TE, Borrelli MR, Dowlut N, Orkar TK, Ahmed M, et al. Validated Outcomes in the Grafting of Autologous Fat to the Breast: The VOGUE Study. Development of a Core Outcome Set for Research and Audit. Plast Reconstr Surg. 2018;141(5):633e-8e.

21. Hirsch M, Duffy JM, Barker C, Hummelshoj L, Johnson NP, Mol B, et al. Protocol for developing, disseminating and implementing a core outcome set for endometriosis. BMJ Open. 2016;6(12):e013998.

22. Duffy JMN, Bhattacharya S, Curtis C, Evers JLH, Farquharson RG, Franik S, et al. A protocol developing, disseminating and implementing a core outcome set for infertility. Human Reproduction Open. 2018;2018(3).

23. Whitehouse KC, Kim CR, Ganatra B, Duffy JMN, Blum J, Brahmi D, et al. Standardizing abortion research outcomes (STAR): a protocol for developing, disseminating and implementing a core outcome set for medical and surgical abortion. Contraception. 2017;95(5):437-41.

24. Egan AM, Smith V, Devane D, Dunne FP. Effectiveness of prepregnancy care for women with pregestational diabetes mellitus: protocol for a systematic review of the literature and identification of a core outcomes set using a Delphi survey. Trials. 2015;16(1):356.

25. Smith P, Cooper N, Dhillon-Smith R, O'Toole E, Clark TJ, Coomarasamy A. Core Outcome Sets in Miscarriage Trials (COSMisT) study: a study protocol. BMJ Open. 2017;7(11):e018535.

26. Dadouch R, Faheim M, Juando-Prats C, Parsons J, D'Souza R, Investigators C. Development of a Core Outcome Set for Studies on Obesity in Pregnant Patients (COSSOPP): a study protocol. Trials. 2018;19(1):655.

27. Egan AM, Dunne FP, Biesty LM, Bogdanet D, Crowther C, Dempsey E, et al. Gestational diabetes prevention and treatment: a protocol for developing core outcome sets. BMJ Open. 2019;9(11):e030574.

28. Duffy JM, van 't Hooft J, Gale C, Brown M, Grobman W, Fitzpatrick R, et al. A protocol for developing, disseminating, and implementing a core outcome set for pre-eclampsia. Pregnancy Hypertens. 2016;6(4):274-8.

29. Healy P, Gordijn S, Ganzevoort W, Beune I, Baschat A, Khalil A, et al. Core Outcome Set for GROwth restriction: deVeloping Endpoints (COSGROVE). Trials. 2018;19(1):451.

30. Prins JR, Holvast F, van 't Hooft J, Bos AF, Ganzevoort JW, Scherjon SA, et al. Development of a core outcome set for immunomodulation in pregnancy (COSIMPREG): a protocol for a systematic review and Delphi study. BMJ Open. 2018;8(8):e021619.

31. Viau-Lapointe J, D'Souza R, Rose L, Lapinsky SE. Development of a Core Outcome Set for research on critically ill obstetric patients: A study protocol. Obstet Med. 2018;11(3):132-6.

32. Khalil A, Perry H, Duffy J, Reed K, Baschat A, Deprest J, et al. Twin-Twin Transfusion Syndrome: study protocol for developing, disseminating, and implementing a core outcome set. Trials. 2017;18(1):325.

33. Khalil A, Duffy JMN, Perry H, Ganzevoort W, Reed K, Baschat AA, et al. Study protocol: developing, disseminating, and implementing a core outcome set for selective fetal growth restriction in monochorionic twin pregnancies. Trials. 2019;20(1):35.

34. Smith V, Daly D, Lundgren I, Eri T, Begley C, Gross MM, et al. Protocol for the development of a salutogenic intrapartum core outcome set (SIPCOS). BMC Med Res Methodol. 2017;17(1):61.

35. Nielsen K, Nielsen KK, O'Reilly S, Wu N, Dasgupta K, Maindal HT. K, et al. Development of a core outcome set for diabetes after pregnancy prevention interventions (COS-DAP): a study protocol. Trials. 2018;19(1):708.

36. Bogdanet D, Egan A, Fhelelboom N, Biesty L, Thangaratinam S, Dempsey E, et al. Metabolic follow-up at one year and beyond of women with gestational diabetes treated with insulin and/or oral hypoglycaemic agents: study protocol for the identification of a core outcomes set using a Delphi survey. Trials. 2019;20(1):9.

37. Webbe J, Brunton G, Ali S, Duffy JM, Modi N, Gale C. Developing, implementing and disseminating a core outcome set for neonatal medicine. BMJ Paediatr Open. 2017;1(1):e000048.

38. Knol M, Wang H, Bloomfield F, Piet T, Damhuis S, Khalil A, et al. Development of a Core Outcome Set and Minimum Reporting Set for intervention studies in growth restriction in the NEwbOrN (COSNEON): study protocol for a Delphi study. Trials. 2019;20(1):511.

39. Allin B, Bradnock T, Kenny S, Walker G, Knight M. NETS(1HD): study protocol for development of a core outcome set for use in determining the overall success of Hirschsprung's disease treatment. Trials.

2016;17(1):577.

40. Allin B, Ross A, Marven S, N JH, Knight M. Development of a core outcome set for use in determining the overall success of gastroschisis treatment. Trials. 2016;17:360.

41. Oei W, Fledderus AC, Korfage I, Eggen CA, van der Horst CM, Spuls PI, et al. Protocol for the development of core set of domains of the core outcome set for patients with Congenital Melanocytic Nevi (OCOMEN project). Journal of the European Academy of Dermatology and Venereology. 2019.

42. Kelly LE, Jansson LM, Moulsdale W, Pereira J, Simpson S, Guttman A, et al. A core outcome set for neonatal abstinence syndrome: study protocol for a systematic review, parent interviews and a Delphi survey. Trials. 2016;17(1):536.

43. Rada M-P, Pergialiotis V, Betschart C, Falconi G, Haddad JM, Doumouchtsis SK. A protocol for developing, disseminating, and implementing a core outcome set for stress urinary incontinence. Medicine. 2019;98(37):e16876.

44. Agha RA, Fowler AJ, Pidgeon TE, Wellstead G, Orgill DP, Group VS. Protocol for the development of a core outcome set for autologous fat grafting to the breast. Int J Surg. 2016;31:104-6.

45. Hirsch M, Duffy JMN, Kusznir JO, Davis CJ, Plana MN, Khan KS, et al. Variation in outcome reporting in endometriosis trials: a systematic review. Am J Obstet Gynecol. 2016;214(4):452-64.

46. Tirlapur SA, Ni Riordain R, Khan KS, Collaboration E-C. Variations in the reporting of outcomes used in systematic reviews of treatment effectiveness research in bladder pain syndrome. Eur J Obstet Gynecol Reprod Biol. 2014;180:61-7.

47. Herman MC, Penninx J, Geomini PM, Mol BW, Bongers MY. Choice of primary outcomes evaluating treatment for heavy menstrual bleeding. BJOG. 2016;123(10):1593-8.

48. Sadownik LA, Yong PJ, Smith KB. Systematic Review of Treatment Outcome Measures for Vulvodynia. J Low Genit Tract Dis. 2018;22(3):251-9.

49. Rahn DD, Abed H, Sung VW, Matteson KA, Rogers RG, Morrill MY, et al. Systematic review highlights difficulty interpreting diverse clinical outcomes in abnormal uterine bleeding trials. J Clin Epidemiol. 2011;64(3):293-300.

50. Wilkinson J, Roberts SA, Showell M, Brison DR, Vail A. No common denominator: a review of outcome measures in IVF RCTs. Hum Reprod. 2016;31(12):2714-22.

51. Braakhekke M, Kamphuis EI, van Rumste MM, Mol F, van der Veen F, Mol BW. How are neonatal and maternal outcomes reported in randomised controlled trials (RCTs) in reproductive medicine? Hum Reprod. 2014;29(6):1211-7.

52. Dapuzzo L, Seitz FE, Dodson WC, Stetter C, Kunselman AR, Legro RS. Incomplete and inconsistent reporting of maternal and fetal outcomes in infertility treatment trials. Fertil Steril. 2011;95(8):2527-30.

53. Smith PP, Dhillon-Smith RK, O'Toole E, Cooper NAM, Coomarasamy A, Clark TJ. Outcomes in prevention and management of miscarriage trials: a systematic review. BJOG: An International Journal of Obstetrics & Gynaecology. 2019;126(2):176-89.

54. Koot MH, Boelig RC, Van't Hooft J, Limpens J, Roseboom TJ, Painter RC, et al. Variation in hyperemesis gravidarum definition and outcome reporting in randomised clinical trials: a systematic review. BJOG. 2018;125(12):1514-21.

55. Malinowski AK, D'Souza R, Khan KS, Shehata N, Malinowski M, Daru J. Reported Outcomes in Perinatal Iron Deficiency Anemia Trials: A Systematic Review. Gynecol Obstet Invest. 2019;84(5):417-34.

56. Al Wattar B, Placzek A, Troko J, Pirie A, Khan K, McCorry D, et al. Variation in the reporting of outcomes among pregnant women with epilepsy: a systematic review. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2015;195:193-9.

57. Duffy J, Hirsch M, Pealing L, Showell M, Khan KS, Ziebland S, et al. Inadequate safety reporting in pre-eclampsia trials: a systematic evaluation. BJOG. 2018;125(7):795-803.

58. Townsend R, Sileo F, Stocker L, Kumbay H, Healy P, Gordijn S, et al. Variation in outcome reporting in randomized controlled trials of interventions for prevention and treatment of fetal growth restriction. Ultrasound Obstet Gynecol. 2019;53(5):598-608.

59. Meher S, Alfirevic Z. Choice of primary outcomes in randomised trials and systematic reviews evaluating interventions for preterm birth prevention: a systematic review. BJOG. 2014;121(10):1188-94; discussion 95-6.

60. Rogozińska E MN, Yang F, Dodd JM, Guelfi K, Teede H, Surita F, Jensen DM, Geiker NR, Astrup A, Yeo S. . Variations in reporting of outcomes in randomized trials on diet and physical activity in pregnancy: A systematic review. . Journal of Obstetrics and Gynaecology Research. 2017;43(7):1101-10.

61. Perry H, Duffy JMN, Umadia O, Khalil A, the International Collaboration to Harmonise Outcomes for Twin–Twin Transfusion S. Outcome reporting across randomized trials and observational studies evaluating treatments for twin–twin transfusion syndrome: systematic review. Ultrasound in Obstetrics & Gynecology. 2018;52(5):577-85.

62. Smith V, Daly D, Lundgren I, Eri T, Bensteom C, Devane D. Salutogenically-focused outcomes in systematic reviews of intrapartum interventions: a systematic review of systematic reviews. Midwifery. 2014;30:151-6.

63. Begley CM, Gross MM, Dencker A, Benstoem C, Berg M, Devane D. Outcome measures in studies on the use of oxytocin for the treatment of delay in labour: a systematic review. Midwifery. 2014;30(9):975-82.

64. O'Reilly SL, Leonard Y, Dasgupta K, Terkildsen Maindal H. Diabetes after pregnancy prevention trials: Systematic review for core outcome set development. Maternal & Child Nutrition. 2020;n/a(n/a):e12947.

65. Webbe J, Brunton G, Ali S, Longford N, Modi N, Gale C, et al. Parent, patient and clinician perceptions of outcomes during and following neonatal care: a systematic review of qualitative research. BMJ Paediatr Open. 2018;2(1):e000343.

66. Webbe JWH, Ali S, Sakonidou S, Webbe T, Duffy JMN, Brunton G, et al. Inconsistent outcome reporting in large neonatal trials: a systematic review. Arch Dis Child Fetal Neonatal Ed. 2019.

67. Allin BS, Irvine A, Patni N, Knight M. Variability of outcome reporting in Hirschsprung's Disease and gastroschisis: a systematic review. Sci Rep. 2016;6:38969.

68. Ross AR, Hall NJ. Outcome reporting in randomized controlled trials and systematic reviews of gastroschisis treatment: a systematic review. J Pediatr Surg. 2016;51(8):1385-9.

69. Hines M, Swinburn K, McIntyre S, Novak I, Badawi N. Infants at risk of cerebral palsy: a systematic review of outcomes used in Cochrane studies of pregnancy, childbirth and neonatology. J Matern Fetal Neonatal Med. 2015;28(16):1871-83.

70. Ioannidis JP, Horbar JD, Ovelman CM, Brosseau Y, Thorlund K, Buus-Frank ME, et al. Completeness of main outcomes across randomized trials in entire discipline: survey of chronic lung disease outcomes in preterm infants. BMJ. 2015;350:h72.

71. Durnea CM, Pergialiotis V, Duffy JMN, Bergstrom L, Elfituri A, Doumouchtsis SK, et al. A systematic review of outcome and outcome-measure reporting in randomised trials evaluating surgical interventions for anterior-compartment vaginal prolapse: a call to action to develop a core outcome set. Int Urogynecol J. 2018;29(12):1727-45.

72. Lourenco T, Pergialiotis V, Duffy J, Durnea C, Elfituri A, Haddad J, et al. A systematic review on reporting outcomes and outcome measures in trials on synthetic mesh procedures for pelvic organ prolapse: Urgent action is needed to improve quality of research. Neurourology and Urodynamics. 2019;38(2):509-24.

73. Lourenço TRM, Pergialiotis V, Durnea CM, Elfituri A, Haddad JM, Betschart C, et al. A systematic review of reported outcomes and outcome measures in randomized trials evaluating surgical interventions for posterior vaginal prolapse to aid development of a core outcome set. International Journal of Gynecology & Obstetrics. 2020;148(3):271-81.

74. Lourenço T, Pergialiotis V, Durnea C, Elfituri A, Haddad JM, Betschart C, et al. A systematic review of reported outcomes and outcome measures in randomized controlled trials on apical prolapse surgery. International Journal of Gynecology & Obstetrics. 2019;145(1):4-11.

75. Rada MP, Jones S, Falconi G, Milhem Haddad J, Betschart C, Pergialiotis V, et al. A systematic review and meta-synthesis of qualitative studies on pelvic organ prolapse for the development of core outcome sets. Neurourology and Urodynamics. 2020;n/a(n/a).

76. Pergialiotis V, Durnea C, Elfituri A, Duffy J, Doumouchtsis SK, International Collaboration for Harmonising Outcomes R, et al. Do we need a core outcome set for childbirth perineal trauma research? A systematic review of outcome reporting in randomised trials evaluating the management of childbirth trauma. BJOG. 2018;125(12):1522-31.

77. Simpson RC, Thomas KS, Murphy R. Outcome measures for vulval skin conditions: a systematic review of randomized controlled trials. Br J Dermatol. 2013;169(3):494-501.

78. Iliodromiti S, Wang W, Lumsden MA, Hunter MS, Bell R, Mishra G, et al. Variation in menopausal vasomotor symptoms outcomes in clinical trials: a systematic review. BJOG: An International Journal of Obstetrics & Gynaecology. 2020;127(3):320-33.

79. Potter S, Brigic A, Whiting PF, Cawthorn SJ, Avery KN, Donovan JL, et al. Reporting clinical outcomes of breast reconstruction: a systematic review. J Natl Cancer Inst. 2011;103(1):31-46.

80. Potter S, Harcourt D, Cawthorn S, Warr R, Mills N, Havercroft D, et al. Assessment of cosmesis after breast reconstruction surgery: a systematic review. Ann Surg Oncol. 2011;18(3):813-23.

81. Lee C, Sunu C, Pignone M. Patient-Reported Outcomes of Breast Reconstruction after Mastectomy: A Systematic Review. Journal of the American College of Surgeons. 2009;209(1):123-33.

82. Potter S, Browning D, Savovic J, Holcombe C, Blazeby JM. Systematic review and critical appraisal of the impact of acellular dermal matrix use on the outcomes of implant-based breast reconstruction. Br J Surg. 2015;102(9):1010-25.

83. Agha RA, Fowler AJ, Herlin C, Goodacre TE, Orgill DP. Use of autologous fat grafting for breast reconstruction: a systematic review with meta-analysis of oncological outcomes. J Plast Reconstr Aesthet Surg. 2015;68(2):143-61.

84. Al Wattar BH, Teede H, Garad R, Franks S, Balen A, Bhide P, et al. Harmonising research outcomes for polycystic ovary syndrome: an international multi-stakeholder core outcome set. Human Reproduction. 2020;35(2):404-12.

85. Egan AM, Galjaard S, Maresh MJA, Loeken MR, Napoli A, Anastasiou E, et al. A core outcome set for studies evaluating the effectiveness of prepregnancy care for women with pregestational diabetes. Diabetologia. 2017;60(7):1190-6.

86. Jansen LAW, Koot MH, van't Hooft J, Dean CR, Duffy JMN, Ganzevoort W, et al. A core outcome set for hyperemesis gravidarum research: an international consensus study. BJOG: An International Journal of Obstetrics & Gynaecology. 2020;n/a(n/a).

87. Al Wattar BH, Tamilselvan K, Khan R, Kelso A, Sinha A, Pirie AM, et al. Development of a core outcome set for epilepsy in pregnancy (E-CORE): a national multi-stakeholder modified Delphi consensus study. BJOG. 2017;124(4):661-7.

88. Healy P, Gordijn SJ, Ganzevoort W, Beune IM, Baschat A, Khalil A, et al. A Core Outcome Set for the prevention and treatment of fetal GROwth restriction: deVeloping Endpoints: the COSGROVE study. Am J Obstet Gynecol. 2019;221(4):339 e1- e10.

89. van 't Hooft J, Duffy JM, Daly M, Williamson PR, Meher S, Thom E, et al. A Core Outcome Set for Evaluation of Interventions to Prevent Preterm Birth. Obstet Gynecol. 2016;127(1):49-58.

90. Devane D, Begley CM, Clarke M, Horey D, C OB. Evaluating maternity care: a core set of outcome measures. Birth. 2007;34(2):164-72.

91. Perry H, Duffy JMN, Reed K, Baschat A, Deprest J, Hecher K, et al. Core outcome set for research studies evaluating treatments for twin–twin transfusion syndrome. Ultrasound in Obstetrics & Gynecology. 2019;54(2):255-61.

92. Townsend R, Duffy JMN, Sileo F, Perry H, Ganzevoort W, Reed K, et al. A core outcome set for studies investigating the management of selective fetal growth restriction in twins. Ultrasound Obstet Gynecol. 2019.

93. Dos Santos F, Drymiotou S, Antequera Martin A, Mol BW, Gale C, Devane D, et al. Development of a core outcome set for trials on induction of labour: an international multistakeholder Delphi study. BJOG. 2018;125(13):1673-80.

94. Briscoe KE, Haas DM. Developing a Core Outcome Set for Cesarean Delivery Maternal Infectious Morbidity Outcomes. Am J Perinatol. 2019.

95. Meher S, Cuthbert A, Kirkham JJ, Williamson P, Abalos E, Aflaifel N, et al. Core outcome sets for prevention and treatment of postpartum haemorrhage: an international Delphi consensus study. BJOG. 2019;126(1):83-93.

96. Bogdanet D, Reddin C, Macken E, Griffin TP, Fhelelboom N, Biesty L, et al. Follow-up at 1 year and beyond of women with gestational diabetes treated with insulin and/or oral glucose-lowering agents: a core outcome set using a Delphi survey. Diabetologia. 2019;62(11):2007-16.

97. Webbe JWH, Duffy JMN, Afonso E, Al-Muzaffar I, Brunton G, Greenough A, et al. Core outcomes in neonatology: development of a core outcome set for neonatal research. Arch Dis Child Fetal Neonatal Ed. 2019.

98. Allin BSR, Bradnock T, Kenny S, Kurinczuk JJ, Walker G, Knight M, et al. NETS(1HD) study: development of a Hirschsprung's disease core outcome set. Arch Dis Child. 2017;102(12):1143-51.

99. Potter S, Holcombe C, Ward JA, Blazeby JM, Group BS. Development of a core outcome set for research and audit studies in reconstructive breast surgery. Br J Surg. 2015;102(11):1360-71.

100. Moller MH. Patient-important outcomes and core outcome sets: increased attention needed! Br J Anaesth. 2019;122(4):408-10.

101. Vermeulen E, Karsenberg K, van der Lee JH, de Wildt SN. Involve Children and Parents in Clinical Studies. Clin Transl Sci. 2020;13(1):11-3.

102. Molloy EJ, Mader S, Modi N, Gale C. Parent, child and public involvement in child health research: core value not just an optional extra. Pediatric Research. 2019;85(1):2-3.

103. Keeley T, Williamson P, Callery P, Jones LL, Mathers J, Jones J, et al. The use of qualitative methods to inform Delphi surveys in core outcome set development. Trials. 2016;17(1):230.

104. Young B, Bagley H. Including patients in core outcome set development: issues to consider based on three workshops with around 100 international delegates. Research Involvement and Engagement. 2016;2(1):25.

105. Jones J, Brown E, Volicer L. Target outcomes for long-term oral health care in dementia: a Delphi approach. Journal of Public Health Dentistry 2000;60:330–4.

106. Gargon E, Crew R, Burnside G, Williamson PR. Higher number of items associated with significantly lower response rates in COS Delphi surveys. Journal of Clinical Epidemiology. 2019;108:110-20.

107. De Villiers M, De Villiers P, Kent A. The Delphi technique in health sciences education research. Medical teacher. 2005;27(7):639-43.

108. Clayton M. Delphi: a technique to harness expert opinion for critical decision-making tasks in education. Educational Psychology. 1997;17:373–86.

109. Campbell SM, JA C. Consensus methods in prescribing research. J Clin Pharm Ther. 2001;26(1):5-15.

110. Bloor M, Sampson H, Baker S, Dahlgren K. Useful but no Oracle: Reflections on the use of a Delphi Group in a multi-methods policy research study. Qualitative Research. 2015;15(1):57-70.

111. Sinha IP, Smyth RL, Williamson PR. Using the Delphi technique to determine which outcomes to measure in clinical trials: recommendations for the future based on a systematic review of existing studies. PLoS Med. 2011;8(1):e1000393.

Table / Figure caption list

Figure 1: PRISMA inclusion

Figure 2: core outcome set publications 2017 and 2020

Supplementary tables:

Table S1: Overview of core outcome sets

Table S2: Published core outcome set protocols

Table S3: Methodological and reporting quality of core outcome development studies

Table S4: Published systematic reviews

Table S5: Registered standalone systematic reviews

Table S6: Published core outcome set development studies

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`Figure 1 PRISMA inclusion.doc` available at https://authorea.com/users/352929/articles/476988-core-outcome-sets-in-women-s-and-newborn-health-a-review-methodological-and-reporting-quality-assessment-informing-recommendations-for-core-outcome-set-developers-and-wider-stakeholders

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`Figure 2 core outcome set publications 2017 and 2020.docx` available at https://authorea.com/users/352929/articles/476988-core-outcome-sets-in-women-s-and-newborn-health-a-review-methodological-and-reporting-quality-assessment-informing-recommendations-for-core-outcome-set-developers-and-wider-stakeholders