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Systematic review of the content validity of patient reported outcome measures of transition to parenthood

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Abstract:	This review aims to identify self-report instruments examining aspects of transition to parenthood for use in practice and research. After performing a literature search in Embase, Medline, Web of Science, Cochrane, PsycINFO and Google Scholar, the Patient Reported Outcome Measures (PROMs) measuring (aspects of) transition to parenthood during pregnancy or up to one-year postpartum were identified. Following COSMIN guidelines for systematic reviews on PROMs, the quality of the PROM development and PROM content validity was evaluated. From the 129 included studies, 39 PROMs assessed aspects of transition to parenthood. A total of 32 PROMs were included in the evaluation. The development quality of 30/32 PROMS was mostly rated as inadequate and the quality of 15 content validity studies was mostly rated as doubtful. All PROMs received inadequate or doubtful ratings on content validity. Most of the PROMs measuring aspects of the transition to parenthood didn't include parents' points of view when developing them. Many PROMs are being used for a long time without reassessing relevance, comprehensiveness, and comprehensibility among parents and/or practitioners. It is recommended that researchers and healthcare professionals assess content validity of the PROM before use with the target population.

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ABSTRACT

This review aims to identify self-report instruments examining aspects of transition to parenthood for use in practice and research. After performing a literature search in Embase, Medline, Web of Science, Cochrane, PsycINFO and Google Scholar, the Patient Reported Outcome Measures (PROMs) measuring (aspects of) transition to parenthood during pregnancy or up to one-year postpartum were identified. Following COSMIN guidelines for systematic reviews on PROMs, the quality of the PROM development and PROM content validity was evaluated. From the 129 included studies, 39 PROMs assessed aspects of transition to parenthood. A total of 32 PROMs were included in the evaluation. The development quality of 30/32 PROMS was mostly rated as inadequate and the quality of 15 content validity studies was mostly rated as doubtful. All PROMs received inadequate or doubtful ratings on content validity. Most of the PROMs measuring aspects of the transition to parenthood didn't include parents' points of view when developing them. Many PROMs are being used for a long time without reassessing relevance, comprehensiveness, and comprehensibility among parents and/or practitioners. It is recommended that researchers and healthcare professionals assess content validity of the PROM before use with the target population.

Key words: Mothers, Pregnant Women, Parenting, Systematic Review, Patient Reported Outcome Measures

BACKGROUND

The transition to parenthood, its features and its challenges have been studied since the 1950s, showing onward changes in the notion of the focus and meaning of this transition experience. The theoretical founders of transition to motherhood define this as either a dynamic transformative cognitive or an experiential process of attaining a certain role or identity, being characterised by various phases (e.g., commitment, attachment, and preparation; acquaintance, learning, and physical restoration; moving to a new normal) (Mercer, 2004; Rubin, 1967, 1984). The overall expectation is that, at the end of transition to parenthood, women (parents) are able to achieve a certain balance in and between their roles as, for example, mother, partner, daughter, friend, employer, employee, colleague - all embedded in their identity and role as a parent and a woman (Arendell, 2000; Kochanska et al, 2009; Meins et al. 2001; Milgrom et al., 2011; Miller, 2007; Paley et al., 2005; Parrat & Fahy, 2011; Prinds et al., 2014; Simpson et al., 2003). The timeframe for the transitional trajectory of change and development includes the pre-conception/pre-pregnancy period, and (early) pregnancy up to, approximately, one-year postpartum (Bell, 2001; Delmore- Ko et al., 2000; Meleis et al., 2000; Mercer, 2004; Miller, 2003; Nelson, 2003; Shannon et al., 2012).

Transition theories assume that specific events can change the existing equilibrium in life and restoring this requires effort. Transition to parenthood can be theoretically approached as well as being regarded a process of practical and emotional steps while mastering certain tasks (Mercer, 2004; Parrat & Fahy, 2011; Rubin, 1967; 1984). Acknowledging the different theoretical thoughts and views of transition to parenthood and incorporating the observable practical and emotional tasks, indicators, and markers, the use of a framework to structure all these features of transition to parenthood is of merit - allowing a comprehensive overview of all relevant aspects. Meleis et al (2000) have generated a theoretical framework focussing on transition experiences, including the nature of transitions, transition conditions (facilitators and

inhibitors), and patterns of response. Barimani et al (2017) have used Meleis' framework to investigate the facilitating and inhibiting factors in transition to parenthood but did not focus on patterns of response, that is, the process and outcome indicators of transition to parenthood. Studying the responses to transition of parenthood adds value to the conceptualization of the practical use and meaning of this process. A more comprehensive understanding of the transition process and its separate constructs can help healthcare professionals to better connect with (future) parents and creates possibilities to monitor the individual transition to parenthood process.

Assigning meaning to the quality of the transition process, in terms of successfulness and effectiveness as functional outcomes of transition to parenthood, has been recognized as an important aspect and marker of the transition process (Emmanuel et al., 2008; Miller, 2003; Parrat & Fahy, 2011). For healthcare professionals and researchers, it seems important to have a tool or approach to recognise the relevant responses to the transition process to identify whether the transition to parenthood has been successfully or effectively accomplished, or to identify if (future) parents encounter difficulties, hurdles, and challenges. Knowing or being aware whether transition to parenthood has been successful or effective seems important for parents as well as for healthcare professionals – indicating parents who need help and support or when this is required. We want to strongly emphasize that (reported) insights of parents themselves are critical in understanding parents' processes of (un)successful transition to parenthood (Parrat & Fahy, 2011). Nevertheless, recognition and awareness are of importance as it has been reported that unsuccessful or ineffective transition to parenthood is associated with impaired cognitive child development and reduced emotional wellbeing of mothers, partners and their children, an unsatisfying couple relationship and negative parenting experiences (Milgrom et al, 2011; Paley et al., 2005; Simpson et al., 2003). This evidence acknowledges the importance of addressing the process of transition to parenthood.

Earlier reviews on measuring transition to parenthood provide fragmented information of the transition, such as: adaptation to motherhood and parents' perceptions of their parenting role (Beck, 1999); parental bonding with the foetus and/or infant (Beck, 1999; Perelli et al., 2014; Van den Bergh & Simons, 2009); adaptation to pregnancy (Beck, 1999); stress and coping (Ayers, 2001); parental self-efficacy (Leahy-Warren & McGarthy, 2011), and aspects of mothering (Fowles & Horowitz, 2006). Although the authors report on the validity of several instruments, it is unclear how this was assessed. An updated overview of existing measures and their quality is required. In terms of public and patient involvement, it is of merit to examine women's involvement in verifying relevance, comprehensiveness, and comprehensibility of items to report on transition to parenthood as the active recipients of the dynamics of transition to parenthood (Banner et al., 2019; Blume, 2017; Parrat & Fahy, 2011).

As far as we are aware, a systematic review covering all process and outcome indicators and the quality of available measures is lacking. The aim of our study is to review which instruments can be used to measure the full scope and/or constructs of transition to parenthood to subsequently recommend which PROMs are preferable to use or are better to be avoided in research and/or practice. Quality in this paper is defined by the COSMIN guidelines of systematic reviews on patient reported outcome measures (PROMs) (Terwee et al., 2018a; 2018b). In the current context, quality is determined by the level of content validity, the development of the measure and the clarity of the description and the origin of the construct transition to parenthood. Quality is also determined by the usefulness of the PROM for the relevance target population, the context of its use, the methods that are used to identify relevant transition to parenthood items, the proficiency of the moderators/interviewers who collected this data and the appropriateness of strategies they used to collect and analyse the data (Terwee et al., 2018b). Subsequently, the evaluation of quality comprises the relevance, comprehensiveness and comprehensibility from a parent perspective and the relevance,

comprehensiveness from a professional perspective (Terwee et al., 2018a; 2018b). In this paper we refer to parenthood with a focus on the mother.

METHODS

Search strategy and selection of studies measuring transition to parenthood

A librarian-assisted (WMB) comprehensive search strategy was developed and performed to identify relevant studies searching the databases *Embase.com (1971-)*, *Medline ALL via Ovid (1946-)*, *Web of Science Core Collection (1975-)*, *Cochrane CENTRAL register of Trials (1992-)*, *PsycINFO via Ovid (1806-)* and *Google Scholar* up to 31 March 2020, without any time limits. We excluded conference papers, non-English studies, and studies focussing on children's behaviour. We aimed to identify studies including self-report instruments to measure aspects of transition to parenthood during pregnancy and/or up to one-year postpartum. We entered a combination of search terms, consisting of 1) who is involved in the measurement (e.g., mother), or the event or period of measurement (e.g., pregnancy, parenthood or postpartum period), 2) what is being measured (e.g., coping behaviour, self-efficacy), and 3) how is it measured (e.g., the development of an instrument). The complete search is presented in Appendix A.

For the selection of studies two authors (EB and YK) independently assessed the eligibility of the studies. Studies were a priori eligible when they described the use of self-report instruments that 1) focussed on process response indicators (e.g., bonding, coping behaviour) or outcome response indicators (e.g., self-efficacy, role attainment) of the transition to parenthood; 2) measured physiological/healthy transition to parenthood (not aiming to identify pathological risks or disorders); 3) were for specific use in pregnancy and/or up to one year postpartum; and 4) were used in their original form or when a translation of the original was used (instead of using only subscales). The title and abstract were used for initial screening

followed by an examination of the full text. After selecting the studies, we hand searched the reference lists for the missing primary development studies of the various PROMs. We contacted the authors by email to retrieve missing information, but none of the authors responded.

Data extraction

We used a data extraction form (Microsoft Excel©) to document generic data items of individual records. We extracted details of the instrument (e.g., number of items), concept of transition being measured, population of study, reliability, validity, and language. The results were compared by two authors (EB and YK) and differences were resolved through discussion reaching consensus.

Qualitative synthesis of the selected studies

Patient Reported Outcome Measures (PROMs) provided information on the process and outcome indicators of transition to parenthood. To evaluate their quality, we used the COSMIN guidelines for systematic reviews of PROMs (Mokkink et al., 2017; Prinsen et al., 2018; Terwee et al., 2018a). First, we searched the COSMIN database of systematic reviews for existing ratings on the identified instruments, resulting in nil findings. Two reviewers evaluated 1) the PROM development (EB and YK), and three reviewers evaluated 2) the PROM content validity (EB, YK, and LB): each set of items that represented (a construct of) transition to parenthood were evaluated (Terwee et al., 2018b). We structured the PROM development and content validity criteria using Microsoft Excel© sheets, formatted according to the COSMIN Risk of Bias Checklist. Risk of bias was scored on the following levels: very good, adequate, doubtful, inadequate, or not applicable. The final rating was determined by the lowest score. In case of missing results, we followed the recommendations of the COSMIN guidelines to either score

these elements as inadequate, doubtful, or not applicable (Mokkink et al., 2017; Prinsen et al., 2018; Terwee et al., 2018a; 2018b). Differences were resolved through discussion, reaching consensus (EB, YK, and LB). After the COSMIN steps 1) evaluating the quality of the PROM development, and 2) evaluating the quality of content validity studies on the PROM, none of the PROMS were considered for further evaluation of internal structure or other measurement properties such as reliability or criterion validity (Terwee et al., 2018b). The review protocol was registered on the PROSPERO database (CRD42021245063).

Patient and public involvement

Patients or the public were not involved in the design, conduct, reporting, or dissemination plans of this review.

RESULTS AND FINDINGS

Study selection

Our search identified 8258 articles. After removing 3395 duplicates we screened 4863 titles and abstracts. Based on the eligibility criteria, we excluded 4465 publications on title and/or abstract. A total of 398 articles were read full text, of which 269 publications were excluded. A PRISMA flowchart was completed to summarise the study selection process and reasons for exclusion are described in Figure 1 (Page et al., 2021). Selection resulted in a total of 129 eligible studies for the qualitative synthesis.

Please insert "Figure 1. PRISMA flowchart for study selection" around here

Study characteristics

The characteristics of the included studies are presented in Appendix B. The selected studies, published between 1980 to 2020, included a total of 39 different PROMs, measuring six constructs of the transition to parenthood (Table 1).

Please insert "Table 1. PROMs measuring constructs of transition to parenthood" around here

Risk of bias of the PROMS

We first assessed PROM development examining general design requirements, involvement of the target population, and cognitive interviewing/pilot testing of the instrument (Mokkink et al., 2017; Prinsen et al., 2018; Terwee et al., 2018a). From the 39 PROMs we evaluated 30 development studies, of which 16 studies were already included in our search, while 14 studies were found through hand searching references. Nine PROM development studies could not be assessed because the article was not available in the English language (n=1), the information on PROM development was only presented as conference material (n=2), or the article was not accessible (after searching online, requesting interlibrary loan, and contacting authors via ResearchGate©, n=6). As a second step, we evaluated content validity of the remaining 30 evaluated PROMs - assessing whether patients and/or professionals were asked about the relevance, comprehensiveness and/or comprehensibility of the PROM items (Mokkink et al., 2017; Prinsen et al., 2018; Terwee et al., 2018a).

From the 129 eligible articles that we included from our search, 113 studies described one or more of the 30 evaluated PROMs. A total of 13 articles provided information on at least one of the content validity aspects. Of the 11 excluded PROMs, two PROMs were among the most frequently used instruments to measure a construct of transition to parenthood: the MAI* for postpartum bonding and the PSOC* for parenting competence. These PROMs were used seven and ten times, respectively, and we therefore decided to include these PROMs in further quality assessment. Since these instruments are often used in practice, we deemed it relevant to

evaluate their content validity to adequately inform clinical practice and research. From the 129 eligible articles that we selected, an additional 12 studies described use of either the MAI or PSOC. Two articles provided information on at least one of the content validity aspects, resulting in a final selection of 15 articles (Figure 2). Table 2 is an overview of which PROMs were assessed for development and content validity.

Please insert "Figure 2. Flowchart for qualitative synthesis" around here

Please insert "Table 2. Included PROM development and content validity studies" around here

Quality assessment PROM development

The quality of PROM development of the 30 PROMs was rated as inadequate (N=23) or doubtful (N=7). For example, when a PROM was developed without input from the target population, this led to the inadequate rating of 14 PROMs. The final rating is determined by the lowest score on general design requirements, concept elicitation, pilot testing, and comprehensibility (Mokkink et al., 2017; Prinsen et al., 2018; Terwee et al., 2018).

Quality assessment PROM content validity

The quality of the content validity of the PROMS was assessed by asking patients about the relevance (N=4, four doubtful), comprehensiveness (N=2, one inadequate and one doubtful) and/or comprehensibility (N=6, one inadequate, five doubtful) of the PROM items. Content validity quality was also assessed by asking professionals about the relevance (N=8, one inadequate and seven doubtful) and/or comprehensiveness (N=3, one inadequate and two doubtful) of the PROM.

Summary

Development of PROMs measuring the constructs bonding, adaptation, and parenting self-esteem were all rated inadequate. One PROM measuring self-efficacy and one PROM measuring parenting competence were rated as doubtful on development. The PSEQ was rated as inadequate for both development and content validity. The two PROMs PMP-SE and BIMF were rated as doubtful for both development and content validity while the other nine PROMs were rated as inadequate for development and doubtful for content validity. All but one study examined translated versions of the original PROM (Table 3). At this point we decided not to continue with the next steps of the COSMIN procedure. Due to the poor fundament of the PROMs no reliance can be placed on the data collected and therefore further COSMIN steps are irrelevant (McKenna et al., 2019; Terwee et al.,2018).

Please insert "Table 3. PROM development and validity rating" around here

DISCUSSION

The aim of our study was to identify instruments reporting on (constructs of) transition to parenthood - defined as PROMs -, and to recommend which PROMs are preferable to use or are better to be avoided in research and/or practice. As shown, none of the PROMs showed adequate evidence of measurement properties as the PROM development and content validity scored poorly against the COSMIN criteria used in this review (Mokkink et al., 2017; Prinsen et al., 2018; Terwee et al., 2018a). Our recommendations were based on these findings (Terwee et al., 2018b).

The COSMIN guidelines emphasize, as a first step of assessing PROM quality, the importance of involving the target population during the development phase of an instrument - that is, service users and service providers (Devlin & Appleby, 2010; Mokkink et al., 2017;

Prinsen et al., 2018; Terwee et al., 2018). This first step of the COSMIN methodology, asserts today's focus on public and patient involvement and equally recognising and respecting the woman's experiential knowledge - that is, acquainted and first-hand authentic and distinct knowledge of how it is to be a parent, opposed to a priori (theoretical or second-hand) knowledge (Banner et al., 2019; Kuipers & Mestdagh, 2021) -, and the health carer's professional knowledge (Devlin & Appleby, 2010; Mokkink et al., 2017; Prinsen et al., 2018; Terwee et al., 2018a). Obtaining parents' views is an essential part of understanding and monitoring quality, effectiveness and outcomes of processes as well as it can be regarded as a mechanism to empower parents (HQIP, 2017; Miller et al., 2016; 2019; Parrat & Fahy, 2011). The content items of the PROMs in this review, however, predominantly originated from theory, theoretical models, research literature, and domain-related knowledge of researchers (Barkin et al., 2010; Condon, 1993; Cranley, 1981; Muller, 1993; Riera-Martin et al., 2018; Shea, 1982; Teti & Gelfand, 1991). Although it can be advised to involve parents and professionals to discuss the meaning of findings and to reflect on parents' needs, insights and priorities (Banner et al., 2019; HQIP, 2017), the development of most of the PROMS included in this review originate from the period before patient and public engagement emerged (Banner et al., 2019). However, when an instrument, that has been developed without a priori meaningful consultation or involvement of the target group of mothers/parents, applies a cut-off value to establish or form an opinion about successfulness or effectiveness of the transition process, we might fail mothers using values thrusted upon them by theory, literature or researchers (Devlin & Appleby, 2010; Banner et al., 2019; Kuipers & Mestdagh, 2021). This can either lead to inadequate or inaccurate representation of transition to parenthood and/or overreporting or underreporting of successful or effective transition or expecting transition to parenthood to occur in a certain period, with potential implications for either a lack of, or unnecessary or inadequate help and support. Limited or insufficient involvement of professionals with expert

knowledge about transition to parenthood in PROM development and validation, might lead to absent or insufficient knowledge and ownership of instruments or the need of measuring transition to parenthood or its constructs (Miller et al., 2016; Nguyen et al., 2020). We suggest that input of mothers, parents and professionals in PROM development is pivotal to contribute to the quality of care when supporting parents in transition to parenthood and it seems of worth to consider adding local population utility (McKenna & Heaney, 2021).

If we solely must make a recommendation regarding using the PROMs evaluated in our review, we would advise against its use. However, to know whether it is justified to use or not use the included instruments for screening purposes or to identify the prevalence of (un)successful or (in)effective transition, a nuanced opinion is in order. First, the term 'PROM' is relatively new in the healthcare research domain and guidelines on developing PROMs were drawn up around the year 2000. Most of the PROMs we evaluated were developed before 2000, being developed in a traditional clinical way of measuring health and wellbeing, while quality was assessed against the COSMIN criteria that were much later developed and thus unknown to the authors at the time (McKeown et al., 2019). Thus are these PROMs indeed poorly developed and validated or might it be possible that content validity was simply not described according to the COSMIN criteria in the publications we examined? For example, when it is not clear which method was used to identify relevant items for a new PROM, the COSMIN guidelines recommend to rate this as doubtful, purely based on a lack of information (Mokkink et al., 2017; Prinsen et al., 2018; Terwee et al., 2018). This could be related to guidelines authors face when publishing studies in peer reviewed journals (e.g., restrictions in word count), which possibly forces authors to put more emphasis on other aspects of the study than the method section. It is likely that these external factors may have affected our results. In terms of timeliness, it is of interest if PROM items that were developed decades ago still capture today's aspects of parenthood to ensure comprehensiveness of the PROM. Although the PROMs were

used in many subsequent publications, they were rarely (re)examined for content validity. With new generations becoming parents, it is of merit to include their point of view on the transition to parenthood in current society (Van Beeck et al., 2019).

A limitation and a strength of our study is that we tried to capture the full concept of transition to parenthood. Narrowing our aim and search strategy by using the COSMIN search filter for relevant studies could have limited our number of identified records (Terwee et al., 2009). However, including a biomedical information specialist (WMB), specialised in developing searches for systematic reviews, ensures the search strategy to be adequate. The COSMIN guideline has been criticized for its intuitive or opinionated method of assessment. In our review, three researchers used the COSMIN Risk of Bias checklist, to minimise reporting bias (McKenna & Heaney, 2021). Our review covered a wide range of process and outcome indicators of transition to parenthood: bonding, self-efficacy, adaptation, parenting competence and self-esteem, involvement, and mastery. Synthesis of the findings showed that the process indicator/construct of bonding was rated most often. PROMs are meant to measure outcome (Devlin & Appleby, 2010), whilst the construct bonding is recognised to be a process indicator of transition to parenthood (Tichelman, 2020). Maybe we need to consider that transition to parenthood or its constructs are too contextual or too multidimensional, making it difficult to measure transition to parenthood with one or more PROMs. This may imply that several PROMs are necessary to measure either one construct or the full concept of transition to parenthood (McKenna & Heaney, 2021). This, however, contradicts with the COSMIN methodology plea for standardization in the uses of outcomes and outcome measurement instruments (Mokking et al., 2016). Although we could not have foreseen the poor PROM development and content validity, the implications of our findings are original and have value for practice and research even though we did not evaluate construct validity, criterion validity and responsiveness of the PROMs (Terwee et al., 2018b).

CONCLUSION

This review shows that currently, based on the results that derived from appraising the PROMs with the first two steps of the COSMIN guidelines, no PROM can be recommended for assessing transition to parenthood. As this review demonstrates almost half of the PROMs measuring (constructs of) the transition to parenthood didn't include parents' point of views at all when developing them. Understanding the content validity of these instruments would enable an understanding of whether the PROMs are fit for purpose among expecting and young parents or whether the use of the PROMs should be discontinued. PROMs are used multiple decades without reassessing relevance, comprehensiveness, and comprehensibility among patients and/or professionals. It is recommended that researchers and healthcare professionals assess content validity of the PROM before using it in the target population.

Author contributions: EB and YK conceptualised the study. WMB designed the search strategy and performed the search. EB and YK screened titles, abstracts and full-text articles. EB, YK, and LB extracted and analysed data from the included articles. Each author reviewed the work and approved the final manuscript. YK supervised the study.

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Data availability statement: All data relevant to the study are included in the article or uploaded as supplementary information. Details of the excluded studies and the Excel sheets of assessments of risk of bias can be requested from the corresponding author.

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Figure 1. PRISMA Flowchart for study selection

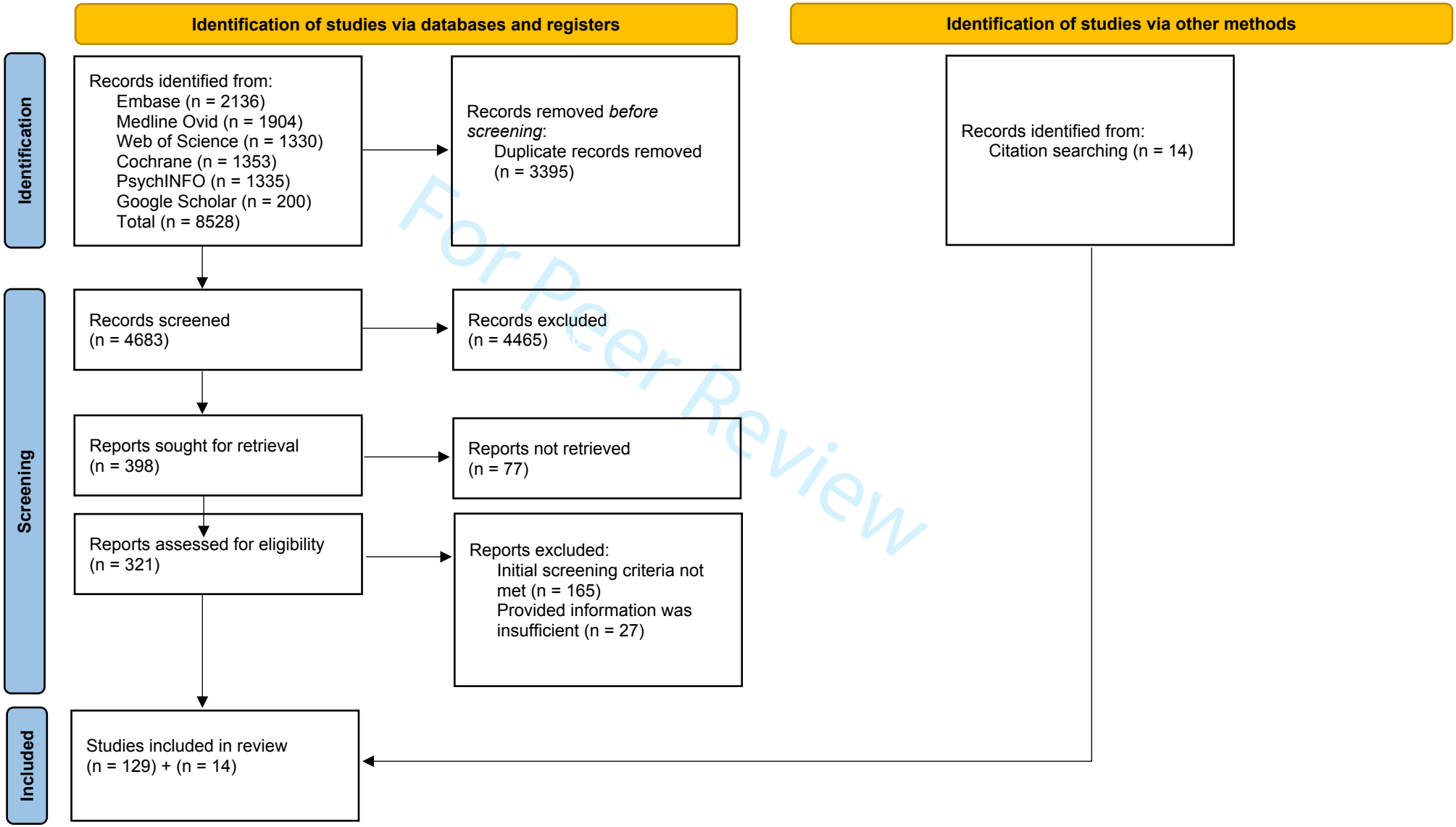

Figure 2. Flowchart for qualitative synthesis

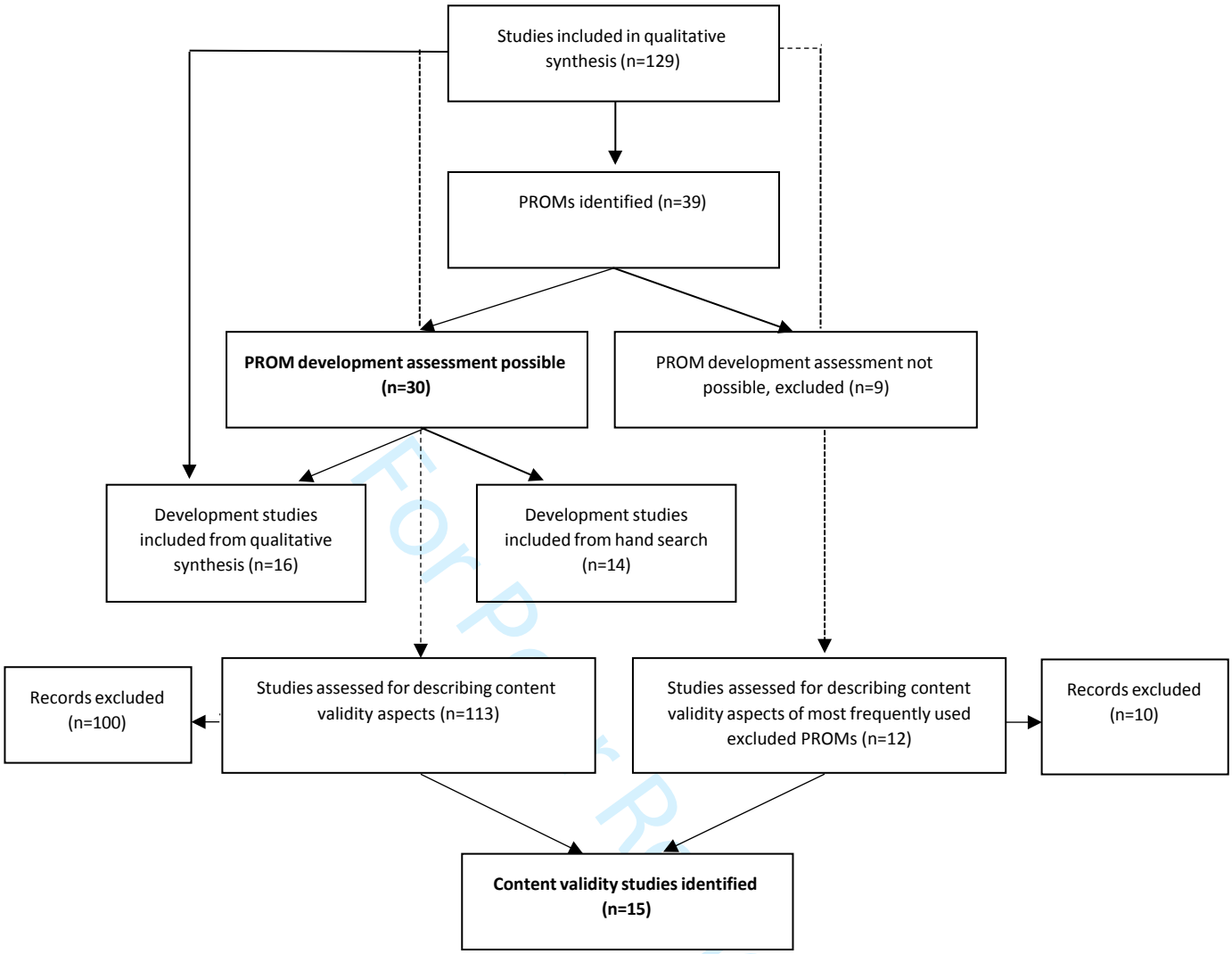

Table 1. PROMs measuring constructs of transition to parenthood

Construct	**Number of identified instruments**	**Names of identified instruments (number of studies reporting the instrument)**
Bonding	n=10	MAAS (20), PAI (19), MFAS (16), MPAS (10), MAI (7), MMFAS (3), PMAS (1), PIL (1), PBS (1), HIFMB (1)
Self-efficacy	n=10	MSQ (5), KPCS (5), PE-scale (3), SENRS (3), PMP-SE (3), PE-survey(3), ICS (2), PS-ES (1), PSE (1), MCQ (1)
Adaptation	n=9	PSEQ (9), PPSEQ (7), CASE (2), WPL-R (2), PAS (1), PPQ (1), IPA (1), EMQ (1), PAQ (1)
Parenting competence	n=7	PSOC (10), BIMF (3), BaM-13 (2), ICEQ (2), ICQ (2), PSCS (1), Rees Scales (1)
Parenting self-esteem	n=1	MSRI (3)
Involvement	n=2	CPS (1), PIQ (1)
Total	**N 39**	

BaM-13=Being a Mother Scale; BIMF=Barkin Index of Maternal Functioning; CASE=Cognitive Adaptation to Stressful Events scale; CPS=Commitment to the Pregnancy Scale; EMQ=Experience of Motherhood Questionnaire; HIFMB=How I Feel About My Baby Now Scale; ICEQ=Infant Care Expectations Questionnaire; ICQ=Infant Care Questionnaire; ICS=Infant Care Survey; IPA=Inventory of Post-partum Adaptation; KPCS=Karitane Parenting Confidence Scale; MAAS=Maternal Antenatal Attachment Scale; MAI=Maternal Attachment Inventory; MCQ=Maternal Confidence Questionnaire; MFAS=Maternal Fetal Attachment Scale; MMFAS=Modified Maternal Fetal Attachment Scale; MPAS=Maternal Postpartum Attachment Scale; MSQ=Maternal Self-Efficacy Scale; MSRI=Maternal Self Report Inventory; PAI=Prenatal Attachment Inventory; PAQ=Postpartum Adjustment Questionnaire;

PAS=Pregnancy Adaptation Scale; PBS=Postnatal Bonding Scale; PE-scale=Parenting Efficacy Scale; PE-survey=Parenting Expectations Survey; PIL=Pregnancy Involvement List; PIQ=Parental Involvement Questionnaire; PMAS=Prenatal Maternal Attachment Scale; PMP-SE=Perceived Maternal Parental Self-Efficacy Tool; PPQ=Prenatal and Postnatal Questionnaire; PPSEQ=Postpartum Self-Evaluation Questionnaire; PSCS=Pharis Self-Confidence Scale; PSE=Parenting Self-Efficacy; PS-ES=Parental Self-Efficacy Scale; PSEQ=Prenatal Self-Evaluation Questionnaire; PSOC=Parenting Sense of Competence Scale; SENRS=Self-efficacy in Nurturing Role Scale; WPL-R=What Being the Parent of a New Baby is Like-Revised.

Table 2. Included PROM development and content validity studies

Construct	Included development studies	Included validity studies
Bonding	n=6: ***MAAS*** (Condon, 1993); ***PAI*** (Muller, 1993); ***MFAS*** (Cranley, 1981); PIL (Kleinveld et al., 2007); MPAS (Condon & Corkindale, 1998); ***PBS*** (Riera-Martin et al., 2018)	n=6: ***MAAS*** (Golbasi et al., 2015); ***PAI*** (Celik & Ergin, 2020; Omani Samani et al., 2016); ***MFAS*** (Busonera et al., 2016); ***PBS*** (Riera-Martin et al., 2018); MAI (Shin & Kim, 2007)
Self-efficacy	n=7: ***MSQ*** (Teti & Gelfand, 1991); KPCS (Crncec et al., 2008); ***PE-scale*** (Leerkes & Crockenberg, 2002); ***PMP-SE*** (Barnes & Adamson-Macedo, 2007); ICS (Froman & Owen, 1989); PSE (Salonen et al., 2008); MCQ (Leiderman et al., 1973)	n=3 : ***MSQ*** (Mirghafourvand et al., 2016); ***PE-scale*** (Shorey et al., 2018); ***PMP-SE*** (Vargas-Porras et al., 2020)
Adaptation	n=9: ***PSEQ*** (Lederman et al., 1979); CASE (Affonso et al., 1994); PAS (Wu & Hung, 2019); PPQ (Sheehan, 1981); PPSEQ (Lederman et al., 1981); WPL-R (Pridham & Chang, 1989); IPA (Affonso & Arizmendi, 1986); EMQ (Astbury, 1994); PAQ (O'Hara et al., 1992)	n=2: ***PSEQ*** (Chou et al., 2005; Lin et al., 2009)

Parenting competence	n=5: ***BIMF*** (Barkin et al., 2010); BaM-13 (Matthey, 2011); ICEQ (Secco, 1997); ***ICQ*** (Affonso & Arizmendi, 1986); Rees Scales (Rees, 1980)	n=3 (***BIMF*** (Aydin & Kukulu, 2018); ***ICQ*** (Secco, 1997); PSOC (Ngai et al., 2007)
Parenting self-esteem	n=1: ***MSRI*** (Shea, 1982)	n=1: ***MSRI*** (Ahn & Kim, 2004)
Involvement	n=2: CPS (Lydon et al., 1996); PIQ (Tikotzky et al., 2011)	-
Total	**N 30 of 32 included PROMS**	**N15 of 32 included PROMS**

Bold and italic: assessed for development and validity (N=11)

Table 3. PROM development and validity rating

Construct	**PROM (abbreviation)**	**PROM development rating***	**PROM content validity rating* (N=13 studies)**
Bonding	Maternal Antenatal Attachment Scale (MAAS)	I	D [patient comprehensibility] *[Turkish version]* (Golbasi et al., 2015)
	Prenatal Attachment Inventory (PAI)	I	D [patient comprehensibility] *[Turkish version]* (Celik & Ergin, 2019)
			D [professional comprehensiveness] *[Persian version]* (Omani-Samani et al., 2016)
	Maternal Fetal Attachment Scale (MFAS)	I	D [patient relevance] D [patient comprehensibility] *[Italian version]* (Busonera et al., 2016)
	Postnatal Bonding Scale (PBS) [modified Maternal/Paternal Postnatal Attachment Scale]	I	D [professional relevance] *[Spanish version]* (Riera-Martin et al., 2018)

Self-efficacy	Maternal Self-Efficacy Scale (MSQ)	I	D [professional relevance] [Persian version] (Mirghafourvand et al., 2016)
	Parenting Efficacy Scale (PES) [modified MSQ]	I	D [professional relevance] *[Singaporean, multi-ethnic context]* (Shorey et al., 2018)
	Perceived Maternal Parental Self-Efficacy Tool (PMP-SE)	D	D [patient comprehensibility] D [professional relevance] *[Spanish version]* (Vargas-Porras et al., 2020)
Adaptation	Prenatal Self-Evaluation Questionnaire (PSEQ)	I	I [patient comprehensibility] I [professional relevance] *[Chinese version]* (Chou et al., 2005)
			I [patient comprehensiveness] I [professional comprehensiveness] *[Chinese version-short form]* (Lin et al., 2009)
Parenting competence	Barkin Index of Maternal Functioning (BIMF)	D	D [professional comprehensiveness] *[Turkish version]* (Aydin & Kukulu 2018)

	Infant Care Questionnaire (ICQ)	I	D [patient relevance] D [patient comprehensiveness] D [professional relevance] *[Original version]* (Secco, 1997)
Parenting self-esteem	Maternal Self Report Inventory (MSRI)	I	D [patient relevance] *[Korean version]* (Ahn & Kim, 2004)

*I = Inadequate; D = Doubtful

Appendix A. Search strategy.

	References	References after deduplication
Embase.com	2136	2120
Medline Ovid	1904	421
Web of science	1330	356
Cochrane	1353	1175
PsycINFO Ovid	1335	635
Google scholar	200	156
Total	**8258**	**4863**

Embase.com

('expectant mother'/de OR 'prenatal period'/de OR 'maternal behavior'/de OR (prenatal* OR antenatal* OR postnatal* OR postpartum* OR post-natal* OR post-partum* OR primigrav* OR primipar* OR ((first-time OR first-year OR transition* OR early) NEAR/3 (mother* OR parent*)) OR ((matern* OR mother*) NEAR/3 behav*) OR *motherhood*):ab,ti,kw) AND ('mother child relation'/de OR 'child parent relation'/de OR 'social bonding'/de OR 'coping behavior'/de OR 'adaptive behavior'/exp OR 'adaptation'/de OR 'emotional attachment'/de OR empathy/de OR love/de OR 'adjustment'/de OR 'internalization'/de OR 'stress management'/de OR 'parental stress'/de OR 'nurturing behavior'/de OR 'role change'/de OR 'self concept'/de OR 'identity'/de OR (*transition** OR ((mother* OR parent* OR maternal*) NEAR/3 (child* OR newborn* OR new*-born* OR fetal OR foetal OR fetus* OR foetus* OR infant* OR baby OR babies) NEAR/6 (psycholog* OR relation* OR bonding OR bond OR connection* OR interact* OR involve* OR aware* OR empath* OR love OR loving OR emotion* OR attitude* OR worries OR worry* OR adjust*)) OR (postpartum NEAR/3 (bonding OR worry OR worries)) OR ((prepar* OR involve* OR aware* OR mastery OR adjust* OR adapt* OR adjust* OR internali* OR transition* OR abilit* OR competenc* OR readiness* OR ready OR fear OR anxiet* OR confiden*) NEAR/6 (parenthood* OR motherhood* OR pregnan*)) OR coping* OR (stress NEAR/3 manage*) OR nurtur* OR (role NEAR/3 (change OR attain*)) OR (self NEXT/1 (concept* OR efficac*)) OR identit* OR attachment* OR attached* OR (mother* NEAR/6 (abilit* OR competen*))):ab,ti,kw) AND ('measurement'/mj OR 'assessment of humans'/mj/exp OR 'questionnaire'/mj/exp OR ((((measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*) NEAR/6 (new OR develop* OR novel OR create* OR compare* OR adaptat* OR construct* OR evaluat*))):ab,ti,kw OR (measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*):ti)) NOT ((child/de OR 'preschool child'/de OR 'school child'/de) NOT (infant/exp)) NOT ([Conference Abstract]/lim OR [Note]/lim OR [Editorial]/lim) AND [english]/lim

Medline Ovid

("Maternal Behavior"/ OR (prenatal* OR antenatal* OR postnatal* OR postpartum* OR post-natal* OR post-partum* OR primigrav* OR primipar* OR ((first-time OR first-year OR transition* OR early) ADJ3 (mother* OR parent*)) OR ((matern* OR mother*) ADJ3 behav*) OR motherhood*).ab,ti,kf.) AND (exp

"Mother-Child Relations"/ OR "Parent-Child Relations"/ OR "Adaptation, Psychological"/ OR "Object Attachment"/ OR Empathy/ OR love/ OR "Emotional Adjustment"/ OR "self concept"/ OR "Self Efficacy"/ OR (transition* OR ((mother* OR parent* OR maternal*) ADJ3 (child* OR newborn* OR new*-born* OR fetal OR foetal OR fetus* OR foetus* OR infant* OR baby OR babies) ADJ6 (psycholog* OR relation* OR bonding OR bond OR connection* OR interact* OR involve* OR aware* OR empath* OR love OR loving OR emotion* OR attitude* OR worries OR worry* OR adjust*)) OR (postpartum ADJ3 (bonding OR worry OR worries)) OR ((prepar* OR involve* OR aware* OR mastery OR adjust* OR adapt* OR adjust* OR internali* OR transition* OR abilit* OR competenc* OR readiness* OR ready OR fear OR anxiet* OR confiden*) ADJ6 (parenthood* OR motherhood* OR pregnan*)) OR coping* OR (stress ADJ3 manage*) OR nurtur* OR (role ADJ3 (change OR attain*)) OR (self ADJ (concept* OR efficac*)) OR identit* OR attachment* OR attached* OR (mother* ADJ6 (abilit* OR competen*))).ab,ti.) AND (*"Personality Assessment"/ OR *"Surveys and Questionnaires"/ OR ((((measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*) ADJ6 (new OR develop* OR novel OR create* OR compare* OR adaptat* OR construct* OR evaluat*))).ab,ti,kf. OR (measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*).ti.)) NOT ((exp child/) NOT (exp infant/)) NOT (news OR comment OR editorial OR congresses OR abstracts).pt. AND english.la.

PsycINFO Ovid

((prenatal* OR antenatal* OR postnatal* OR postpartum* OR post-natal* OR post-partum* OR primigrav* OR primipar* OR ((first-time OR first-year OR transition* OR early) ADJ3 (mother* OR parent*)) OR ((matern* OR mother*) ADJ3 behav*) OR motherhood*).ab,ti.) AND (exp "Mother Child Relations"/ OR "Parent Child Relations"/ OR "Adaptation"/ OR "Attachment Behavior"/ OR Empathy/ OR love/ OR "Emotional Adjustment"/ OR "self-concept"/ OR "Self-Efficacy"/ OR (transition* OR ((mother* OR parent* OR maternal*) ADJ3 (child* OR newborn* OR new*-born* OR fetal OR foetal OR fetus* OR foetus* OR infant* OR baby OR babies) ADJ6 (psycholog* OR relation* OR bonding OR bond OR connection* OR interact* OR involve* OR aware* OR empath* OR love OR loving OR emotion* OR attitude* OR worries OR worry* OR adjust*)) OR (postpartum ADJ3 (bonding OR worry OR worries)) OR ((prepar* OR involve* OR aware* OR mastery OR adjust* OR adapt* OR adjust* OR internali* OR transition* OR abilit* OR competenc* OR readiness* OR ready OR fear OR anxiet* OR confiden*) ADJ6 (parenthood* OR motherhood* OR pregnan*)) OR coping* OR (stress ADJ3 manage*) OR nurtur* OR (role ADJ3 (change OR attain*)) OR (self ADJ (concept* OR efficac*)) OR identit* OR attachment* OR attached* OR (mother* ADJ6 (abilit* OR competen*))).ab,ti.) AND (*"Personality Measures"/ OR *Measurement/ OR *"Questionnaires"/ OR ((((measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*) ADJ6 (new OR develop* OR novel OR create* OR compare* OR adaptat* OR construct* OR evaluat*))).ab,ti. OR (measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*).ti.)) NOT ((100.ag.) NOT (120.ag. OR 140.ag.)) NOT (news OR comment OR editorial OR congresses OR abstracts).pt. AND english.la.

Cochrane

((prenatal* OR antenatal* OR postnatal* OR postpartum* OR post-natal* OR post-partum* OR primigrav* OR primipar* OR ((first-time OR first-year OR transition* OR early) NEAR/3 (mother* OR

parent*)) OR ((matern* OR mother*) NEAR/3 behav*) OR motherhood*):ab,ti) AND ((transition* OR ((mother* OR parent* OR maternal*) NEAR/3 (child* OR newborn* OR new NEXT born* OR fetal OR foetal OR fetus* OR foetus* OR infant* OR baby OR babies) NEAR/6 (psycholog* OR relation* OR bonding OR bond OR connection* OR interact* OR involve* OR aware* OR empath* OR love OR loving OR emotion* OR attitude* OR worries OR worry* OR adjust*)) OR (postpartum NEAR/3 (bonding OR worry OR worries)) OR ((prepar* OR involve* OR aware* OR mastery OR adjust* OR adapt* OR adjust* OR internali* OR transition* OR abilit* OR competenc* OR readiness* OR ready OR fear OR anxiet* OR confiden*) NEAR/6 (parenthood* OR motherhood* OR pregnan*)) OR coping* OR (stress NEAR/3 manage*) OR nurtur* OR (role NEAR/3 (change OR attain*)) OR (self NEXT (concept* OR efficac*)) OR identit* OR attachment* OR attached* OR (mother* NEAR/6 (abilit* OR competen*))):ab,ti) AND (((((measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*) NEAR/6 (new OR develop* OR novel OR create* OR compare* OR adaptat* OR construct* OR evaluat*))):ab,ti OR (measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*):ti)) NOT ((child*) NOT (infan*)):ab,ti

Web of science core collection, consisting of: *Science Citation Index Expanded (1975-present) ; Social Sciences Citation Index (1975-present) ; Arts & Humanities Citation Index (1975-present) ; Conference Proceedings Citation Index- Science (1990-present) ; Conference Proceedings Citation Index- Social Science & Humanities (1990-present) ; Emerging Sources Citation Index (2015-present)

((TS=(prenatal* OR antenatal* OR postnatal* OR postpartum* OR post-natal* OR post-partum* OR primigrav* OR primipar* OR ((first-time OR first-year OR transition* OR early) NEAR/2 (mother* OR parent*)) OR ((matern* OR mother*) NEAR/2 behav*) OR motherhood*)) AND (TS=(transition* OR ((mother* OR parent* OR maternal*) NEAR/2 (child* OR newborn* OR new*-born* OR fetal OR foetal OR fetus* OR foetus* OR infant* OR baby OR babies) NEAR/5 (psycholog* OR relation* OR bonding OR bond OR connection* OR interact* OR involve* OR aware* OR empath* OR love OR loving OR emotion* OR attitude* OR worries OR worry* OR adjust*)) OR (postpartum NEAR/2 (bonding OR worry OR worries)) OR ((prepar* OR involve* OR aware* OR mastery OR adjust* OR adapt* OR adjust* OR internali* OR transition* OR abilit* OR competenc* OR readiness* OR ready OR fear OR anxiet* OR confiden*) NEAR/5 (parenthood* OR motherhood* OR pregnan*)) OR coping* OR (stress NEAR/2 manage*) OR nurtur* OR (role NEAR/2 (change OR attain*)) OR (self NEAR/1 (concept* OR efficac*)) OR identit* OR attachment* OR attached* OR (mother* NEAR/5 (abilit* OR competen*)))) AND ((TS=(((measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*) NEAR/5 (new OR develop* OR novel OR create* OR compare* OR adaptat* OR construct* OR evaluat*))) OR Ti=(measur* OR instrument* OR assess* OR inventor* OR questionnaire* OR scale* OR tool* OR checklist*))) NOT TS=((child*) NOT (infan*))) AND DT=(article) AND LA=(english)

Google scholar

prenatal|antenatal|postnatal|postpartum|motherhood
transition|relation|bonding|connection|interaction|involvement|parenthood
measurement|instrument|assessment|inventory|questionnaire

Appendix B

	Characteristics of the included studies						
Instrument	**Author(s) (year of publication)**	**Number of items**	**Participants involved**	**Reliability analysis[1]**	**Validity analysis[2]**	**Country/ region**	**Assessed for development or validity**
MAAS	Condon (1993)	19	112 pregnant women	α = 0.818	FA: 2 factors found	Australia	Development
	Golbasi (2015	19	190 pregnant women	α = 0.79	Content validity: consistency of expert opinion: uniformity of 10 experts achieved. FA: 2 factors confirmed	Turkey	Validity
PAI	Muller (1993)	27	310 low-risk pregnant women	α = 0.81	Concurrent validity with MFAS FA: one dimension found	USA	Development
	Celik & Ergin (2020)	21	100 pregnant women	α = 0.815	Comprehensibility pilot tested, data not included	Turkey	Validity
	Omani Samani et al. (2016)	21	322 pregnant primigravida	α = 0.856 ICC = 0.784	FA: one dimension confirmed	Iran	Validity
MFAS	Cranley (1981)	24	71 pregnant women	α = 0.85	Intercorrelations were performed among subscales and total scale	USA	Development
	Busonera (2016)	20	482 pregnant women	α = 0.77	Concurrent validity with PAI FA:3 factors found	Italy	Validity
PIL	Kleinveld et al. (2007)	10	1418 pregnant women	α = 0.79-0.81	Concurrent validity with PAI FA: one dimension confirmed	The Netherlands	Development
MPAS	Condon & Corkindale (1998)	19	200+ women	α = 0.78-0.79 ICC = 0.70	FA: 2 of the 4 postulated constellations were confirmed.	Australia	Development
PBS	Riera-Martin et al (2018)	15	571 mothers	α = 0.70	FA: 3 factors confirmed Concurrent validity with EPDS and DAS	Spain	Development & validity
MAI	Shin & Kim (2007)	26	196 mothers	α = 0.94	FA: 3 factors confirmed	South Korea	Validity
MSQ	Teti & Gelfand (1991)	10	86 mothers	α = 0.86	Concurrent validity with PSI Sense of Competence Scale	USA	Development
	Mirghafourvand et al. (2016)	10	437 mothers	α = 0.89 ICC = 0.98	FA: one dimension confirmed Content validity by experts	Iran	Validity

KPCS	Crncec et al. (2008)	15	187 mothers	α = 0.81	FA: one dimension with 3 subscales confirmed Discriminant and convergent validity were established	Australia	Development
PE-scale	Leerkes & Crockenberg (2002)	10	92 primiparous mothers	α = 0.70	Not performed	USA	Development
	Shorey et al. (2018)	10	105 mothers	α = 0.92 ICC = 0.71	FA: one dimension confirmed	Singapore	Validity
PMP-SE	Barnes & Adamson-Macedo (2007)	20	160 mothers of preterm infants	α = 0.91	FA: 4 factors confirmed Discriminant validity with MSRI and MPAS	UK	Development
	Vargas-Porras et al. (2020)	20	210 women	α = 0.98	FA: 4 factors confirmed Content validity by experts	Colombia	Validity
ICS	Froman & Owen (1989)	51	142 subjects	α = 0.975	FA: one dimension confirmed	USA	Development
PSE	Salonen et al. (2008)	27	863 mothers	α = 0.96	Not performed	Finland	Development
MCQ	Leiderman et al. (1973)	Paired comparison on 6 items	66 mothers	Not performed	Not performed	USA	Development
PSEQ	Lederman et al. (1979)	Not reported	32 primigravida pregnant women	Not performed	Not performed	USA	Development
	Chou et al. (2005)	79	30 pregnant women	α = 0.93	Content analysis by experts	China	Validity
	Lin et al. (2009)	35	225 pregnant women	α = 0.90 ICC = 0.97	FA: 6 factors confirmed Discriminant and convergent validity were established	China	Validity
CASE	Affonso et al. (1994)	37	202 primigravida women	α = 0.94-0.96	FA: one factor confirmed Discriminant and convergent validity were established	USA	Development
PAS	Wu & Hung (2019)	28	121 pregnant women	α = 0.91	Content analysis by experts	China	Development
PPQ	Sheehan (1981)	46	6 women	Not performed	Not performed	USA	Development
PPSEQ	Lederman et al. (1981)	81	58-91 mothers	α = 0.62-0.90	Not performed	USA	Development

WPL-R	Pridham & Chang (1989)	25	93 mothers	α = 0.77-0.90	FA: 3 factors confirmed	USA	Development
IPA	Affonso & Arizmendi (1986)	35	80 women	α = 0.89-0.90	Not performed	USA	Development
EMQ	Astbury (1994)	20	87 mothers	α = 0.78	FA: 6 factors confirmed	Australia	Development
PAQ	O'Hara et al. (1992)	61	124 women	α = 0.86	Convergent validity was established	USA	Development
BIMF	Barkin et al. (2010)	20	109 postpartum women with depressive symptomatology	α = 0.87	Content validity via focus groups and expert critique Concurrent validity with GRAT, HSDR-17, and SF-12 Mental	USA	Development
	Aydın & Kukulu (2018)	20	235 postpartum women	α = 0.73	FA: 5 factors confirmed	Turkey	Validity
BAM-13	Matthey (2011)	13	630 mothers	α = 0.80	Concurrent validity with EPDS; discriminant validity was established FA: 3 factors confirmed	Australia	Development
ICEQ	Secco (1997)	30	60 primiparous adolescent mothers	α = 0.91	Concurrent validity with self-esteem and perceived social support from friends	USA	Development
ICQ	Secco (1997)	28	164 mothers	α = 0.92	Concurrent validity with MCS	USA	Development
	Secco (1997)	28	60 primiparous adolescent mothers	α = 0.88-0.89	Content validation with mothers and researchers Concurrent validity with self-esteem and perceived social support from friends	USA	Validity
PSOC	Ngai et al. (2007)	17	170 mothers	α = 0.85	FA: 2 factors confirmed Construct validity with Rosenburg's self-esteem scale and EPDS	China	Validity
Rees scales	Rees (1980)	30 28 20	34 first-time expectant mothers	α = 0.87 α = 0.89 α = 0.67	Convergent validity established Criterion and discriminant validity not established	USA	Development
MSRI	Shea (1982)	100	30 mothers	r = 0.85	Face validity with 10 mothers and 5 psychologists Concurrent validity with SRI and clinical ratings	USA	Development

					Construct validity was demonstrated		
	Ahn & Kim (2004)	25	35 mothers	α = 0.88-0.82	Not performed	Korea	Validity
CPS	Lydon et al. (1996)	8	218 women	α = 0.91 r = 0.94	Not performed	Canada and USA	Development
PIQ	Tikotzky et al. (2011)	10	56 couples	α = 0.80 r = 0.55	Not performed	Israel	Development

[1]Internal consistency measured by Cronbach's alpha (α) and/or Intraclass Correlation Coefficient (ICC) and/or Test-retest reliability (r)
[2]FA = Factor analysis;