

Nakić Radoš, S., Matijaš, M., Brekalo, M., Hollins Martin, C.J., Martin, C.R. (2021). Further validation of the Birth Satisfaction Scale-Revised: factor structure, validity, and reliability. *Current Psychology*. <https://doi.org/10.1007/s12144-021-02688-2>

**Title: Further validation of the Birth Satisfaction Scale-Revised: factor structure, validity, and reliability**

**Sandra Nakić Radoš\***, PhD, Spec. Clin. Psychol., Department of Psychology, Catholic University of Croatia, Zagreb, Croatia, 0000-0002-8330-8427

**Marijana Matijaš**, MSc, Department of Psychology, Catholic University of Croatia, Zagreb, Croatia, 0000-0003-2474-340X

**Maja Brekalo**, PhD, Department of Psychology, Catholic University of Croatia, Zagreb, Croatia, 0000-0001-6766-5304

**Caroline J. Hollins Martin**, PhD, MPhil BSc RGN RM Cert Ed, School of Nursing, Midwifery and Social Care, Edinburgh Napier University, Scotland, UK, 0000-0002-3185-8611

**Colin R. Martin**, RN; MBA; PhD; YCAP; CPsychol; CSci; AFBPsS; Institute for Health and Wellbeing, University of Suffolk, England, UK, 0000-0002-0263-0204

**\*Corresponding author:** Sandra Nakić Radoš, Department of Psychology, Catholic University of Croatia, Ilica 242, 10000 Zagreb, Croatia, Tel: +38513706635, Fax: 385137066, [snrados@unicath.hr](mailto:snrados@unicath.hr),

**Funding:** This work was financed by the project of the Catholic University of Croatia “Parental mental health and contextual factors as determinants of parent-infant bonding”, under Grant HKS-2018-4.

## **Further validation of the Birth Satisfaction Scale-Revised: factor structure, validity, and reliability**

### **Abstract**

The Birth Satisfaction Scale-Revised is a short but valid and reliable robust measure of different aspects of birth satisfaction. This study aimed to test factor structure, validity and reliability of the Croatian version of the Birth Satisfaction Scale-Revised. In the cross-sectional study, a convenient online sample of 552 women completed questionnaires in the first year postpartum. The Birth Satisfaction Scale-Revised, subscale Satisfaction with Delivery from the Childbirth Perception Questionnaire, and a set of questions on demographic and obstetric data were administered. The results showed the excellent fit of both the three-factor model (Stress experienced during labour, Women's personal attributes, Quality of care) and two-factor model (with Stress and Women's attributes combined into one factor), with no significant difference between the two models.

Furthermore, bi-factor modeling revealed a general factor of childbirth experience, which explains the variance of items from Stress and Women's attributes subscales. The internal consistency was high for the total scale and Quality of care, while acceptable for the other two subscales. Convergent and divergent validity was high. Known-group discriminant validity showed that women who gave birth by unassisted vaginal birth and planned caesarean section reported higher levels of birth satisfaction. In conclusion, both empirical findings and theoretical background suggest a three-factor model as the better solution for the Birth Satisfaction Scale-Revised conceptualization. As the Croatian version of the Birth Satisfaction Scale-Revised was proved to be valid and reliable, it is recommended for use to measure birth satisfaction both for research and practical purposes.

**Keywords:** Birth Satisfaction Scale-Revised; birth; perinatal care; reliability and validity.

## **Introduction**

Childbirth is an important event, and for many women it is a life-changing experience. Childbirth experience is complex and multidimensional, including physiological and psychological aspects within the social, organizational and administrative context (Larkin et al., 2009). One aspect of childbirth experience is satisfaction with birth, often described in different ways, yet a complex and evaluative process shaped by individual perception and attitudes about care received (Sawyer et al., 2013). Birth satisfaction is essential, not only from the women's perspective, but also from the standpoint of delivering quality perinatal care. Childbearing women's satisfaction with health care is the most common measure from which health care providers and policymakers can improve services (Goodman et al., 2004), with it now crucial to consider using an additional valid and reliable instrument to measure women's satisfaction with their birth experience.

Several instruments for measuring birth satisfaction have been developed (for a review, see Sawyer et al., 2013). However, some of these scales are very focused and specific, such as the questionnaires that measure satisfaction during very early preterm birth (Sawyer et al., 2014) and caesarean section (Morgan et al., 1999). There is also a review of different instruments of satisfaction, which reports that most lack theoretical background (Sawyer et al., 2013). A scale that has tried to overcome some of the shortcomings of prior measures built upon a comprehensive literature review, is the Birth Satisfaction Scale (BSS) (Hollins Martin & Fleming, 2011). Three themes emerged from the literature, upon which 30 items were constructed, which included quality of the provided service, personal attributes (e.g., ability to cope and have control over the process), and stress experienced during birth. Validity tests trimmed the 30-item BSS down to a 10-item scale (Hollins Martin & Martin, 2014). Since its validation, the BSS-R has gained international attention and has been validated in English speaking countries (US) (Fleming et al., 2016)) and non-English speaking countries, such as Greece (Vardavaki et al., 2015) and Turkey (Cosar Cetin et al., 2015).

To date, the BSS-R has been validated in English speaking countries, such as the original study in the UK (Hollins Martin & Martin, 2014), the USA (Barbosa-Leiker et al., 2015; Martin et al., 2017), and Australia (Jefford et al., 2018) where it was recently replicated with high consistency (Martin et al., 2020). From all these versions, factor structure invariance and validity were upheld. In response, the BSS-R was selected by the International Consortium for Health Outcomes Measurement (USA) as the instrument of choice for assessing birth satisfaction (International Consortium for Health Outcomes Measurement, 2021). There is also a BSS-R website (BSS-R, 2021). It is also the only patient-reported measure to receive 100% endorsement (Nijagal et al., 2018) and it has been in use in 39 countries worldwide (Hollins Martin et al., 2020).

The BSS-R has been translated and validated into some other non-English languages, including Greek (Martin et al., 2016), Italian (Nespoli et al., 2020), Turkish (Göncü Serhatlıoğlu et al., 2018), Hebrew (Skvirsky et al., 2019), Spanish (Romero-Gonzalez et al., 2019), Iranian (Mortazavi et al., 2020; Omani-Samani et al., 2019), Portuguese (Ferrari et al., 2021), and Urdu (Zafar et al., 2021). From the validation studies across both English and non-English speaking countries, several conclusions emerged about the factor structure. (i) The three-factor structure fit the data adequately and superiorly opposed to unidimensional structure (Göncü Serhatlıoğlu et al., 2018; Hollins Martin & Martin, 2014; Jefford et al., 2018; Romero-Gonzalez et al., 2019; Vardavaki et al., 2015). (ii) A hierarchical model based on the three-factor model, but with a higher-order factor called the *experience of childbearing* had been proposed, with some contrary findings. Namely, Hollins Martin and Martin (2014) found the excellent fit of the model to the UK data, while Martin et al. (2017) found a marginally better fit of the simpler three-factor model in the USA data than the hierarchical model. (iii) A bi-factor model with one general factor showed an excellent fit to the extensive US sample data (Martin et al., 2018). However, this general factor explained somewhat better

Women's attributes (WA) and Stress experienced during labour (SE), than the Quality of care factor (QC). (iv) Also, a two-factor model gained an excellent fit when WA and SE were combined. However, it did not outperform the three-factor model (Martin et al., 2018). In summary, the final structure is still inconclusive, predominantly in non-English language validation in which case the bi-factor model was not tested.

Furthermore, although construct validity and reliability have been previously examined, convergent and discriminant validity were not tested sufficiently. Namely, the BSS-R has not been compared to some other measure of the birth experience so far, except with the more extended 30-item version of the same scale (Fleming et al., 2016). Also, when discriminant validity was tested by known-groups differences, just a few characteristics were used, such as pregnancy plans (Fleming et al., 2016; Martin et al., 2017) and birth type, where the only distinction was between unassisted vaginal birth versus intervention (Jefford et al., 2018; Romero-Gonzalez et al., 2019; Vardavaki et al., 2015). However, these differences might be extended to differences between alternative types of interventions used, given that there is a bulk of studies which show that emergency caesarean section and instrumental vaginal birth provoke more traumatic experience than planned caesarean section (Andersen et al., 2012; Olde et al., 2006; Söderquist et al., 2009).

Also, some cross-cultural differences were established. For example, the wording of items 1 and 4 were changed from the UK version when applied in Australian validation, and it was shown that these two items appeared as the only non-invariant items, both in the Australian (Jefford et al., 2018) and Greek versions (Vardavaki et al., 2015). Therefore, further examinations in other languages are needed.

This study aimed to translate and validate the Croatian version of the BSS-R and:

- (1) to test the adequacy of fit of the one-factor model (Hollins Martin & Martin, 2014), three-factor correlated model (Hollins Martin & Martin, 2014; Romero-Gonzalez et

al., 2019; Vardavaki et al., 2015), and bi-factor model with three-factor(Martin et al., 2018);

- (2) to examine the reliability of the BSS-R;
- (3) to explore the convergent validity of the BSS-R against Satisfaction with delivery from the Childbirth Perception Questionnaire (Padawer et al., 1988);
- (4) to examine divergent validity of the BSS-R via correlations with maternal age and time since birth;
- (5) to test discriminant validity as possible differences in the BSS-R total and subscale scores between known-groups, concerning the type of birth, parity, traumatic birth experience, and pregnancy plans.

Based on previous studies with different models substantiated, we could not hypothesize which model would fit better to the Croatian dataset. However, we expected the Croatian BSS-R to be reliable and to have high convergent and divergent validity. Namely, we expected the BSS-R to have moderate correlations with Childbirth Perception Questionnaire, while in non-significant correlations with maternal age and time since birth. Also, we anticipated that BSS-R would show high discriminant validity. Precisely, we expected that women who had planned their pregnancy, had an unassisted vaginal birth, and who did not perceive their birth as a traumatic experience, would have higher levels of birth satisfaction measured with the BSS-R.

## **Methods**

### ***Participants***

A convenience sample of 603 mothers with 1-12-month-old infants was recruited. We applied exclusion and inclusion criteria from the study by Hollins Martin and Martin (2014), thus

excluding women with prematurity (<37 weeks,  $n = 36$ ) and postmaturity (>42 weeks,  $n = 5$ ). The final sample included 562 women.

The average maternal age was 30.59 years ( $SD = 4.63$ , range 20-47), and the mean time from birth was 6.12 months ( $SD = 3.38$ , range 1-12). Out of the sample, the majority of participants were married or cohabiting (99.3%), and had graduated from tertiary schooling (70.6%). One in two women reported being of average socioeconomic status (48.2%), with 10.5% below average, and 41.3% above average.

The majority of the sample were primiparas (60.9%), one in four gave birth to a second child (27.4%), and 11.7% were multiparas. In addition, the majority had an unassisted vaginal delivery (76.1%), 2.0% had instrumental vaginal childbirth, 7.7% had a planned caesarean section, and 14.2% had an emergency caesarean section (in total, 23.9% received an intervention), which is following the national statistics (Rodin et al., 2018).

### ***Instruments***

The *Birth Satisfaction Scale-Revised* (BSS-R)(Hollins Martin & Martin, 2014) is a 10-item scale that measures satisfaction in relation to three aspects of the birth experience: *stress experienced during labour* (SE, four items,  $\alpha = .71$ ), *Women's personal attributes* (WA, two items,  $\alpha = .64$ ), and *Quality of care provision* (QC, four items,  $\alpha = .74$ ). Each item is scored on a 5-point scale (0 – *strongly disagree* to 4 – *strongly agree*). The total score ranges from 0 to 40, where a higher score indicates greater satisfaction with birth. Cronbach's  $\alpha$  for the whole scale was .79 (Hollins Martin and Martin, 2014). The back-translation method was used to translate the BSS-R to Croatian. One author translated it from English to Croatian (MB), and another translated it back from Croatian to English (SNR), with independent proofreading applied.

The *Childbirth Perception Questionnaire* (CPQ)(Padawer et al., 1988) is a 27-item questionnaire that measures different aspects of the childbirth experience, including Satisfaction with physical appearance/sexuality (5 items;  $\alpha = .58$ ), Satisfaction with delivery and conduct during labour/delivery (13 items;  $\alpha = .82$ ), and Satisfaction with interaction with spouse during childbirth (9 items;  $\alpha = .75$ ). Each item is rated on a 6-point scale (1 – *agree completely* to 6 – *disagree completely*). A subscale of Satisfaction with delivery was used to examine the convergent validity against the BSS-R. The total score for this subscale can range from 13 to 78, where a higher number indicates a lower level of satisfaction. In this study, the one-factor structure was established, and the coefficient of internal consistency of both Cronbach's  $\alpha$  and McDonald's  $\omega$  was .88.

The General Data Sheet was comprised of questions that gathered maternal demographic data (i.e., age, education, marital status). Obstetric data included questions about *parity* (coded as primiparous vs multiparous), *pregnancy plans* (planned pregnancy, unplanned but wanted pregnancy, unplanned and unwanted pregnancy), *gestational age at birth* (coded as preterm vs term birth), *time since birth* (months), *type of birth* (i.e., vaginal, instrumental vaginal, planned caesarean section, emergency caesarean section, which was coded as vaginal unassisted vs intervention), and *traumatic birth experience* (yes vs no).

### ***Procedure***

A cross-sectional study was conducted online during November-December 2018. Participants were recruited via social networks. For example, Facebook and groups for parents in Croatia. Following informed consent, participants anonymously completed the questionnaires. The Ethical Committee of the [removed for blind review] approved the study.



### ***Statistical analysis***

Factor structure was examined by Confirmatory Factor Analysis (CFA). Interpretation of the fit indices of Confirmatory Fit Index (CFI) and Tucker-Lewis Index (TLI) values were above .95, Standardized Root Mean Square Residual (SRMR) below .08, and 90% confidence interval for the Root Mean Square Error Approximation (RMSEA) below .08 indicated a good fit (Browne & Cudeck, 1993; Hu & Bentler, 1999). We followed a general rule to have at least 200 participants to conduct the CFA, but this figure was substantially exceeded. Reliability of the BSS-R was examined using internal consistency Cronbach's  $\alpha$  coefficient and McDonald's  $\omega$  calculated with OMEGA macro for SPSS (Hayes & Coutts, 2020). Convergent validity was assessed using Pearson's correlation coefficients between the BSS-R total scale and subscale of the Childbirth Perception Questionnaire. Discriminant validity was examined by a series of one-way analysis of variance (ANOVA) of the BSS-R whole scale and subscales concerning different known groups. CFA analysis was performed using MPlus, version 8.1 and others using SPSS Statistics 21.0 for Windows.

## **Results**

### ***Data screening***

There were no missing data in relation to BSS-R items. The dataset was screened for univariate and multivariate outliers and normality of distributions. No univariate outliers were found based on the z scores, which were all below  $z < 3.29$  (Tabachnick & Fidell, 2007). However, by calculating Mahalanobis distances, 10 (1.8%) multivariate outliers were revealed and excluded from the following analysis. Inspecting the absolute values of skew (SI) and kurtosis (KI) indexes, all items were well below 3 and KI below 8. Thus we concluded that the normality of distributions were not violated (Kline, 2011).

### ***Item analysis***

Descriptive statistics for individual items of the BSS-R showed that all items had the full range of answers on the 5-point scale. For example, women were the most satisfied with the clean and hygienic delivery room, as the aspect of the Quality of care. On the other hand, they reported the lowest level of satisfaction for items 9 and 3, which refer to feelings of distress during labour and encouragement from the delivery room staff to make decisions about their birth progress.

### ***Factor structure***

We conducted CFA with one factor, which showed poor fit indices (Table 1). On the other hand, the fit indices for the three-factor model were excellent. However, there was an extremely high correlation between the subscales of SE and WA ( $r = .995$ ). Therefore, we conducted CFA with a two-factor solution, where we combined factors of SE and WA. The fit indices were almost identical, as was the case for the three-factor model. The chi-square difference test for these two models was also insignificant.

Also, we tried to replicate the bi-factor model, based upon the three-factor model (Martin et al., 2018). The bi-factor model was identified with excellent fit indices (Table 1), but was not significantly better than the three-factor model ( $\Delta\chi^2 = 8.25$ ,  $\Delta df = 7$ ,  $p = .3110$ ). Factor loadings for this model are presented in Figure 1. Items of both SE and WA subscale were more saturated with the general factor than with the specific factor, while items of the QC had higher factor loadings on the specific factor. The proportion of variance contributed to each set of items by the corresponding latent factor were .33, .04, .01, and .42 for the general factor, SE, WA, and QC, respectively. Furthermore, the general factor explained 40% of the variance for the SE subscale items, 56% of the variance for the WA subscale items, and only 15% of the QC subscale items.

### ***Reliability***

Reliability was analyzed as the internal consistency coefficient of .85 for both Cronbach's  $\alpha$  and McDonald's  $\omega$ . In addition, reliability of each subscale was above the standard threshold of .70 (Kline, 2000) and was  $\alpha = .72$  and  $\omega = .73$  for the SE;  $\alpha = .72$  for WA; and  $\alpha = .81$  and  $\omega = .85$  for QC, respectively.

### ***Convergent validity***

The BSS-R total score and the subscale scores were in moderate and significant negative correlations with the Childbirth Perception Questionnaire, i.e. subscale Satisfaction with Delivery (Table 2). Namely, higher levels of birth satisfaction on the BSS-R were related to higher satisfaction levels on the Childbirth Perception Questionnaire. The same findings were found for the total score and the three subscales: SE, WA, and QC, compared with the Childbirth Perception Questionnaire. The correlations of the combined subscales of SE/WA and the Childbirth Perception Questionnaire are presented in the Online Resource 1.

### ***Divergent validity***

The BSS-R total score was not related to maternal age ( $r = .01, p = .9040$ ). Moreover, none of the BSS-R subscales correlated with maternal age ( $r_{SE} = .01, p = .7720$ ;  $r_{WA} = -.06, p = .1810$ ;  $r_{QC} = .03, p = .4300$ ), respectively. Furthermore, time since birth had a low, but significant negative correlation with the BSS-R total score ( $r = -.09, p = .0350$ ) and non-significant correlations with the subscales ( $r_{SE} = -.08, p = .0800$ ;  $r_{WA} = -.07, p = .0860$ ;  $r_{QC} = -.07, p = .0850$ ), respectively. We suspected that the significant correlation with the total BSS-R score might be due to higher occurrence of traumatic birth in women who gave birth 8, 11, and 12 months ago (35.29%, 42.55%, and 38.24%, respectively, vs. 26.99% for the whole sample).

When we controlled for the traumatic birth on the relationship between the total BSS-R score and time since birth, we found a non-significant partial correlation ( $r = -.03, p = .5040$ ).

### ***Discriminant validity***

Discriminant validity of the BSS-R full scale and subscale was examined via known-groups differences (Table 3). Scores on the whole scale and subscales SE and WA were sensitive to *type of birth*. More specifically, women with unassisted vaginal birth and planned caesarean section had significantly higher levels of birth satisfaction than women with assisted vaginal delivery and emergency caesarean section.

Concerning *parity*, multiparous women reported greater total satisfaction, satisfaction with SE and QC than primiparous women, but there was no difference in WA. Concerning *birth trauma*, women who reported traumatic childbirth had significantly lower levels of birth satisfaction on the total scale and all subscales. Finally, there was no difference in any aspect of birth satisfaction in relation to *pregnancy plans*. Although there was a tendency of women with an unwanted pregnancy to report lower levels of birth satisfaction, there was not enough statistical power to detect the significance due to a small subsample ( $n = 9$ ).

Known-group differences for the combined subscales of SE/WA are presented in Online Resource 2.

## **Discussion**

Our findings contribute to existing literature about the BSS-R, confirming its validity and reliability as a short measure of birth satisfaction, even when the scale is translated into a non-English language. Factor structure analysis yielded a competing three-factor and two-factor model with excellent fit. Also, the bi-factor model was shown to be statistically equivalent to the established tri-dimensional measurement model. Furthermore, internal consistency was

high for the total scale and acceptable for the subscales. Also, convergent, divergent validity, and known-group discriminant validity were all high. These specific psychometric properties are further discussed.

First, concerning factor structure, the results showed the excellent fit of both the three-factor model (SE, WA, QC) and two-factor model (with SE and WA combined into one factor), with no significant difference between the two models. Similar findings were found in a recent study by Martin et al. (2018), where also the two-factor model yielded excellent fit, but it did not outperform the three-factor model. The high correlation between SE and WA was also demonstrated in another CFA of the BSS-R (Hollins Martin & Martin, 2014). From parsimony aspects (Brown, 2015), one could argue that the two-factor model should be recommended. However, analysis other than CFA provided interesting findings, as well.

Namely, analysis of the known-group discriminant validity revealed some differences between the SE and WA. Although on the majority of inspected variables, the two subscales were quite consistent. The SE was sensitive to parity, while the WA subscale was not. Despite the small number of items, both subscales had reliability above the threshold for the acceptable internal consistency (Kline, 2000), which was even higher than in other studies (Hollins Martin and Martin, 2014; Romero-Gonzalez et al., 2019). Finally, given that the three factors initially emerged from the literature (Hollins Martin & Fleming, 2011) and that there are substantiated arguments from the analysis findings, the three-factor model is recommended for use.

We further examined the bi-factor model with three specific factors. Results were similar to the findings from the US study by Martin et al. (2018) in several ways. First, as in the US, the bi-factor model showed a similar fit to the three-factor model; also, all items had high loadings ( $> .30$ ) on general factors except for item 10; and finally, the QC subscale was more independent, while the variance of both SE and WA items were accounted by general

factor. This replication shows that the BSS-R scale can be used in Croatia in a similar way as in English speaking countries.

Furthermore, the convergent and divergent validity was high. We found that the BSS-R was moderately related to the older measure of satisfaction with birth, as measured by the Childbirth Perception Questionnaire (Padawer et al., 1988). The Childbirth Perception Questionnaire is a unidimensional measure that comprises different aspects of satisfaction, including experiences of personal control during birth, personal dealing with pain, satisfaction with the type of birth, and pain management. From this finding, it is clear that these specific aspects tap all three subscales of the BSS-R. Therefore, we did not expect the correlations to be too high. On the other hand, the BSS-R was not related to maternal age and time since birth, thus demonstrating high divergent validity.

Known-group discriminant validity showed that women who gave birth vaginally and had a planned caesarean section reported higher levels of birth satisfaction than those who gave birth by instrumental vaginal birth and emergency caesarean section. This is an interesting finding, given that this is the first study to look at specific childbirth types. In previous validations on the BSS-R, the only general distinction between unassisted vaginal birth and intervention birth was analyzed showing that women with vaginal birth reported higher birth satisfaction (Jefford et al., 2018; Romero-Gonzalez et al., 2019; Vardavaki et al., 2015). Our findings are thus a meaningful extension to those of previous studies, as they show that the BSS-R is also sensitive to different types of operative birth. Also, the findings are in line with literature which shows that emergency caesarean section and instrumental vaginal birth provokes a more traumatic birth experience (Andersen et al., 2012; Dahan, 2021; Olde et al., 2006; Söderquist et al., 2009). In line with that, our findings showed that women who reported traumatic birth had significantly lower levels of birth satisfaction.

Furthermore, the known-group analysis also revealed that primiparous women had lower levels of birth satisfaction. This is consistent with the previous prospective study (Ayers & Pickering, 2005) that found that primiparous women expected more negative emotions before birth and reported more negative emotions after birth and more traumatic birth.

Before drawing firm conclusions, several shortcomings of the study need to be addressed. First, the convenience sample was recruited online. Although online recruitment has advantages, especially in collecting larger samples within a short time, it is restricted to those women who use technology. However, the sample was representative of Croatian women, at least in regard to type of birth (Rodin et al., 2018), which was one of the main variables for testing known-group validity. Furthermore, in most of the studies that validate the BSS-R, women completed questionnaires within several weeks of birth. In contrast, in this study, women in their first postnatal year participated. As such, one could argue that women could forget or change recollections of their birth over time. However, there are studies that show that some women have vivid memories of their childbirth, even after 20 years (Simkin, 1991). Also, we established a non-significant correlation between the time since birth and the BSS-R, which is an important finding and suggests that the scale can be used in postnatal women even after the puerperal period. However, this should be further tested with a longitudinal design, especially to examine test-retest reliability as a measure of stability over time. In this research, we did not establish discriminant validity based on pregnancy plans. However, mothers may be reluctant to admit unwanted pregnancy, especially if their opinion changes after the birth. Therefore, longitudinal studies would also be beneficial for examination of possible effects of attitudes towards fertility and motherhood (Kossakowska & Söderberg, 2020; Söderberg et al., 2015) and reported birth satisfaction. Also, we did not collect information on the received medications and analgesics during childbirth, which may affect birth satisfaction (Dickinson et al., 2003; Nahae et al., 2020). Finally, future studies

would benefit from investigating the prognostic validity of the BSS-R, especially in relation to comparing birth satisfaction with different outcomes of postnatal mental health and relationships with a baby.

Nevertheless, this study adds to the current literature about BSS-R validation. Given that this scale is the measure of choice for evaluating birth satisfaction (Nijagal et al., 2018), it is imperative to confirm its validity in different settings and countries. Furthermore, this study contributes to the bi-factor modeling literature in general, as an over 80-years old technique that has received more attention only recently (Liao, 2018). Also, the findings of this study contribute to the literature about negative birth experiences (Andersen et al., 2012; Dahan, 2021; Olde et al., 2006; Söderquist et al., 2009), showing that it is not the medical intervention during childbirth that is associated with birth dissatisfaction. However, *unplanned* interventions, such as instrumental vaginal birth and emergency caesarean section, are associated with lower levels of birth satisfaction. Therefore, these women should receive special care during and after delivery.

In conclusion, both empirical findings and theoretical background suggest a three-factor model is the best solution for conceptualizing the BSS-R. As the Croatian version of the BSS-R was proved to be valid and reliable, it is recommended for use to measure birth satisfaction both for research and practical purposes. Recently, the World Health Organization indicated patient's satisfaction with the health service as an outcome measure of quality of perinatal care (World Health Organization, 2016), and the International Consortium for Health Outcomes Measurement chose the BSS-R as the recommended instrument of choice to assess birth satisfaction (Nijagal et al., 2018). Therefore, the BSS-R should be used as a standard procedure for evaluating perinatal healthcare. Women's experiences of childbirth are essential aspect of maternal care, with high scores of birth satisfaction setting a 'gold standard' for service provision.



**Declarations:**

**Funding:** This work was financed by the project of the Catholic University of Croatia “Parental mental health and contextual factors as determinants of parent-infant bonding”, under Grant HKS-2018-4.

**Conflict of interest:** The authors have no relevant financial or non-financial interests to disclose.

**Availability of data and material:** The datasets analyzed during the current study are available from the corresponding author on reasonable request.

**Code availability:** Not applicable.

**Authors' contribution:**

All authors contributed to the conceptualization. The methodology was prepared by Sandra Nakić Radoš, Marijana Matijaš and Maja Brekalo. Formal analysis was conducted by Sandra Nakić Radoš, Marijana Matijaš and Colin R. Martin. The first draft of the manuscript was written by Sandra Nakić Radoš, Marijana Matijaš and Maja Brekalo, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript. Funding acquisition and project administration were cured by Sandra Nakić Radoš. Supervision was conducted by Sandra Nakić Radoš and Colin R. Martin.

**Ethics Approval:** This study was approved by the Ethical Committee of the Catholic University of Croatia (Class: 602-04/18-04/12, No: 498-04-06-18-06-1), and it was conducted in accordance with the ethical standards of the Declaration of Helsinki.

**Consent to participate:** Informed consent was obtained from all individual participants included in the study.

**Consent for publication:** All participants gave their consent to publish the data analyzed on the group level.

## References

- Andersen, L. B., Melvaer, L. B., Videbech, P., Lamont, R. F., & Joergensen, J. S. (2012). Risk factors for developing post-traumatic stress disorder following childbirth: A systematic review. *Acta Obstetrica et Gynecologica Scandinavica*, *91* (11), 1261–1272. <https://doi.org/10.1111/j.1600-0412.2012.01476.x>
- Ayers, S., & Pickering, A.D. (2005). Women's expectations and experience of birth. *Psychology and Health*, *20*, 79–92. <https://doi.org/10.1080/0887044042000272912>
- Barbosa-Leiker, C., Fleming, S., Hollins Martin, C. J., & Martin, C. R. (2015). Psychometric properties of the Birth Satisfaction Scale-Revised (BSS-R) for US mothers. *Journal of Reproductive and Infant Psychology*, *33* (5), 504–511. <https://doi.org/10.1080/02646838.2015.1024211>
- Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). The Guilford Press.
- Browne, M. W., & Cudeck, R. (1993). Alternate ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–1626). Sage.
- BSS-R. (2021, September 25). *Birth Satisfaction Scale-Revised*. <https://www.bss-r.co.uk>
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155-159. <https://doi.org/10.1037//0033-2909.112.1.155>
- Cosar Cetin, F., Sezer, A., & Dogan Merih, Y. (2015). The Birth Satisfaction Scale: Turkish Adaptation, Validation And Reliability Study. *Northern Clinics of Istanbul*, *2* (2), 142–150. <https://doi.org/10.14744/nci.2015.40412>
- Dahan, O. (2021). The riddle of the extreme ends of the birth experience: Birthing consciousness and its fragility. *Current Psychology*, Advance online publication.

<https://doi.org/10.1007/s12144-021-01439-7>

Dickinson, J. E., Paech, M. J., McDonald, S. J., & Evans, S. F. (2003). Maternal satisfaction with childbirth and intrapartum analgesia in nulliparous labour. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, *43*(6), 463-468.

<https://doi.org/10.1046/j.0004-8666.2003.00152.x>

Ferrari, R. B., Martin, C., Hollins Martin, C., de Souza, F. G., Clini, J. V., Onofre, L. B. O., & Diniz-Zanett, M. R. (2021). Translation of the UK-Birth-Satisfaction-Scale-Revised (BSS-R) into Brazilian (Portuguese) and description of initial measurement properties. *The Journal of Maternal-Fetal & Neonatal Medicine*. Advance online publication. <https://doi.org/10.1080/14767058.2021.1913579>

Fleming, S. E., Donovan-Batson, C., Burduli, E., Barbosa-Leiker, C., Hollins Martin, C. J., & Martin, C. R. (2016). Birth Satisfaction Scale/Birth Satisfaction Scale-Revised (BSS/BSS-R): A large scale United States planned home birth and birth centre survey. *Midwifery*, *41*, 9–15. <https://doi.org/10.1016/j.midw.2016.07.008>

Göncü Serhatlıoğlu, S., Karahan, N., Hollins Martin, C. J., & Martin, C. R. (2018). Construct and content validity of the Turkish Birth Satisfaction Scale–Revised (T-BSS-R). *Journal of Reproductive and Infant Psychology*, *36* (3), 235–245.

<https://doi.org/10.1080/02646838.2018.1443322>

Goodman, P., Mackey, M. C., & Tavakoli, A. S. (2004). Factors related to childbirth satisfaction. *Journal of Advanced Nursing*, *46* (2), 212–219.

<https://doi.org/10.1111/j.1365-2648.2003.02981.x>

Hayes, A. F., & Coutts, J. J. (2020). Use omega rather than Cronbach's alpha for estimating reliability. But... *Communication Methods and Measures*, *14*, 1-24.

<https://doi.org/10.1080/19312458.2020.1718629>

- Hollins Martin, C. J., & Fleming, V. (2011). The birth satisfaction scale. *International Journal of Health Care Quality Assurance*, 24 (2), 124–135.  
<https://doi.org/10.1108/09526861111105086>
- Hollins Martin, C.J., Jimenez Martinez, L., & Martin, C.R. (2020). Measuring women's experiences of childbirth using the Birth Satisfaction Scale-Revised (BSS-R). *British Journal Midwifery*. 28(5), 306-312. <https://doi.org/10.12968/bjom.2020.28.5.306>
- Hollins Martin, C. J., & Martin, C. R. (2014). Development and psychometric properties of the Birth Satisfaction Scale-Revised (BSS-R). *Midwifery*, 30 (6), 610–619.  
<https://doi.org/10.1016/j.midw.2013.10.006>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6 (1), 1–55. <https://doi.org/10.1080/10705519909540118>
- International Consortium for Health Outcomes Measurement Pregnancy and Childbirth. (2021, September 25). *Pregnancy and Childbirth*. [www.ichom.org/medical-conditions/pregnancy-and-childbirth/](http://www.ichom.org/medical-conditions/pregnancy-and-childbirth/)
- Jefford, E., Hollins Martin, C. J., & Martin, C. R. (2018). Development and validation of the Australian version of the Birth Satisfaction Scale-Revised (BSS-R). *Journal of Reproductive and Infant Psychology*, 36 (1), 42–58.  
<https://doi.org/10.1080/02646838.2017.1396302>
- Kline, P. (2000). *A psychometrics primer*. Free Association Books.
- Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (3rd ed.). Guilford Press.
- Kossakowska, K., & Söderberg, M. (2020). Psychometric properties and factor structure of

- the attitudes to fertility and childbearing scale (AFCS) in a sample of polish women. *Current Psychology*, 1-11. <https://doi.org/10.1007/s12144-020-01004-8>
- Larkin, P., Begley, C. M., & Devane, D. (2009). Women's experiences of labour and birth: an evolutionary concept analysis. *Midwifery*, 25 (2), e49–e59. <https://doi.org/10.1016/j.midw.2007.07.010>
- Liao, X. (2018). *Several issues concerning the use of bifactor model in understanding dimensionality* (Doctoral dissertation, University of Oklahoma). SHAREOK. <https://shareok.org/handle/11244/302321>
- Martin, C. R., Hollins Martin, C. J., Burduli, E., Barbosa-Leiker, C., Donovan-Batson, C., & Fleming, S. E. (2017). Measurement and structural invariance of the US version of the Birth Satisfaction Scale-Revised (BSS-R) in a large sample. *Women and Birth*, 30 (4), e172–e178. <https://doi.org/10.1016/j.wombi.2016.11.006>
- Martin, C. R., Hollins Martin, C. J., Burduli, E., Barbosa-Leiker, C., Donovan-Batson, C., & Fleming, S. E. (2018). The Birth Satisfaction Scale–Revised (BSS-R): should the subscale scores or the total score be used? *Journal of Reproductive and Infant Psychology*, 36 (5), 530–535. <https://doi.org/10.1080/02646838.2018.1490498>
- Martin, C.R., Jefford, E., & Hollins Martin, C.J. (2020). Crisis, what crisis? Replicability of the key measurement characteristics of the Australian version of the Birth Satisfaction Scale-Revised (BSS-R). *International Journal of Childbirth*, 10(3):140-150. <https://dx.doi.org/10.1891/IJCBIRTH-D-20-00006>
- Martin, C. R., Vardavaki, Z., & Hollins Martin, C. J. (2016). Measurement equivalence of the Birth Satisfaction Scale-Revised (BSS-R): further evidence of construct validity. *Journal of Reproductive and Infant Psychology*, 34 (4), 394–402. <https://doi.org/10.1080/02646838.2016.1184747>

- Morgan, P. J., Lo, J., & Halpern, S. (1999). The development of a maternal satisfaction scale for caesarean section. *International Journal of Obstetric Anesthesia*, 8 (3), 165–170.  
[https://doi.org/10.1016/S0959-289X\(99\)80132-0](https://doi.org/10.1016/S0959-289X(99)80132-0)
- Mortazavi, F., Mehrabadi, M., Hollins Martin, C. J., & Martin, C. R. (2020). Psychometric Properties of the Birth Satisfaction Scale-Revised (BSS-R) in a Sample of Postpartum Iranian Women. *Health Care for Women International*. <https://doi.org/10.1080/07399332.2020.1802464>
- Nahae, J., Mohammad-Alizadeh-Charandabi, S., Abbas-Alizadeh, F., Martin, C. R., Martin, C. J. H., Mirghafourvand, M., & Hassankhani, H. (2020). Pre-and during-labour predictors of low birth satisfaction among Iranian women: a prospective analytical study. *BMC Pregnancy and Childbirth*, 20(1), 1-11. <https://doi.org/10.1186/s12884-020-03105-5>
- Nespoli, A., Colciago, E., Fumagalli, S., Locatelli, A., Hollins Martin, C. J., & Martin, C. R. (2020). Validation and factor structure of the Italian version of the Birth Satisfaction Scale-Revised (BSS-R). *Journal of Reproductive and Infant Psychology*.  
<https://doi.org/10.1080/02646838.2020.1836333>
- Nijagal, M. A., Wissig, S., Stowell, C., Olson, E., Amer-Wahlin, I., Bonsel, G., et al. (2018). Standardized outcome measures for pregnancy and childbirth, an ICHOM proposal. *BMC Health Services Research*, 18 (1), 953. <https://doi.org/10.1186/s12913-018-3732-3>
- Olde, E., Van Der Hart, O., Kleber, R., & Van Son, M. (2006). Posttraumatic stress following childbirth: A review. *Clinical Psychology Review*, 26 (1), 1–16.  
<https://doi.org/10.1016/j.cpr.2005.07.002>
- Omani-Samani, R., Hollins Martin, C., Martin, C., Ghareri, S. M. A., & Navid, B. (2019). The Birth Satisfaction Scale-Revised Indicator (BSS-RI): A validation study in Iranian

- mothers. *The Journal of Maternal-Fetal & Neonatal Medicine*. 7, 1-5.  
<https://doi.org/10.1080/14767058.2019.165126>
- Padawer, J. A., Fagan, C., Janoff-Bulman, R., Strickland, B. R., & Chorowski, M. (1988). Women's Psychological Adjustment Following Emergency Cesarean Versus Vaginal Delivery. *Psychology of Women Quarterly*, 12 (1), 25–34.  
<https://doi.org/10.1111/j.1471-6402.1988.tb00925.x>
- Rodin, U., Draušnik, Ž., Cerovečki, I., & Jezdić, D. (2018). *Porodi u zdravstvenim ustanovama u Hrvatskoj 2017. godine [Childbirths in healthcare institutions in Croatia in 2017]*. Hrvatski zavod za javno zdravstvo. Retrieved from [https://www.hzjz.hr/wp-content/uploads/2018/07/Porodi\\_2017.pdf](https://www.hzjz.hr/wp-content/uploads/2018/07/Porodi_2017.pdf)
- Romero-Gonzalez, B., Peralta-Ramirez, M. I., Caparros-Gonzalez, R. A., Cambil-Ledesma, A., Hollins Martin, C. J., & Martin, C. R. (2019). Spanish validation and factor structure of the Birth Satisfaction Scale-Revised (BSS-R). *Midwifery*, 70, 31–37.  
<https://doi.org/10.1016/j.midw.2018.12.009>
- Sawyer, A., Ayers, S., Abbott, J., Gyte, G., Rabe, H., & Duley, L. (2013). Measures of satisfaction with care during labour and birth: a comparative review. *BMC Pregnancy and Childbirth*, 13 (1), 108. <https://doi.org/10.1186/1471-2393-13-108>
- Simkin, P. (1991). Just Another Day in a Woman's Life? Women's Long-Term Perceptions of Their First Birth Experience. Part I. *Birth*, 18 (4), 203–210.  
<https://doi.org/10.1111/j.1523-536X.1991.tb00103.x>
- Skvirsky, V., Taubman-Ben-Ari, O., Hollins Martin, C. J., & Martin, C. R. (2019). Validation of the Hebrew Birth Satisfaction Scale-Revised (BSS-R) and its relationship to perceived traumatic labour. *Journal of Reproductive and Infant Psychology*, 38(2), 214-2020.  
<https://doi.org/10.1080/02646838.2019.1600666>

- Söderberg, M., Lundgren, I., Christensson, K., & Hildingsson, I. (2013). Attitudes toward fertility and childbearing scale: An assessment of a new instrument for women who are not yet mothers in Sweden. *BMC Pregnancy and Childbirth*, *13*, 197. <https://doi.org/10.1186/1471-2393-13-197>
- Söderquist, J., Wijma, B., Thorbert, G., & Wijma, K. (2009). Risk factors in pregnancy for post-traumatic stress and depression after childbirth. *BJOG: An International Journal of Obstetrics and Gynaecology*, *116* (5), 672–680. <https://doi.org/10.1111/j.1471-0528.2008.02083.x>
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics (Vol. 5)*. Pearson.
- Vardavaki, Z., Hollins Martin, C. J., & Martin, C. R. (2015). Construct and content validity of the Greek version of the Birth Satisfaction Scale (G-BSS). *Journal of Reproductive and Infant Psychology*, *33* (5), 488–503. <https://doi.org/10.1080/02646838.2015.1035235>
- World Health Organization. (2016). *Standards for improving of maternal and newborn care in health facilities*. World Health Organization.
- Zafar, S., Tayyab, F., Liaqat, A., Sikander, S., Martin, C. J. H., & Martin, C. R. (2021). Translation and Validation of the Birth Satisfaction Scale-Revised in Urdu for Use in Pakistan. *International Journal of Childbirth*. Advance online publication. <https://doi.org/10.1891/IJCBIRTH-D-21-00001>



Table 1. Model comparison of the BSS-R ( $N=552$ )

Model	$\chi^2$ ( <i>df</i> )	$\Delta\chi^2$	$\Delta df$	<i>p</i>	RMSEA	SRMR	CFI
One-factor model	816.84 (35)	-	-	-	.201	.145	.687
Two-factor model	113.09 (34)	703.75	1	< .001	.065	.047	.968
Three-factor model	112.99 (32)	0.10	2	.476	.068	.047	.968
Bi-factor model	104.74 (25)	8.25	7	.311	.076	.047	.968

Note: BSS-R: Birth Satisfaction Scale – Revised; RMSEA - Root Mean Square Error Approximation  
 SRMR - Standardized Root Mean Square Residual; CFI - Confirmatory Fit Index.

Table 2. Intercorrelations of the BSS-R total scale and subscales, and correlations with Satisfaction with delivery measured by CPQ ( $N = 552$ )

	<i>M (SD)</i>	1.	2.	3.	4.	5.
1. BSS-R Total score	22.96 (8.63)	-	.88**	.80**	.78**	-.72**
2. Stress during labour	8.33 (4.11)		-	.71**	.44**	-.67**
3. Women's attributes	4.43 (2.43)			-	.40**	-.64**
4. Quality of care	10.20 (3.94)				-	-.48**
5. Satisfaction with delivery (CPQ)	30.85 (13.42)					-

Note: \*  $p < .05$ , \*\*  $p < .01$ . BSS-R - the Birth Satisfaction Scale-Revised, CPQ - Childbirth Perception Questionnaire. The absolute value of the correlation is its effect size (Cohen, 1992).

Table 3. Differences in the BSS-R total score and subscales between known-groups ( $N = 552$ )

		Total score	Stress during labour	Women's attributes	Quality of care
Groups		$M (SD)$	$M (SD)$	$M (SD)$	$M (SD)$
Type of birth	Unassisted vaginal ( $n = 421$ )	23.54 (8.67)	8.62 (4.15)	4.60 (2.40)	10.32 (3.99)
	Instrumental vaginal ( $n = 11$ )	18.00 (9.82)	6.09 (4.57)	2.72 (2.10)	9.18 (4.92)
	Emergency c.s. ( $n = 78$ )	19.31 (7.72)	6.42 (3.70)	3.47 (2.36)	9.41 (3.59)
	Planned c.s. ( $n = 42$ )	25.24 (7.37)	9.50 (3.14)	4.98 (2.49)	10.76 (3.78)
		$F(3, 548) = 7.75$ $p < .0001^a$	$F(3, 548) = 8.88$ $p < .0001^a$	$F(3, 548) = 7.43$ $p < .0001^a$	$F(3, 548) = 1.70$ $p = .1650$
Parity	Primiparous ( $n = 335$ )	21.85 (8.68)	7.74 (4.06)	4.33 (2.49)	9.78 (4.03)
	Multiparous ( $n = 217$ )	24.67 (8.28)	9.23 (4.03)	4.59 (2.35)	10.85 (3.72)
		$F(1, 550) = 14.43$ $p < .0001$	$F(1, 550) = 17.74$ $p < .0001$	$F(1, 550) = 1.52$ $p = .2180$	$F(1, 550) = 9.91$ $p = .0020$
Birth trauma	Non-traumatic ( $n = 403$ )	25.96 (7.22)	9.72 (3.48)	5.15 (2.11)	11.09 (3.57)
	Traumatic ( $n = 149$ )	14.85 (6.69)	4.56 (3.25)	2.49 (2.19)	7.80 (3.92)
		$F(1, 550) = 267.30$ $p < .0001$	$F(1, 550) = 247.27$ $p < .0001$	$F(1, 550) = 169.45$ $p < .0001$	$F(1, 550) = 87.61$ $p < .0001$
Pregnancy plans <sup>b</sup>	Planned pregnancy ( $n = 267$ )	23.11 (8.60)	8.18 (4.22)	4.57 (2.43)	10.36 (3.87)
	Unplanned but wanted ( $n = 132$ )	22.90 (9.58)	8.36 (4.21)	4.45 (2.56)	10.10 (4.35)
	Unplanned and unwanted ( $n = 9$ )	18.78 (8.90)	6.44 (3.50)	3.22 (2.68)	9.11 (4.28)
		$F(2, 405) = 1.03$ $p = .3590$	$F(2, 405) = 0.88$ $p = .4170$	$F(2, 405) = 1.32$ $p = .2680$	$F(2, 405) = 0.56$ $p = .5750$

Note: <sup>a</sup> *post hoc*: vaginal = planned c.s. > instrumental vaginal = emergency c.s.; <sup>b</sup> pregnancy plans: the only analysis with the subsample of 408 women due to missing data on this variable.

Figure 1. Bi-factor model with standardized factor-loading of BSS-R. Arrows to the immediate right of items represent residual values.

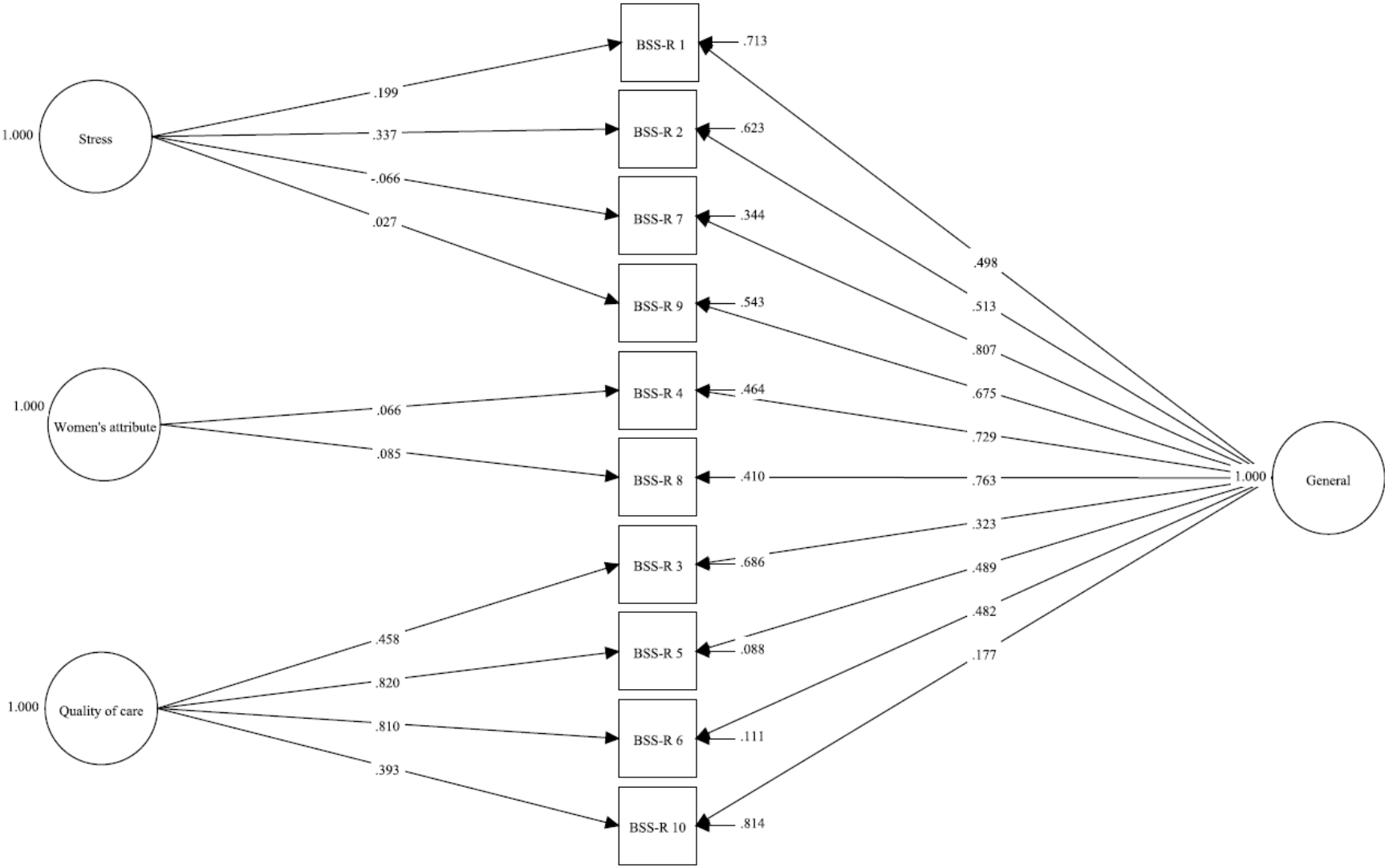


Table S1. Correlations of the combined factor of Stress during labour and Women's attributes (SL/WA) with the BSS-R total scale and subscales, and correlations with Satisfaction with delivery measured by CPQ ( $N = 552$ )

	Stress during labour/ Women's attributes
	$\alpha = .83$
1. BSS-R Total score	.91**
2. Stress during labour	.96**
3. Women's attributes	.88**
4. Quality of care	.45**
5. Satisfaction with delivery (CPQ)	-.71**

Note: \*  $p < .05$ , \*\*  $p < .01$ . BSS-R - the Birth Satisfaction Scale-Revised, CPQ - Childbirth Perception Questionnaire.

Table S2. Differences in the combined factor of Stress during labour and Women's attributes (SL/WA) between known-groups ( $N = 552$ )

		Stress during labour/ Women's attributes
Groups		$M (SD)$
Type of delivery	Unassisted vaginal ( $n = 421$ )	13.22 (6.08)
	Instrumental vaginal ( $n = 11$ )	8.82 (6.26)
	Emergency c.s. ( $n = 78$ )	9.90 (5.53)
	Planned c.s. ( $n = 42$ )	14.48 (5.25)
		$F (3, 548) = 9.63$
		$p < .0001^a$
Parity	Primiparous ( $n = 335$ )	12.07 (6.12)
	Multiparous ( $n = 217$ )	13.82 (5.90)
		$F (1, 550) = 11.06$
		$p < .0001$
Birth trauma	Non-traumatic ( $n = 403$ )	14.87 (5.07)
	Traumatic ( $n = 149$ )	7.05 (4.83)
		$F (1, 550) = 265.13$
		$p < .0001$
Pregnancy plans <sup>b</sup>	Planned pregnancy ( $n = 267$ )	12.75 (6.23)
	Unplanned but wanted ( $n = 132$ )	12.80 (6.39)
	Unplanned and unwanted ( $n = 9$ )	9.67 (5.79)
		$F (2, 405) = 1.08$
		$p = .3410$

Note: <sup>a</sup> *post hoc*: vaginal = planned c.s. > instrumental vaginal = emergency c.s.; <sup>b</sup> pregnancy plans: the only analysis with the subsample of 408 women due to missing data on this variable.