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# Assessing the Validity of the Scale for Breastfeeding Ability in Mothers After Cesarean Section: A Cross-Sectional Study at the University Medical Center of Ho Chi Minh City

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## ABSTRACT

*Objectives:* To determine the rate of non-exclusive breastfeeding one month postpartum after cesarean section in the University Medical Center at Ho Chi Minh City, and to evaluate the tool for measuring the likelihood of non-exclusive breastfeeding. *Methods:* A cross-sectional study was conducted on mothers one month postpartum after cesarean section in the University Medical Center at Ho Chi Minh City from 11/2024 to 1/2025. *Results:* A month after a cesarean section, 59.6% of mothers were not exclusively breastfeeding (95%CI: 54.7 - 64.4). The evaluation method demonstrated strong reliability with a Cronbach's alpha score of 0.74. Structural values meet requirements with the 3-factor model: CFI = 0.957, TLI = 0.935, SRMR = 0.038, RMSEA = 0.052 (90%CI: 0.031 - 0.073). AUC = 0.9423 (95%CI: 0.9150 - 0.9695) shows good standard values. At the cutoff point of 30, sensitivity is 95.65%, and specificity is 85.26%. *Conclusion:* The rate of non-exclusive breastfeeding among mothers who have had a cesarean section after 1 month remains high. The constructed scale shows good reliability and validity. It could be used for early screening of women who have had a cesarean section and are likely to be non-exclusively breastfeeding.

**Keywords:** breastfeeding, cesarean section, postpartum, Cronbach's alpha score

## 1. INTRODUCTION

C-section rates worldwide are on the rise, jumping from 7% in 1990 to around 21% now. This is way above the World Health Organization's recommendation of 10–15% (WHO, 2023). In Vietnam, the increase is even more dramatic, with rates in cities more than double those recommendations. A study by Giang et al., (2022) found that private hospitals have a higher C-section rate than public ones, at 57.8% versus 49.1%. Joshi et al., (2014) demonstrated that C-sections significantly reduce the likelihood of exclusive breastfeeding (EBF) (aOR = 0.45; 95% CI: 0.19–1.03). This is supported by Onah et al., (2014), who also reported a decreased likelihood of EBF following surgical delivery (OR =0.38; 95% CI: 0.18–0.84).

The one-month postpartum period represents a critical window for both maternal and infant health. During this stage, it's super important to have routine

postnatal check-ups. They keep an eye on your recovery and check how the baby is growing, plus they ensure vaccinations are administered on schedule. Therefore, determining the prevalence of exclusive breastfeeding (EBF) among mothers one month after a cesarean section (C-section) is of significant clinical value.

Consequently, we conducted this study to address the following questions: (1) What is the rate of non-exclusive breastfeeding among post-C-section mothers at the University Medical Center of Ho Chi Minh City one month after delivery? and (2) Can our newly developed scale effectively screen for women at high risk of EBF failure following a C-section?

## 2. SUBJECTS AND METHODS OF STUDY

**Research Design**

Cross-sectional study.

**Sampling criteria**

The study enrolled mothers who satisfied all inclusion criteria and presented no exclusionary factors. Specifically, study participants were mothers aged 18 years or older, carrying a singleton, who had a cesarean section at the University Medical Center of Ho Chi Minh City - Campus 1, at least one month (± 7 days) post-cesarean section, and who agreed to participate in the study. Mothers with active tuberculosis, HIV infection, or those unable to answer interview questions were excluded from the study.

**Sample Size**

The sample size needed was calculated using a formula for a single proportion:

$$n \geqslant \frac{Z^2_{1-\alpha/2}(1-p)p}{d^2}$$

Research on breastfeeding after a cesarean section shows a lot of variation. Zhang et al., (2019) found that the rate was 59.7%, while Paksoy Erbaydar and Erbaydar (2020) indicated it was 41%, and Juan et al., (2022) reported only 37.1%. Given these differences worldwide and the lack of initial data for Vietnam, we went with a safe estimate of p = 0.5 for our calculations, which means we need at least 384 participants for our study.

**Sampling procedure**

The study used a convenient sampling method. Participants were recruited on three randomly chosen weekdays, from Monday to Friday, between 8:00 AM and 4:00 PM, from November 2024 to January 2025. During these periods, we screened all mothers attending postnatal follow-up visits with their newborns at the Neonatal Clinic (3rd Floor) of the University Medical Center Ho Chi Minh City – Campus 1. A midwife from the research team, who is also a hospital healthcare worker, received the mothers. The midwife read the information on the cover page of the Maternal and Child Health Monitoring Booklet to screen mothers aged 18 and over with singleton pregnancies and then referred suitable cases to the researchers. The researchers then checked information on the method of delivery, time of delivery, and medical history on page 5 of the Maternal and Child Health Monitoring Booklet. Mothers who have undergone cesarean section and whose current child is 1 month ± 7 days old will have their information in their birth records verified by researchers, including the date and location of the cesarean section at the University Medical Center of Ho Chi Minh City. Cases that meet all criteria are invited to participate in the study.

**Research Tools**

The tools we used to conduct the research were the research dossier, which included:

- The interview questions were prepared in advance by the researchers.
- Scale for assessing the likelihood of not exclusively breastfeeding (Appendix 1).

The Likelihood of Non-Exclusive Breastfeeding Scale was developed through thorough literature research and expert input from obstetrics and pediatrics professionals. It contains 9 items rated on a 5-point Likert scale. These items assess three main areas influencing breastfeeding behaviors: healthcare advice, family impact, and the role of social media and peer influence.

**Variable definition:**

"Breastfeeding one month after a C-section":

We looked at exclusive breastfeeding based on the definition from the WHO. We asked, "What did you give your baby to eat in the first hour after a C-section?" If, within the past month, the child has been fed any other liquid or solid substance, even water—except for oral rehydration solutions, eye drops, vitamin or mineral syrups, or medications, this will be considered non-exclusive breastfeeding.

**Research Process**

Selected participants were provided with study information and consent forms. After reading the study information, those who did not consent proceeded with the standard examination process for their child at the clinic. Those who consented signed the consent form, were then directed to a private room, and asked to complete a self-administered questionnaire, which included a scale assessing the likelihood of not exclusively breastfeeding.

To help with the process, a research assistant was on hand to answer any questions from participants during the session. We emphasized the importance of anonymity and confidentiality by having completed questionnaires sealed in envelopes and placed into a secure collection box. These researchers remained blinded to the questionnaire responses to prevent ascertainment bias. Mothers identified as non-exclusively breastfeeding received post-assessment counseling regarding the benefits of optimal breastfeeding practices for both mother and infant.

To maintain data integrity and participant anonymity, survey responses and clinical interview results were linked using unique study identification codes pre-printed on all forms. This procedure ensured that no personally identifiable information was stored or accessible during the analysis phase.

**Data management and analysis**

We'll use descriptive analysis to summarize the data, looking at frequencies and percentages for categories and figuring out means and standard deviations for continuous data. To evaluate the reliability of the non-exclusive breastfeeding scale, we'll use Cronbach's alpha along with corrected item-total correlation coefficients (Cronbach, 1951).

Construct validity will be evaluated through Confirmatory Factor Analysis (CFA), testing a hypothesized three-factor model based on the theoretical framework. Model fit will be primarily assessed using the Chi-square test; however, as this statistic is highly sensitive to sample size (Lance et al., 2006), a suite of goodness-of-fit indices will also be employed. These include the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Standardized Root Mean Square Residual (SRMR), and the Root Mean Square Error of Approximation (RMSEA). CFI and TLI values > 0.90 are considered indicative of a good fit (Hu & Bentler, 1999; Brown, 2015). Conversely, SRMR and RMSEA reflect the degree of model misspecification; therefore, values < 0.08 suggest an acceptable fit between the hypothesized model and the observed data (Hooper et al., 2008). The RMSEA will be reported alongside its 90% confidence interval to assess the precision of the fit estimate.

For criterion validity, the researcher's interview results and the WHO definition of exclusive breastfeeding are considered the gold standard. Therefore, ROC curve analysis was used to assess sensitivity, specificity, and area under the curve (AUC). For a screening tool, sensitivity is expected to be ≥80% to minimize false negatives, while an AUC ≥ 0.80 indicates the ability to correctly classify between those who are and are not exclusively breastfeeding. To determine the optimal cutoff for the scale, we used the Index of Union (IU): IU = |Sens - AUC| + [Spec - AUC|; the optimal cutoff is the threshold with the smallest IU value (Unal, 2017). All assessments were done using Stata 17.0 software.

## 3. RESULTS

From November 2024 to January 2025, we evaluated 557 mothers during their follow-up appointments in the University Medical Center at Ho Chi Minh City, Vietnam. We used a convenient sampling method to gather a solid number of participants within the clinical environment. Of these, 390 mothers met the study's eligibility criteria and were enrolled. Following data collection, four participants withdrew for personal reasons, resulting in a final analytical sample of 386 mothers. The socio-demographic characteristics of the study population are summarized in Table 1.

**Table 1.** Social characteristics of the participants

| Characteristic | Number of cases (n = 386) | Percentage (%) |
|---|---|---|
| **Age*:** 29.8 ± 4.4 years old | | |
| < 25 | 35 | 9.1 |
| 25-35 | 310 | 80.3 |
| > 35 | 41 | 10.6 |
| **Address** | | |
| Inner city | 269 | 69.7 |
| Suburbs | 33 | 8.6 |
| Other provinces | 84 | 21.8 |
| **Job** | | |
| Manual labor | 18 | 4.7 |
| Intellectual labor | 355 | 92.0 |
| Housewife | 13 | 3.4 |
| **Educational level** | | |
| Secondary school | 1 | 0.3 |
| High school | 168 | 43.5 |
| Above high school | 217 | 56.2 |
| **Average income** | | |
| Low (< 10 million VND) | 2 | 0.5 |
| Average (10-30 million VND) | 274 | 71.0 |
| High (> 30 million) | 110 | 28.5 |
| **Body mass index (BMI) before pregnancy** | | |
| Lightweight | 18 | 4.7 |
| Normal | 216 | 56.0 |
| Overweight | 152 | 39.4 |
| **Marital status** | | |
| Living with husband | 373 | 96.6 |
| Divorced/Single | 13 | 3.4 |
| **Number of children born** [a] | | |
| 1 | 181 | 46.9 |
| 2 | 185 | 47.9 |
| ≥ 3 | 20 | 5.2 |
| **Premature birth** | | |
| None | 373 | 96.6 |
| ≥ 1 time | 13 | 3.4 |
| **Abortion, miscarriage** | | |
| None | 306 | 79.3 |
| Yes | 80 | 20.7 |
| **Previous C-Section** [b] **(n = 205)** | | |
| None | 41 | 20.0 |
| Yes | 164 | 80.0 |

**: Mean ± SD; [a]: This birth is included; [b]: Only recorded in previous pregnancies*

**Rate of non-exclusive breastfeeding one month after cesarean section.**

Of the 386 mothers who underwent cesarean section and participated in the study, 230 did not exclusively breastfeed their babies in the first month after birth, accounting for 59.6% (95% CI: 54.7 - 64.4) (Table 2).

**Table 2.** Percentage of non-exclusive breastfeeding 1 month after cesarean section.

| Breastfeeding | Number (n = 386) | Ratio (%) | 95% CI |
|---|---|---|---|
| No | 230 | 59.6 | 54.7 - 64.4 |
| Yes | 156 | 40.4 | 35.5 - 45.3 |

**Internal reliability of the non-exclusive breastfeeding assessment scale**

The internal consistency of the non-exclusive breastfeeding scale was deemed acceptable, with a total Cronbach's alpha of 0.74. All nine observed items exhibited corrected item-total correlation coefficients > 0.30. Furthermore, the 'alpha if item deleted' analysis indicated that removing any individual item would not significantly improve the overall reliability. Consequently, all nine items were retained for subsequent analysis (Table 3).

**Table 3.** Question distribution, internal reliability

| Item (Item) | Score* [n (%)] | | | | | Item-total correlation | Cronbach's alpha |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | |
| **Healthcare workers** | | | | | | | |
| Item 1 | 59 (15.3) | 82 (21.2) | 81 (21.0) | 103 (26.7) | 61 (15.8) | 0.63 | 0.71 |
| Item 2 | 78 (20.2) | 89 (23.1) | 59 (15.3) | 97 (25.1) | 63 (16.3) | 0.74 | 0.68 |
| Item 3 | 23 (6.0) | 67 (17.4) | 78 (20.2) | 121 (31.4) | 97 (25.1) | 0.66 | 0.70 |
| **Family members** | | | | | | | |
| Item 4 | 136 (35.2) | 83 (21.5) | 77 (20.0) | 49 (12.7) | 41 (10.6) | 0.64 | 0.71 |
| Item 5 | 10 (2.6) | 107 (27.7) | 137 (35.5) | 90 (23.3) | 42 (10.9) | 0.52 | 0.73 |
| Item 6 | 0 (0.0) | 35 (9.1) | 145 (37.6) | 162 (42.0) | 44 (11.4) | 0.50 | 0.73 |
| **Friends and media** | | | | | | | |
| Item 7 | 2 (0.5) | 3 (0.8) | 112 (29.0) | 123 (31.9) | 146 (37.8) | 0.47 | 0.73 |
| Item 8 | 0 (0.0) | 50 (13.0) | 117 (30.3) | 109 (28.2) | 110 (28.5) | 0.53 | 0.73 |
| Item 9 | 0 (0.0) | 19 (4.9) | 125 (32,4) | 178 (46.1) | 64 (16.6) | 0.39 | 0.74 |

**Cronbach's alpha for the entire questionnaire:** 0.74

*: 1 = A lot; 2 = A lot; 3 = Moderate; 4 = Very little; 5 = Not at all.

**Construct Validity**

We performed confirmatory factor analysis (CFA) with three factors: Healthcare workers, Family members, and Friends and media. The CFA analysis revealed significant differences between the observed and expected models using the Chi-squared statistic ($\chi^2 = 49.35$, df = 24, $p = 0.002$). However, as mentioned above, the Chi-squared value is likely affected by the large sample size. The CFI (0.957), TLI (0.935), RMSEA (0.052; 90% CI = 0.031-0.073), and SRMR (0.038) indices all indicate that the indicated model has good fit.

The factor loadings of the observed variables ranged from 0.37 to 0.81, indicating that the observed variables all contributed moderately to the latent factors. Specifically, items under the Healthcare workers factor had loadings from 0.63 to 0.81; the Family members factor from 0.52 to 0.61; and the Friends and media factor from 0.37 to 0.56.

The three factors are moderately to strongly correlated with each other, with correlation coefficients ranging from 0.55 to 0.76. Factor loadings range from 0.37 to 0.81.

Overall, these results indicate that the observed variables provide an acceptable to good level of explanation for the latent factors in the CFA model (Figure 1). In general, these data suggest that the scale has adequate construct validity.

**Criterion Validation**

The scale scores were summed up and compared with exclusive breastfeeding practices after 1 month (with the gold standard of YES/NO exclusive breastfeeding mentioned). ROC curve analysis showed the area under the curve (AUC) of the scale was 0.9423 (95% CI: 0.9150 - 0.9695), indicating very good differentiation between subjects who did and were likely to practice exclusive breastfeeding after 1 month (Figure 2).

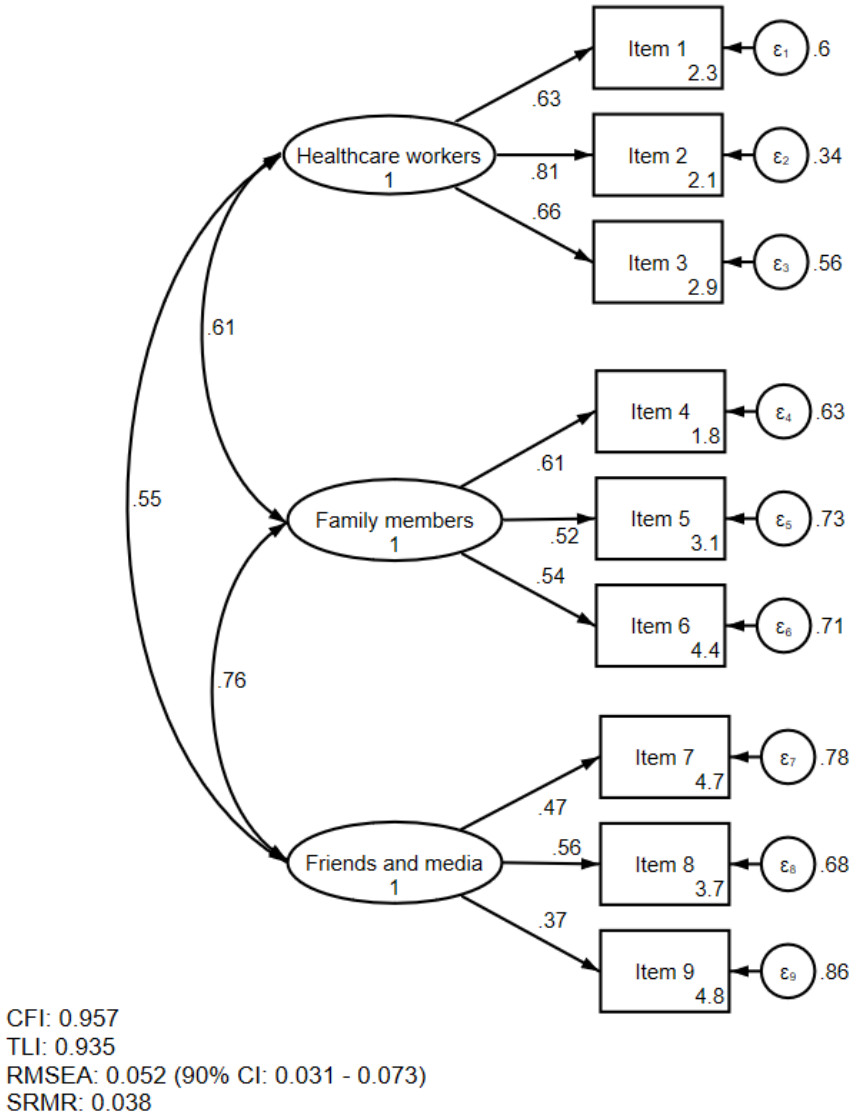


**Figure 1.** Results of CFA analysis of the scale.

The optimal cutoff threshold of the scale is determined by the UI index through a few cutoff points (Table 3). When considering different cutoff thresholds, the IU (Index of Union) was used to determine the optimal cutoff point. The findings indicated that a cutoff point of 30 or higher had the lowest IU value at 0.0939, along with a sensitivity of 95.65% and a specificity of 85.26%. This means it's the best cutoff point for the scale used in this study, as shown in Table 4.

**Table 4.** Sensitivity and effectiveness of the scale at different cutoff thresholds.

| Intersection point | Sensitivity (%) | Specificity (%) | UI Index |
|---|---|---|---|
| ≥ 28 | 97.83 | 76.92 | 0.2091 |
| ≥ 29 | 97.83 | 80.77 | 0.1706 |
| ≥ 30 | 95.65 | 85.26 | **0.0939** |
| ≥ 31 | 88.70 | 87.18 | 0.1258 |
| ≥ 32 | 79.13 | 91.67 | 0.1766 |

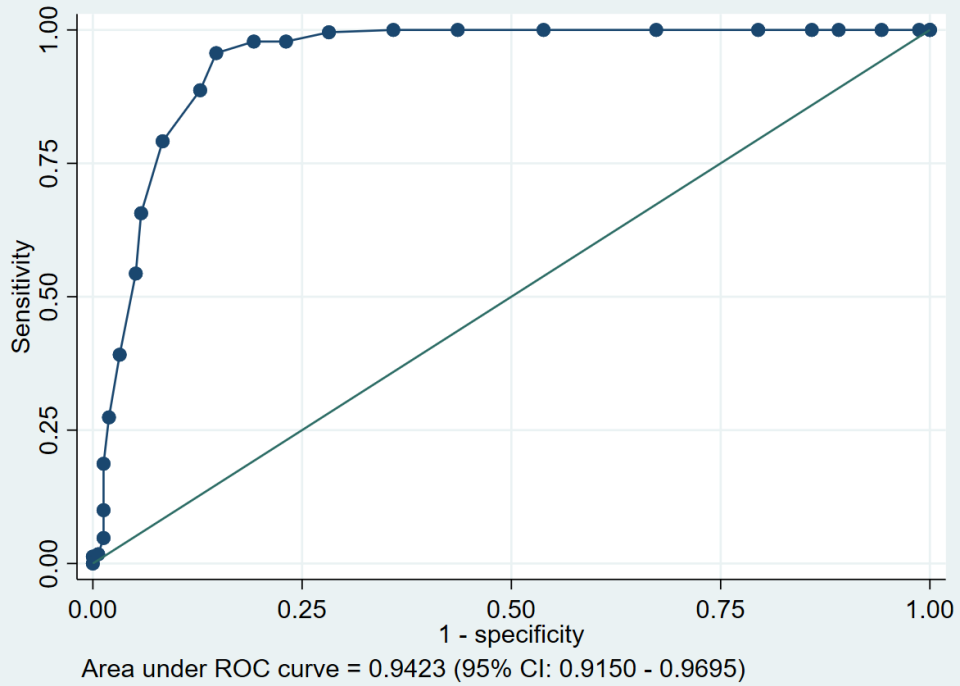


**Figure 2.** Performance characteristics of the scale

## 4. DISCUSSION

In a study involving 386 mothers assessed one-month post-cesarean delivery, findings revealed that 59.6% of them were not exclusively breastfeeding their infants. This finding contrasts with earlier research conducted in Vietnam by Giang and Duy in 2022, which did not show similar results. The discrepancy may stem from the specific focus of our study on mothers who underwent cesarean sections, along with potential shifts in the surrounding socio-economic conditions affecting breastfeeding practices. However, investigations conducted internationally by Zhang et al., in 2019 and Juan et al., in 2022 demonstrate that this challenge with breastfeeding is not unique to our study but is a widespread issue faced by many regions across the globe.

This continuing trend indicates a clear necessity for targeted support services instead of broad, general advice. It underlines the significance of developing tailored systems that specifically tackle the problems associated with breastfeeding after surgical births. Consequently, our research sheds light on the vital need to promptly identify mothers who may be struggling with breastfeeding. By utilizing the validated assessment tool from our initial studies, healthcare practitioners can accurately recognize those at risk and offer suitable guidance that is critical for enhancing.

## 5. CONCLUSION

A month after having a cesarean section, the rate of mothers who are not exclusively breastfeeding is still high at 59.6% (95% CI: 54.7 - 64.4), which is a worrying issue for postpartum support. The scale created in this study showed solid internal reliability (Cronbach's alpha: 0.74), good structural metrics [CFI: 0.957, TLI: 0.935, RMSEA: 0.052; 90% CI = 0.031-0.073], and positive conditional values (AUC: 0.9423). It is suggested that this tool could be used as an early screening method to identify women who have undergone cesarean section and are at risk of not being able to breastfeed exclusively, thereby helping healthcare professionals provide timely counseling and support, contributing to improving the rate of exclusive breastfeeding in the postpartum period.

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**Authors' Contributions**

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

**Informed consent**

Written informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

**Ethical approval**

The study was approved by the Ethics Committee in Biomedical Research of the University of Medicine and Pharmacy at Ho Chi Minh City (No. 2485/HĐĐĐ-ĐHYD, dated September 23, 2024) and data collection was approved at the University of Medicine and Pharmacy Hospital of Ho Chi Minh City (No. 413/GGT-ĐHYD-SDH, dated October 10, 2024).

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**Conflict of interest**

The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

**Data and materials availability**

All data associated with this study are present in the paper.

**Appendix 1**

**SCALE FOR ASSESSING THE ABILITY TO NOT EXCLUSIVELY BREASTFEED A CHILD**

Please rate the level of influence of the information and advice you received about EXCLUSIVE BREASTFEEDING before giving birth. Please circle your answer (for **9** items) on the scale below:

**PLEASE MAKE SURE YOU TO ANSWER ALL QUESTIONS**

| Question | Answer | | | | |
|---|---|---|---|---|---|
| 1. How does your obstetrician influence your decision to exclusively breastfeed your baby? | 1 | 2 | 3 | 4 | 5 |
| 2. How does your pediatrician influence your decision to exclusively breastfeed your baby? | 1 | 2 | 3 | 4 | 5 |
| 3. How did the care provided by your midwife influence your decision to exclusively breastfeed your baby? | 1 | 2 | 3 | 4 | 5 |
| 4. How did your husband/boyfriend influence your decision to exclusively breastfeed your child? | 1 | 2 | 3 | 4 | 5 |
| 5. How did your mother influence your decision to exclusively breastfeed your child? | 1 | 2 | 3 | 4 | 5 |
| 6. How did other family members influence your decision to exclusively breastfeed your child? | 1 | 2 | 3 | 4 | 5 |
| 7. How did your friends/colleagues influence your decision to exclusively breastfeed your child? | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| 8. How did the books and articles you read influence your decision to exclusively breastfeed your child? | 1 | 2 | 3 | 4 | 5 |
| 9. How do social media platforms influence your decision to exclusively breastfeed your child? | 1 | 2 | 3 | 4 | 5 |

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