

Challenging the utility of 24-hour recall of exclusive breast feeding in Japan

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ABSTRACT

Introduction WHO recommends exclusive breast feeding from birth to 6 months. However, to monitor populations, it recommends using the proportion of infants under 6 months who were exclusively breastfed during the previous 24 hours. To assess the usefulness of 24-hour recall, we (1) compared the prevalence of exclusive breast feeding measured by since-birth recall to the prevalence measured by 24-hour recall and (2) quantified each indicator's association with WHO-recommended, well-established methods for in-hospital breastfeeding support.

Methods We conducted two online surveys of mothers in Japan (total n=4247) who had a healthy singleton delivery in the previous 25 months. They reported on their breast feeding (a) from birth to 5 months; or (b) during the previous 24 hours, for those with infants under 5 months; or (c) both, for those who participated in the initial survey and also in the follow-up survey. All mothers also reported on their in-hospital support. The strength of each indicator's association with provision of in-hospital support was quantified as the area under the curve (AUC).

Results The prevalences of exclusive breast feeding by since-birth recall were 4.4% (first survey) and 2.5% (second survey). By 24-hour recall, the prevalence appeared to be 29.8%. More in-hospital support was moderately well associated with more exclusive breast feeding measured by since-birth recall: AUC 0.72 (95%CI 0.66 to 0.78). That association is consistent with the known benefits of in-hospital support. In contrast, when exclusive breast feeding was measured by 24-hour recall, its association with in-hospital support appeared to be extremely weak: AUC 0.59 (95% CI 0.54 to 0.65).

Conclusion Using 24-hour recall substantially overestimates the prevalence of exclusive breast feeding since birth, and it conceals the benefits of in-hospital breastfeeding support. To monitor population achievement of exclusive breast feeding for the first 6 months, or to evaluate breastfeeding interventions, 24-hour recall of exclusive breast feeding should not be used alone.

BACKGROUND

Recognising that breast feeding benefits both mothers and their children, WHO and many other organisations recommend exclusive breast feeding for the first 6 months of life.^{1,2} Measuring compliance with that recommendation is difficult. Specifically, the percentage

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ There is a discrepancy between WHO and UNICEF's infant-feeding recommendation (exclusive breast feeding from birth to 6 months of age) and their recommended infant-feeding indicator (prevalence, among infants under 6 months, of exclusive breast feeding measured by 24-hour recall).

WHAT THIS STUDY ADDS

⇒ Exclusive breast feeding measured by 24-hour recall overestimates the prevalence of exclusive breast feeding. It may also conceal the benefit of in-hospital breastfeeding support.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ To monitor population achievement of exclusive breast feeding for the first 6 months, or to evaluate the impact of breastfeeding interventions, 24-hour recall of exclusive breast feeding should not be used alone. Further research is necessary to assess whether measuring the full set of the indicators recommended by WHO and UNICEF can compensate for the potential risks of using 24-hour recall of exclusive breast feeding.

of infants who are exclusively breastfed from birth to 6 months can be measured by monitoring breastfeeding status in a cohort from birth to 6 months. However, the time and resources required can make that method impractical for short-term monitoring of breastfeeding status in the community. Another method relies on asking an adult to recall an infant's feeding status from birth to 6 months, but that might be affected by faulty memory and social-desirability bias.

WHO and UNICEF proposed indicators to assess and monitor population-level infant-feeding practices.³ One of those indicators is the proportion of infants 0–5 months of age who were fed exclusively with breast milk during the 24 hours before the survey. Specifically, the numerator is the number of infants 0–5 months of age who were fed only breast milk during the previous 24 hours, and the denominator is the number

of infants 0–5 months of age.³ This method has some important practical advantages. Because this measurement is cross-sectional with 24-hour recall, it is convenient and it costs less than prospectively following a cohort. The risk of imprecise or biased recall may also be lower than in a retrospective survey of infant-feeding history since birth.⁴ That 24-hour recall indicator is widely used in global reports, such as *The State of the World's Children* by UNICEF, to compare and monitor national and global breastfeeding status. Its wide and consistent use means that any newly measured values of 24-hour recall can easily be compared with previously collected data.

Despite the practical advantages of 24-hour recall, its use has been criticised.⁵ One reason is terminology confusion. For example, the official webpage of WHO states that ‘contrary to WHO recommendations, fewer than half of infants under 6 months old are exclusively breastfed’.⁶ For those who know the definition of the monitoring indicator recommended by WHO, the quotation above means that fewer than half of infants aged 0–5 months were exclusively breastfed during the 24 hours before the survey. However, for those who do not know the definition of WHO’s recommended indicator, a more natural interpretation would be that more than half of infants are given other liquids or foods at least once before 6 months of age.

Another criticism of the use of 24-hour recall is that it overestimates breastfeeding status, when compared with prospective or recall-since-birth methods.^{5 7–14} A prospective longitudinal study in Sweden found a wide discrepancy between the results obtained by 24-hour recall of breast feeding at 6 months (11%) and those obtained by daily maternal reports from birth to 6 months (1.8%).⁹ Other prospective cohort and cross-sectional studies consistently showed that 24-hour recall overestimates the prevalence of exclusive breast feeding, when compared with since-birth follow-up or since-birth recall.^{7 8 10 11 13 14}

In 2021, WHO and UNICEF revised the recommended indicators of infant and young-child feeding. That revision included the 24-hour-recall method for measuring breastfeeding rates, but it did not include the since-birth-recall method.³ Indicators are important for making assessments, monitoring progress towards goals, evaluating interventions and identifying populations at risk and in need of more intervention.³ To the best of our knowledge, the utility of 24-hour recall as an indicator for evaluating breastfeeding interventions has not been studied. Therefore, we tested whether 24-hour recall reflects the effectiveness of interventions that are known to be beneficial: eight in-hospital breastfeeding support practices that are recommended by WHO and UNICEF as part of the Ten Steps to Successful Breastfeeding.¹⁵ If 24-hour recall is a good indicator of the achievement of WHO’s exclusive breastfeeding goal, and if it is useful for evaluating breastfeeding interventions, then the results from since-birth recall and from 24-hour recall should be similar.

Using online survey data on breastfeeding status measured both by 24-hour recall and also by history-since-birth recall, in this study, we had two objectives:

1. To compare the prevalence of exclusive breast feeding as measured by exclusive breast feeding since birth (since-birth recall) with the prevalence as measured by exclusive breastfeeding for the 24 hours before the survey.
2. To quantify each indicator’s association with in-hospital breastfeeding support practices that are known to promote breast feeding.

METHODS

Study design and participants

This was a cross-sectional study among mothers living in Japan. The data were collected online as a part of the Japan COVID-19 and Society Internet Survey (JACSIS), which aimed to evaluate the impact of the COVID-19 pandemic on society and health in Japan.¹⁶ For this study, data from two surveys were merged. The first survey was conducted in July and August 2021 and the second survey was conducted in February 2022 as a follow-up to the first survey. The JACSIS gathers data from pooled panels of an internet research agency (Rakuten Insight), which had approximately 2.3 million panellists. Details for the JACSIS have been published elsewhere.^{16 17}

Participant flow is indicated in [figure 1](#). In July 2021, we distributed a screening survey to 440 323 panellists and identified 14 086 women who were pregnant or had had a live singleton delivery within the past 25 months. All of them were invited to participate in the first survey, and the recruitment was finished when the number of respondents reached 8047, which was slightly more than the goal of 8000 participants. Among the 8047 responses, 720 invalid responses, and 1639 responses from pregnant women were omitted. From the 5688 valid and eligible responses, 801 (14.1%) were excluded because the respondent reported having a medical condition that could interfere with breast feeding (ie, delivery before 34 weeks of gestation, being told by a physician not to breastfeed, admission to an Neonatal Intensive Care Unit (NICU) and maternal isolation from the infant for more than a whole day). Further, 640 responses (11.3%) were excluded from analysis because of missing, logically inconsistent or obviously inaccurate responses to the questions related to infant feeding status and infant age. Consequently, data from 4247 mothers who responded to the first survey were included in the analysis. Among them, 3416 mothers with an infant older than 5 months reported on their breast feeding from birth to 5 months, and 831 mothers with an infant younger than 5 months reported on their breast feeding over the previous 24 hours. The invitations to the second survey were sent to all mothers from the first survey who had an infant under 5 months old at the time of that survey, to collect information on their infant-feeding history from birth to 5 months. Among those 831 mothers, 395 (47.5%)

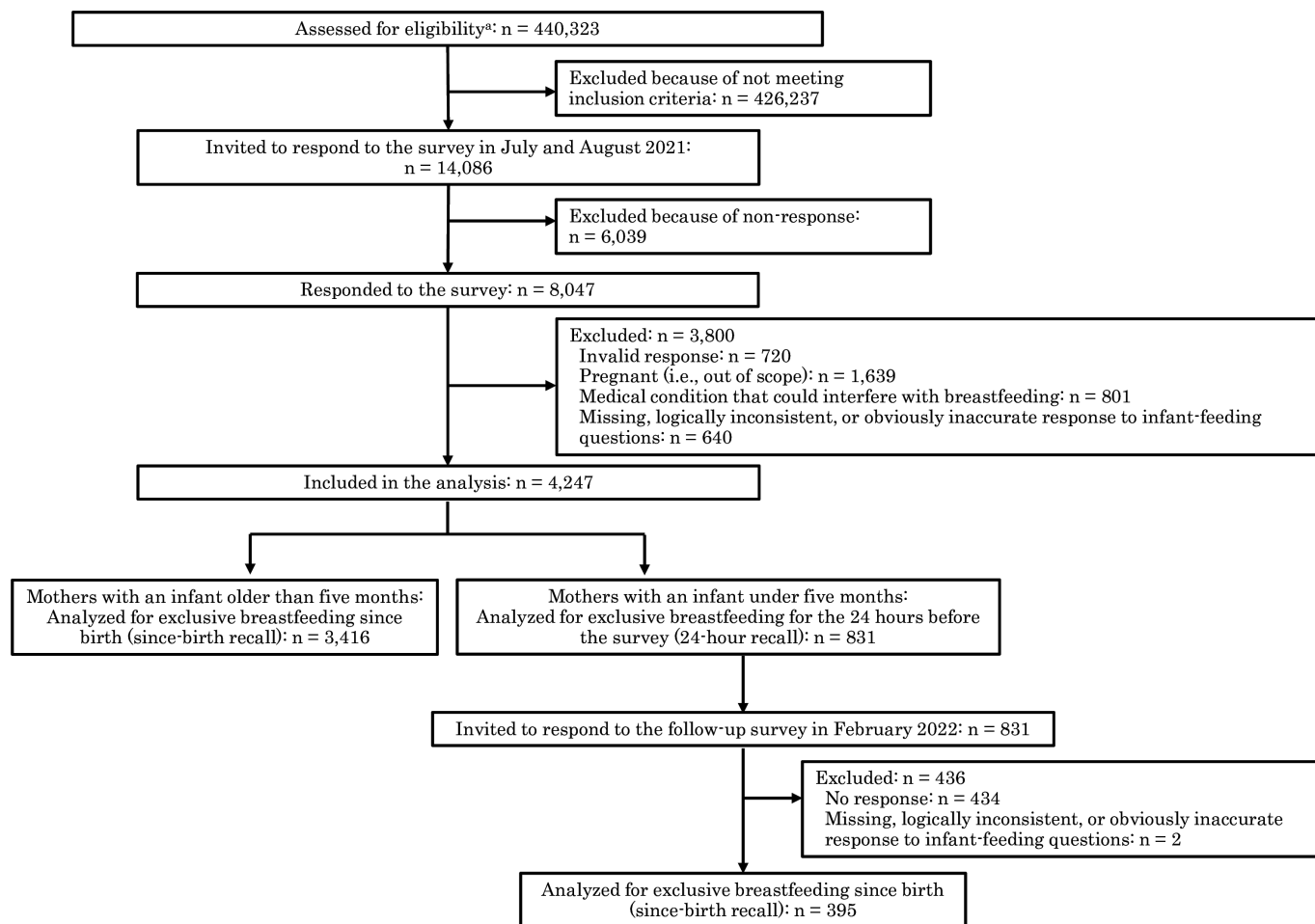


Figure 1 Flow diagram of the participants. ^aPregnant or had a live singleton delivery within the past 25 months.

returned valid responses to infant-feeding questions in the second survey and reported on their breast feeding from birth to 5 months.

Exclusive breast feeding under 5 months (24-hour recall)

Exclusive breast feeding under 5 months (24-hour recall) was measured in a manner consistent with the Infant and Young Child Feeding indicators recommended by WHO and UNICEF.³ WHO and UNICEF recommend measuring exclusive breast feeding under 6 months, but in this study, we measured exclusive breast feeding under 5 months, because Japan's Ministry of Health, Labour and Welfare recommends that complementary feeding start between 5 and 6 months of life.¹⁸ In this study, we asked if the infant consumed the following items during the previous day and night, even if that included time in a nursery: breastmilk, infant formula, follow-up formula, liquids other than breast milk, formula, or follow-up formula (excluding medication and K2 syrup), and any foods, including soft, paste-like food such as rice porridge. Infants who consumed breast milk and no other foods or liquids (except medication or K2 syrup) were considered to have been exclusively breastfed for the 24 hours immediately before the survey. To calculate the prevalence of exclusive breast feeding under 5 months, the numerator was defined as the number of infants 0–4 completed

months of age who were fed only breast milk during the previous 24 hours, and the denominator was defined as the number of infants 0–4 completed months of age.

Exclusive breast feeding from birth to 5 months of age (since-birth recall)

To measure exclusive breast feeding since birth, we asked about the timing of breastfeeding initiation, the timing of formula milk initiation, the timing of the complete withdrawal of breast feeding, the timing of the complete withdrawal of formula feeding, and the timing of the start of complementary feeding. The response choices to each of those questions were as follows: never, within 24 hours of birth, between 1 day and 7 days after birth, between 1 week and 1 month after birth, between 2 months and 3 months after birth, each month after birth up to 12 months, after 1 year old and continuing. The last choice did not apply to the questions that asked about the timing of initiation. Because giving infant formula is a routine practice in many obstetric wards in Japan and mothers and infants commonly stay in the hospital for about 5 days after delivery, the times of the initiation and withdrawal of breastmilk and formula milk were measured more precisely if those events occurred within the first few days after birth than if they occurred 1 week after birth or later. When the answers to each of the questions about

the timing of initiation and withdrawal of breastfeeding and formula feeding met all of the following criteria, the case was considered as exclusive breast feeding for the first 5 months: initiated breast feeding within 7 days of birth, no termination of breast feeding before 5 months of age, and no initiation of formula milk or complementary foods before 5 months. Initiation of breast feeding more than 7 days after birth was not considered as exclusive breast feeding even if infant formula was not initiated, because it was highly likely that something other than breast milk and infant formula had been given to the infant.

Similar to exclusive breast feeding under 5 months, instead of exclusive breast feeding from birth to 6 months of age (which is recommended by WHO and other health organisations^{1 2}), exclusive breast feeding from birth to 5 months was calculated for those whose infants were above 5 months of age in this study. Specifically, the numerator was the number of infants over 5 months of age who were fed only breastmilk since birth, and the denominator was the number of infants over 5 months of age.

Mothers whose infants were under 5 months old at the time of first survey were of course unable to report on infant-feeding status during the first 5 months in that survey. Instead, they reported it in the second survey, which was conducted 6 months after the first survey.

In-hospital breastfeeding support practices

The in-hospital breastfeeding support practices in this study were eight of the Ten Steps to Successful Breastfeeding (Ten Steps). The Ten Steps are a series of professional breastfeeding support practices recommended by WHO and UNICEF based on evidence showing that they can improve breastfeeding outcomes.^{15 19} There is no established method to assess the implementation of each step by maternal self-report. Consistent with previous studies assessing the effectiveness of the Ten Steps,²⁰ the number of in-hospital practices that were consistent with the Ten Steps was measured in this study. Steps 2 and 6 were not considered in this study. Step 2 is about hospitals' policies and practices regarding their staff, which we did not expect to discern from mothers' responses. Step 6 is 'do not provide breastfed newborns any food or fluids other than breast milk unless medically indicated', and not implementing this step directly results in non-exclusive breast feeding since birth. With steps 2 and 6 excluded, the possible range of the number of in-hospital breastfeeding support practices (ie, the number of steps) that were implemented was from 0 to 8. Online supplemental table 1 shows the questions that were given to mothers. It also shows how their responses were converted into numbers reflecting the number of steps that were implemented.

Intention to breastfeed, obstetric factors and social background

Breast feeding is associated with maternal intention to breastfeed,^{21 22} obstetric factors^{23 24} and social background,^{23 24} in addition to professional support such as the Ten Steps.¹⁵ Mothers were asked which of the following best described their original plan to feed their baby for the first five-to-6 months: breast feeding, mixed feeding of breast milk and formula milk, formula feeding, and no plan. Those who chose breast feeding were considered to have intended exclusive breast feeding. We also collected data on parity, mode of delivery (ie, vaginal delivery or caesarean section), gestational week of delivery, mother's age, mother's formal education, household income and working status (ie, returned to work or planning to return to work within 5 months after delivery or not).

Analysis

Prevalence of exclusive breast feeding was computed from the two different indicators being studied: exclusive breast feeding under 5 months (24-hour recall), and exclusive breast feeding from birth to 5 months (since-birth recall). Exclusive breast feeding under 5 months (24-hour recall) was measured among infants who were under 5 months old at the time of the first survey. Exclusive breast feeding from birth to 5 months (since-birth recall) was measured among those who were over 5 months old at the time of the first survey. In addition, it was measured among those who were under 5 months old at the time of the first survey and were later represented in the second survey when they were over 5 months old.

The association between the number of steps and each of the two exclusive breastfeeding indicators was analysed using simple and multiple logistic regression analyses. The following procedure was repeated for each indicator. First, the association between the number of steps and the exclusive breastfeeding indicator was analysed (model 1). Next, the intention to exclusively breastfeed was added as an independent variable to model 1, resulting in model 2. Third, obstetric factors, including parity, mode of delivery and late preterm birth, were added as independent variables to model 2, resulting in model 3. Finally, social background, including mother's formal education, household income and working status, was added as independent variables to model 3, resulting in model 4. Teenage mothers are known to terminate breast feeding early, but that variable was not included in these analyses as there were no teenage mothers in this study.

Finally, using the predicted probabilities produced from the logistic regression analyses, we computed the areas under the receiver operating characteristic (ROC) curves.²⁵ An ROC curve is constructed by plotting the true-positive ratio (sensitivity), against the false-positive ratio (1–specificity). The area under the curve (AUC) can range from 0.5 to 1.0, and higher AUCs indicate a better predictive ability, that is, predictions that are more likely to be correct. In this study, we considered that if

Table 1 Characteristics of participants* and prevalence of exclusive breast feeding†

Variables	First survey in July–August 2021		Second survey‡ in February 2022 (n=395)
	Whose infants was older than 5 months (n=3416)	Whose infants was younger than 5 months (n=831)	
Age (years, SD)	32.4, 4.3	31.5, 4.3	32.0, 4.2
Primiparous	1844 (54.0 %)	415 (49.9%)	228 (57.7%)
Delivery by caesarian section	573 (16.8 %)	141 (17.0 %)	87 (22.0%)
Late preterm delivery	103 (3.0 %)	21 (2.5 %)	11 (2.8%)
Intended exclusive breast feeding	1708 (50.0 %)	378 (45.5%)	186 (47.1%)
Formal education for 12 years or less	536 (15.7 %)	115 (13.9%)	44 (11.2%)
Low household income§	858 (29.9%)	201 (27.3%)	87 (25.2%)
Returned/had a plan to return to work within 5 months of delivery	240 (8.8%)	35 (5.4%)	17 (5.5%)
Prevalence of exclusive breast feeding	149/3416 (4.4%)	248/831 (29.8%)	10/395 (2.5%)

*All the characteristic variables presented were measured at the first survey, with the exception of maternal age.

†Prevalence of exclusive breast feeding under 5 months (24-hour recall) among infants younger than 5 months of age, and exclusive breast feeding from birth to 5 months (since-birth recall) among infants older than 5 months of age.

‡Those whose infants were younger than 5 months at the first survey were invited for the second survey.

§Household income (ie, cumulative income of the mother and her partner) was within the lowest 25 percentile among the participants of the first survey.

both exclusive breastfeeding indicators clearly reflect the known benefit of in-hospital breastfeeding support, then the two AUCs (one calculated from the ROC predicting exclusive breast feeding from birth to 5 months, and the other calculated from the ROC predicting exclusive breast feeding for 24 hours) should be similar and large. We did not employ a particular statistical test for the comparison (eg, Mann-Whitney U-test or the parametric test of comparing two population proportions) since such a test is typically used for comparing two AUCs based on the same indicator from different groups of participants or comparing two AUCs based on different indicators from the same group of participants.²⁵ In this study, two different exclusive breastfeeding indicators were obtained from different groups of women.

Patient and public involvement

Our study did not include current patients. In addition, the public was not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Characteristics of participants and prevalence of exclusive breast feeding

Table 1 shows the characteristics of the participants and the prevalences of exclusive breast feeding as measured by the two indicators. At the time of the first survey, the apparent prevalence of exclusive breast feeding was much higher if exclusive breast feeding under 5 months (24-hour recall) was used as the indicator (29.8%) than if exclusive breast feeding from birth to 5 months (since-birth recall) was used (4.4%). Among those who participated in the second survey (ie, those whose infants were

under 5 months old at the time of the first survey and who participated in the second survey), the prevalence of exclusive breast feeding from birth to 5 months (since-birth recall) was 2.5%.

Associations between provision of in-hospital breastfeeding support and the two breastfeeding indicators

Table 2 shows the associations between the number of steps and the two breastfeeding indicators. More in-hospital breastfeeding support was clearly associated with more exclusive breast feeding from birth to 5 months (since-birth recall). The OR for model 1 was 1.49 (95% CI 1.36 to 1.63), and the adjusted ORs for models 2, 3 and 4 were 1.45 (95% CI 1.32 to 1.59), 1.44 (95% CI 1.31 to 1.58) and 1.52 (95% CI 1.35 to 1.71), respectively, all of which indicate that providing more steps was followed by more exclusive breast feeding since birth. In contrast, all of those associations were much weaker when the outcome was exclusive breast feeding under 5 months (24-hour recall). The OR for model 1 was 1.15 (95% CI 1.06 to 1.25), and the adjusted ORs for models 2–4 were 1.10 (95% CI 1.01 to 1.20), 1.08 (95% CI 0.99 to 1.18) and 1.15 (95% CI 1.06 to 1.29), respectively, which indicate that the association between the number of the steps provided and exclusive breastfeeding was weak and inconsistent when exclusive breastfeeding was measured by 24-hour recall. In all four of the models, the ORs were unambiguously larger for the since-birth recall outcome than for the 24-hour recall outcome, with no overlapping of their 95% CIs. In other words, for each unit increase in the number of steps, the increase in the odds of exclusive breast feeding was greater with since-birth recall than with 24-hour recall.

Table 2 Association between the provision of in-hospital breastfeeding support and the two exclusive breastfeeding indicators

	Exclusive breast feeding from birth to 5 months of age (since-birth recall)*				Exclusive breast feeding under 5 months (24-hour recall)†					
	B	P value	OR or adjusted OR (95% CI)	R ²	AUC (95% CI)‡	B	P value	OR or adjusted OR (95% CI)	R ²	AUC (95% CI)§
Model 1										
In-hospital support¶	0.40	<0.001	1.49 (1.36 to 1.63)	0.07	0.72 (0.66 to 0.78)	0.14	<0.001	1.15 (1.06 to 1.25)	0.02	0.59 (0.54 to 0.65)
Model 2										
In-hospital support¶	0.37	<0.001	1.45 (1.32 to 1.59)	0.14	0.80 (0.76 to 0.84)	0.10	0.027	1.10 (1.01 to 1.20)	0.15	0.71 (0.66 to 0.76)
Intention**	1.68	<0.001	5.36 (3.41 to 8.42)			1.43	<0.001	4.19 (3.03 to 5.79)		
Model 3										
In-hospital support¶	0.36	<0.001	1.44 (1.31 to 1.58)	0.15	0.80 (0.76 to 0.84)	0.08	0.079	1.08 (0.99 to 1.18)	0.17	0.72 (0.67 to 0.77)
Intention**	1.65	<0.001	5.23 (3.32 to 8.23)			1.40	<0.001	4.03 (2.91 to 5.60)		
Primiparous	0.41	0.022	1.50 (1.06 to 2.13)			0.52	0.002	1.68 (1.22 to 2.32)		
Caesarean section	-0.19	0.428	0.83 (0.52 to 1.32)			0.08	0.722	1.08 (0.70 to 1.69)		
Late preterm	-0.31	0.562	0.74 (0.26 to 2.08)			0.45	0.372	1.58 (0.58 to 4.26)		
Model 4										
In-hospital support¶	0.42	<0.001	1.52 (1.35 to 1.71)	0.18	0.81 (0.77 to 0.85)	0.14	0.016	1.15 (1.06 to 1.29)	0.18	0.73 (0.68 to 0.77)
Intention**	1.84	<0.001	6.28 (3.37 to 11.67)			1.41	<0.001	4.08 (2.71 to 6.14)		
Primiparous	0.53	0.020	1.70 (1.09 to 2.65)			0.50	0.017	1.65 (1.10 to 2.49)		
Caesarean section	-0.19	0.551	0.83 (0.44 to 1.55)			0.17	0.578	1.18 (0.65 to 2.14)		
Late preterm	-0.03	0.960	0.97 (0.29 to 3.29)			-0.18	0.779	0.84 (0.24 to 2.89)		
Low education††	-0.46	0.222	0.63 (0.30 to 1.32)			-0.07	0.833	0.94 (0.51 to 1.72)		
Low income‡‡	-0.06	0.834	0.95 (0.56 to 1.59)			0.05	0.847	1.05 (0.64 to 1.74)		
Returning to work early§§	0.03	0.943	1.03 (0.49 to 2.18)			0.03	0.946	1.03 (0.39 to 2.76)		

*Among 3416 participants, 149 (4.6%) reported exclusive breast feeding since birth.

†Among 831 participants, 248 (29.8%) reported exclusive breast feeding during the last 24 hours.

‡Areas under the receiver operating characteristic curves shown in figure 2, and the 95% confidence intervals of those areas.

§Areas under the receiver operating characteristic curves shown in figure 3, and the 95% CIs of those areas.

¶Number of in-hospital breastfeeding support practices provided, among the eight practices measured.

**Intention to exclusively breast feed for the first 5–6 months.

††No more than 12 years of formal education.

‡‡'Low income' means that the total income of the mother and her partner was within the lowest 25% of the participants in the first survey.

§§Returned to work, or planned to return to work, within 5 months of delivery.

AUC, area under the curve.

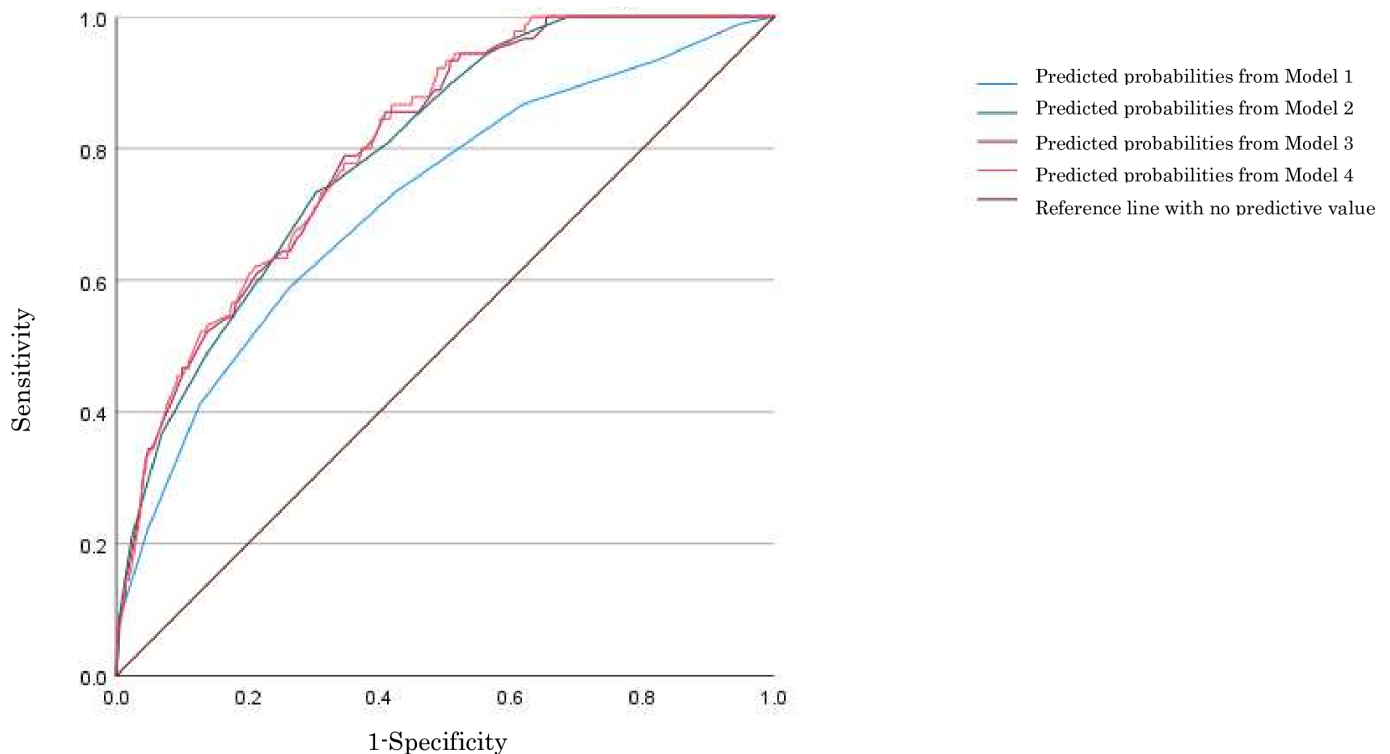


Figure 2 ROC curves for exclusive breast feeding from birth to 5 months of age (since-birth recall), created from predicted probabilities produced from multiple logistic-regression models 1–4. ROC, receiver operating characteristic.

Figure 2 shows the ROC curves created from the predicted probabilities produced by the logistic regression analyses of the relationship between in-hospital breastfeeding support and exclusive breast feeding for the first 5 months (since-birth recall). The AUC was 0.72 (95% CI 0.66 to 0.78) when the ROC curve was created from the predicted probabilities produced from model 1 (ie, with the number of steps as the only independent variable). When intention to exclusively breastfeed was included (model 2), the AUC was greater (0.80, 95% CI 0.76 to 0.84). The AUCs were stable when obstetric factors, and then social factors, were included (AUC 0.80 and 95% CI 0.76 to 0.84, AUC 0.81 and 95% CI 0.77 to 0.85, respectively.)

Figure 3 shows the ROC curves created from the predicted probabilities produced by the logistic regression analyses of the relationship between in-hospital breastfeeding support and exclusive breast feeding under 5 months (24-hour recall). The AUC was low (0.59, 95% CI 0.54 to 0.65) when the ROC curve was created from the predicted probabilities produced from model 1 (ie, with the number of steps as the only independent variable). When intention to exclusively breastfeed was included (model 2), the AUC was somewhat higher (0.71, 95% CI 0.66 to 0.76). When obstetric factors and then social factors were included, the AUCs were 0.72, 95% CI 0.67 to 0.77; and 0.73, 95% CI 0.68 to 0.77, respectively.

In all models, the AUCs were greater when in-hospital support was used to predict exclusivity measured by since-birth recall than when it was used to predict exclusivity measured by 24-hour recall, with almost no overlapping

of the confidence intervals between comparable models. Thus, with the AUCs as well as with the ORs, the benefit of in-hospital support was clear when since-birth recall was used, but using 24-hour recall made that benefit appear to be very small.

DISCUSSION

Twenty-four-hour recall overestimated the prevalence of exclusive breast feeding, when compared with recall from birth to 5 months of age. The prevalence of exclusive breast feeding under 5 months appeared to be 29.8% when assessed using 24-hour recall. This method was consistent with a monitoring indicator recommended by WHO and UNICEF. However, when measured from birth to 5 months, the prevalence of exclusive breast feeding was only 4.4% in the first survey and 2.5% in the second survey. In addition to the difference between those measured prevalences, the other important comparison in this study is between the results of the two sets of logistic regression analyses, that is, between the two sets of ORs and AUCs. Specifically, whether the strength of the effect of in-hospital breastfeeding support is quantified as an odds ratio or as an AUC, the effect of in-hospital support on exclusivity measured by since-birth recall was stronger than the ostensible effect of in-hospital support on exclusivity measured by 24-hour recall. When 24-hour recall of exclusive breast feeding was the outcome measure, the benefit of in-hospital breastfeeding support was obscured.

Consistent with previous research,^{5 7–11} we found that using 24-hour recall to measure exclusive breast feeding

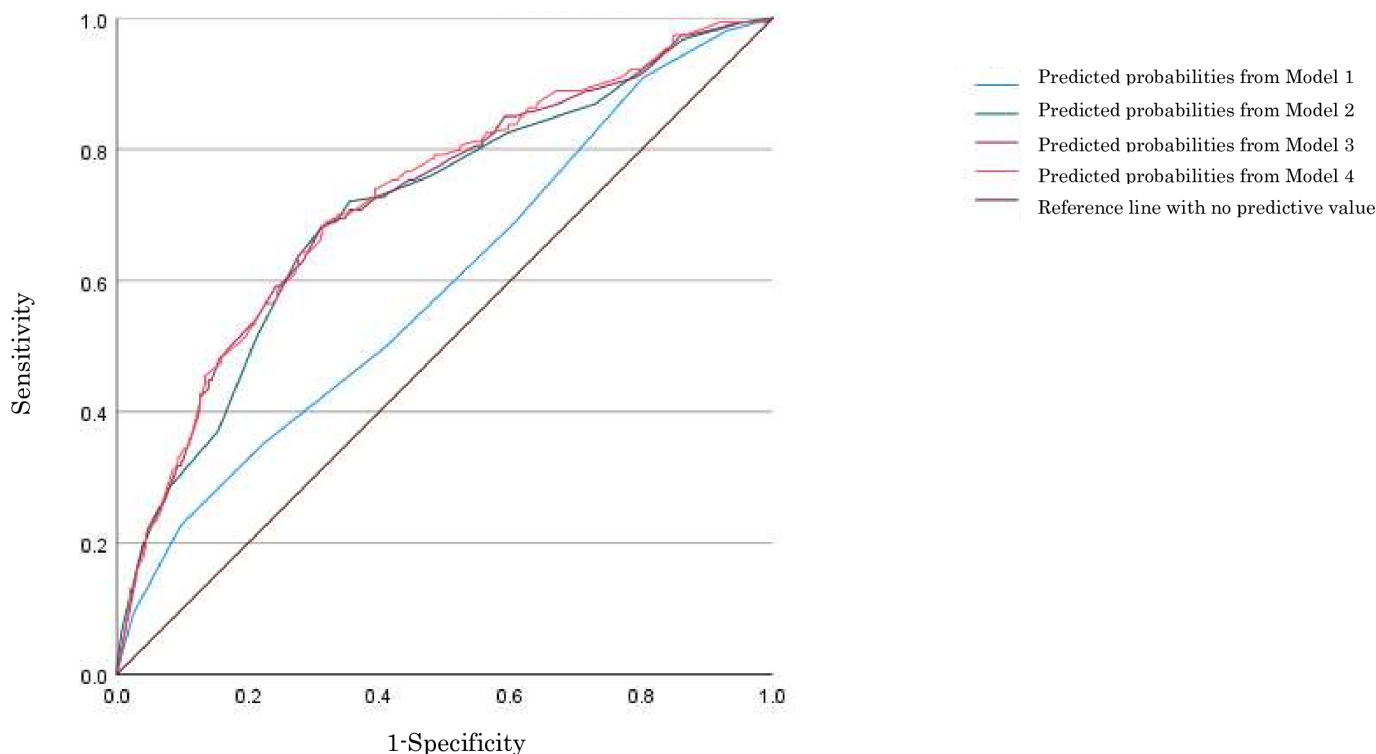


Figure 3 ROC curves for exclusive breast feeding under 5 months of age (24-hour recall), created from predicted probabilities produced from multiple logistic-regression models 1–4. ROC, receiver operating characteristic.

greatly overestimated breastfeeding status. When exclusive breast feeding under 5 months was measured using 24-hour recall, it was 29.8%. However, the prevalence of exclusive breast feeding measured using recall from birth to 5 months was 4.4% for infants over 5 months at the time of the first survey, and it was 2.5% for infants under 5 months at the time of the first survey and whose mothers responded to the second survey 6 months later. When the use of 24-hour recall causes the prevalence of exclusive breast feeding to be overestimated, population-level breastfeeding status can appear to be much better than it really is. Because the gap between the 24-hour recall results and the since-birth recall results is very wide, when WHO-recommended 24-hour recall method is used and the results appear to show that a high percentage of exclusive breast feeding under 6 months has been achieved, in fact those results are highly unlikely to reflect actual achievement of WHO's goal.⁸ The present results show again that, when breastfeeding status is discussed, when goals are proposed, and when interventions are evaluated, 24-hour recall and since-birth recall should be clearly described, and they should be clearly distinguished.

Our results are consistent with existing knowledge that providing in-hospital breastfeeding support consistent with WHO's Ten Steps can increase exclusive breast feeding from birth.^{15 19} However, the evidence of that effectiveness becomes nearly invisible when 24-hour recall is used to measure breastfeeding exclusivity. The provision of in-hospital breastfeeding support was clearly associated with exclusive breast feeding from birth to

5 months (since-birth recall), regardless of other factors included in the multiple regression models. In contrast, when exclusive breast feeding was defined using 24-hour recall, giving more in-hospital breastfeeding support appeared to result in only very small increases in exclusivity: the regression coefficients, ORs and AUCs for all four of the 24-hour-recall regression models were lower than those for the corresponding since-birth-recall models.

Another important finding is that when 24-hour recall is used, concealment of the success of in-hospital support can cause breastfeeding intention to appear to be more important than it is. That is, using 24-hour recall (figure 3) gives the false impression that intention to breastfeed is the most salient predictor of exclusive breast feeding, even though since-birth recall shows that in-hospital support is in fact a stronger predictor. The AUC was a mere 0.59 when in-hospital breastfeeding support alone was used to predict 24-hour recall of exclusive breast feeding. Without careful attention to the difference between 24-hour recall and since-birth recall, the AUC (and the logistic-regression results on which it is based) could easily give the false impression that the number of in-hospital support practices has no important effect on exclusive breast feeding. Next, when breastfeeding intention was included in the model, the resulting predictions of 24-recall of exclusive breast feeding were considerably better. That is, breastfeeding intention appeared to be more important than in-hospital support. Thus, if 24-hour recall is used when planning and evaluating programmes to promote exclusive breast feeding, one could easily

misconclude that in-hospital support is nearly useless and that more emphasis should be put instead on interventions to increase mothers' intentions to breastfeed, even though exclusive breast feeding from birth in fact depends most strongly on in-hospital support (figure 2).

Regarding the causes of the effects found in this study, we suspect that the success of in-hospital breastfeeding support was concealed, and the importance of maternal intention was overestimated, because 24-hour recall could not reflect changes in breastfeeding practices that occur during the first few postpartum months. Exclusive breast feeding soon after birth can depend on in-hospital support, while exclusive breast feeding later can be driven to a large extent by the mother's strong intention. We suggest that 24-hour recall of exclusive breast feeding may give undue weight to maternal intention, and if 24-hour recall is used then it should be used in combination with indicators that are sensitive enough to accurately reflect early exclusive breast feeding. WHO and UNICEF recommend assessing data from 17 indicators of infant and young-child feeding. Among them, two indicators relate to in-hospital support: (1) the proportion of children under 24 months who were put on the breast within an hour of birth and (2) the proportion of children under 24 months who were exclusively breastfed for the first 2 days after birth. In addition, to understand how population-level feeding patterns change with the age of the infant, WHO and UNICEF also recommend creating an area graph, with the age group in months on the x-axis and the feeding pattern on the y-axis.³ Future studies should test whether using 24-hour recall of exclusive breast feeding in combination with those indicators allows the population-level breastfeeding status to be assessed accurately, whether it accurately reflects the effectiveness of interventions, and whether it leads to the public-health goal of exclusive breast feeding from birth to 6 months.

There are several limitations of this study. First, the data were collected cross-sectionally. Since-birth recall obviously covers a much longer time than 24-hour recall, so it may be more susceptible to incorrect memory than 24-hour recall. In this study, the longest recall period was 25 months for a mother who recalled infant-feeding status since birth. Inaccuracies in long-term recall of infant feeding practices are of course possible.^{4 26} Further studies are necessary to assess both the reliability and the accuracy of the recall of breast feeding from birth. Second, neither 24-hour recall nor since-birth recall provides a perfect measure of exclusive breast feeding. Recall bias and social-desirability bias are among the various possible sources of error, and the AUCs could have been affected by 'imperfect gold standard bias', which can raise or lower sensitivity and specificity.^{25 27} In addition, this study was conducted in Japan, where the vast majority of mothers intend and initiate breast feeding,²⁸ although only a small proportion of mother–infant pairs receive appropriate in-hospital breastfeeding support.²⁹ Moreover, the mother and the newborn usually stay in a

hospital for approximately 5 days in Japan. Those Japan-specific intentions and practices might have highlighted the effect of the provision of in-hospital breastfeeding support on exclusive breast feeding from birth. To assess the generalisability of the findings, additional studies may be required in societies where mothers stay in a health facility for a shorter period with less intention to breastfeed. Despite these limitations, this study demonstrates the potential risks of measuring breastfeeding status by 24-hour recall.

In conclusion, 24-hour recall of exclusive breast feeding, an indicator included in the 2021 recommendation of indicators to measure infant and young-child feeding by WHO and UNICEF, should not be used alone to monitor population achievement of exclusive breast feeding for the first 6 months, or to evaluate the impact of breastfeeding interventions. That indicator greatly overestimated breastfeeding status when compared with recall from birth. Also, 24-hour recall of exclusive breast feeding concealed the effectiveness of in-hospital support. Moreover, 24-hour recall can unduly emphasise the importance of maternal intention to exclusively breastfeed. Therefore, using 24-hour recall as the only indicator of exclusive breast feeding can absolve hospitals of their responsibility to give breastfeeding mothers support that is consistent with WHO's Ten Steps. That would deprive infants of some of the benefits of breast feeding and thereby endanger their health. Further research is necessary to assess whether measuring the full set of the indicators recommended by WHO and UNICEF can compensate for the potential risks of 24-hour recall of exclusive breast feeding.

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