

Exclusive and any breast-feeding rates of Pacific infants in Auckland: data from the Pacific Islands Families First Two Years of Life study

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Abstract

Objectives: To present current breast-feeding rates for Pacific infants resident in New Zealand. Reasons for the introduction of complementary liquid foods were also explored.

Design: A longitudinal study using hospital discharge summary records and maternal home interviews undertaken at 6 weeks, 12 and 24 months postpartum. Turnbull's non-parametric survival analysis was used to model exclusive breast-feeding rates.

Setting: Auckland, New Zealand.

Results: The cohort comprised 1376 infants at 6 weeks, 1223 infants at 12 months and 1142 infants at 24 months. Exclusive breast-feeding rates at hospital discharge, 6 weeks, 3 and 6 months postpartum were 84% (95% confidence interval (CI): 80–88%), 49% (95% CI: 43–55%), 37% (95% CI: 32–42%) and 9% (95% CI: 7–11%), respectively. Significant ethnic difference existed, with Samoan mothers having higher exclusive breast-feeding rates than Tongan mothers ($P = 0.002$). The percentage of infants receiving any breast milk at hospital discharge, 6 weeks, 12 and 24 months was 96% (95% CI: 94–97%), 95% (95% CI: 94–96%), 31% (95% CI: 28–34%) and 15% (95% CI: 13–17%), respectively. Again ethnic differences emerged. Common reasons cited for discontinuation of exclusive breast-feeding included uncertainty of breast milk supply (56%), problems with breasts (30%) and difficulties breast-feeding in work or educational environments (26%). However, 691 (50%) mothers sought no advice about their breast-feeding concerns within the first six weeks of life.

Conclusions: Exclusive breast-feeding rates for Pacific infants are ethnically heterogeneous, have declined since the 1990s and fall short of the World Health Organization recommendations. The principal reasons cited for exclusive breast-feeding discontinuation echo those reported over a decade ago.

Keywords
Breast-feeding rates
Pacific infants
Epidemiology
Longitudinal study

Breast-feeding confers substantial benefits to both mother and child¹. Following a systematic review of current scientific evidence on the optimal duration of exclusive breast-feeding², a recent international meeting of experts coordinated under the auspices of the World Health Organization (WHO) continued to recommend exclusive breast-feeding for the first six months, with introduction of complementary foods and continued breast-feeding thereafter³. Many other international organisations concur with this recommendation¹. However, the WHO Global Data Bank on Breastfeeding and Complementary Feeding, which presently covers 94 countries and 65% of the world's infant population, estimates that only 35% of infants are exclusively breast-fed between 0 and 4 months of age⁴. Rates between countries vary widely, from extremely low (e.g. Nigeria: 2% in 1992, Central African Republic: 4% in 1995) in the African Region to 68% in 1995 for Egypt and 61% in 1993 for Sweden⁴.

Within the New Zealand context, Pacific peoples are one of the fastest growing subpopulations⁵, now estimated to exceed 284 000 people comprising 6.8% of the total population⁶, and Auckland is their preferred region of domicile⁷. However, Pacific people are over-represented in multiple adverse health and social statistics^{6,7}. Results from the Plunket National Child Study, conducted on a birth cohort of 4286 infants born during 1990–91, demonstrated that overall exclusive breast-feeding rates at hospital discharge, 6 weeks, 3 months and 6 months postpartum were 93.8%, 68.4%, 47.6% and 2.5%, respectively⁸. Exclusive breast-feeding rates for the Pacific sub-sample at hospital discharge, 6 weeks, 3 months and 6 months postpartum were comparable at 93%, 70%, 52% and 2%, respectively⁸. However, in a birth cohort study of Pacific infants resident in New Zealand we recently identified that breast-feeding rates at hospital discharge and 6 weeks were below those

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derived from the Plunket National Child Study and that internationally recommended^{1,3,8,9}. The present paper extends these findings to report current exclusive and any breast-feeding rates for the Pacific cohort over infants' first two years of life.

Previous New Zealand studies have consistently found that the most common reason for the supplementation of breast milk or cessation of breast-feeding was a perceived inadequate milk supply^{8,10–13}. Essex and colleagues concluded that the decline in breast-feeding rates with length of time postpartum could be reduced with education of mothers and health professionals about the management of breast-feeding problems, and increased support from employers or educational facilities⁸. Using data across the first two years of life, a second aim of this paper is to report the reasons for the introduction of complementary liquid or solid foods. From this we can gauge whether mother's perceptions of barriers to breast-feeding have changed from those observed over a decade ago.

Methods

Data were collected as part of the Pacific Islands Families: First Two Years of Life (PIF) study. This study follows a cohort of Pacific Islands' infants born at Middlemore Hospital between 15 March and 17 December 2000. The rationale for selecting Middlemore Hospital was that approximately two-thirds of Pacific communities resident in New Zealand live within the Auckland region¹⁴ and this hospital has the largest number of Pacific births in the country, with all major Pacific ethnic groups represented. All potential participants were selected from births where at least one parent was identified as being of Pacific Island ethnicity and a New Zealand permanent resident. Participants were identified through the Birthing Unit, in conjunction with the Pacific Islands Cultural Resource Unit. Information about the study was provided and consent was sought to make a home visit.

Approximately six weeks after the infant's birth, female interviewers of Pacific Island ethnicity who were fluent in English and a Pacific Islands language visited the mother in her home. Once eligibility was confirmed and informed consent obtained, mothers participated in a one hour interview concerning family functioning and the health and development of the child. This interview was conducted in the preferred language of the mother. With consent, home visits were repeated at approximately 12 months and 24 months postpartum. Detailed information about the cohort and procedures is described elsewhere¹⁵.

Measures of breast-feeding

Breast-feeding at hospital discharge was obtained from Middlemore Hospital's hospital discharge summary records for each mother. At the 6-week interview, mothers were asked how they fed their baby for the first six weeks.

Problems with breast-feeding, reasons for the introduction of complementary liquid or solid foods, and whether advice was sought for infant feeding and from whom, were also elicited. At the 12-month interview, the current method of feeding was elicited from options that included: exclusive breast-feeding (breast milk only); combining breast-feeding with other feeding (formula or solid food); not breast-feeding, feeding only formula or other milk; not breast-feeding, combining formula/other milk and solid food; and other (describe). Participants were also asked about the feeding of other liquids in the last seven days including: water, juices, coconut derivatives, soft drinks, tea or coffee. The age of introduction of complementary liquid foods was elicited, as was the age when complementary solid foods were introduced where applicable. Reasons why complementary liquid foods were introduced were also asked. For the 24-month interview mothers were asked whether their child had breast milk at any time in the past seven days.

Infants were defined as exclusively breast-fed if they were described at discharge from hospital as being breast-fed and they continued to receive only breast milk until the age in question. Infants were deemed not to be exclusively breast-fed if any complementary solid or liquid foods (except minimal amounts of water or prescribed medicine) were consumed by the infant before the age in question or if there was any inconsistency between the elicited answers.

Statistical analysis

All infants who were singletons or first-borns from multiple births were included within the analyses. Cross-tabulations of feeding variables collected between interview waves were conducted to find inconsistencies in response. If mothers claimed to be exclusively breast-feeding at one interview but not exclusively breast-feeding at a previous interview, then the exclusive breast-feeding response was modified to non-exclusive breast-feeding. A similar strategy was used for the any breast-feeding variables. Also, the ages that infants were introduced complementary liquid foods or solids were compared with the breast-feeding variables. If mothers claimed to be exclusively breast-feeding at a give point in time yet provided information in another question that the infant had received complementary liquid foods or solids before that time, then the exclusive breast-feeding response was modified to that of non-exclusive breast-feeding.

The likelihood that infants were exclusively breast-feeding over age postpartum was modelled using Turnbull's non-parametric survival analysis¹⁶. This technique allows both interval and right censoring of the event of interest over time. In these analyses the event was taken to be the feeding of an infant complementary liquid or solid foods and the time component was deemed to be the age at which this

event occurred. In instances where the time component was missing yet information was available from the interview or subsequent interviews that exclusive breast-feeding had discontinued, then time was assigned as the interval beginning at the last known age where the infant was exclusively breast-fed and ending at the earliest age at which it was known that the infant was no longer exclusively breast-fed. If the age at which the infant was no longer exclusively breast-fed was unavailable, then observations were treated as being right censored and time was equated to that last known age of exclusive breast-feeding. Hypothesis tests between Turnbull's non-parametric survival curves were based on a modified log rank test and calculated using the PROC IML algorithm originated by So¹⁷ and adapted by Lindsey and Ryan¹⁶.

Rates of any breast-feeding were determined cross-sectionally at each interview time point and confidence intervals were calculated using an exact binomial method. Fisher's exact test was used to compare rates across ethnic groups and assess whether there was differential loss to follow-up. SAS version 8.2¹⁸ and Stata version 8.0¹⁹ were used for all computations and a level of $P < 0.05$ was used to define statistical significance.

Ethics

Ethical approval was obtained from the Auckland Branch of the National Ethics Committee, the Royal New Zealand Plunket Society, and the South Auckland Health Clinical Board.

Results

Overall, 1708 mothers were identified, 1657 were invited to participate, 1590 (96%) consented to a home visit and, of these, 1477 (93%) were eligible for the PIF study. Of those eligible, 1376 (93%) participated at the 6-week interview, 1224 (83%) participated at the 12-month interview and 1144 (77%) participated at the 24-month interview. At the 6-week interview, mothers' self-identified major ethnic affiliations included 650 (47%) Samoan, 289 (21%) Tongan, 232 (17%) Cook Island Maori, 59 (4%) Niuean, 47 (3%) other Pacific (including mothers who identified equally with two or more ethnic groups) and 99 (7%) non-Pacific (infants with non-Pacific mothers and Pacific fathers). Mothers' mean age was 27.9 years (standard deviation 6.2 years), 1107 (80%) were married or in *de facto* relationships, 377 (27%) gained post-secondary school qualifications, 343 (25%) admitted to current cigarette smoking, and 56 (4%) were in full-time and 28 (2%) were in part-time employment (see Table 1).

Of the 1376 selected infants, 662 (48%) were female, the mean infant birth weight was 3583 g (standard deviation 616 g) with 65 (5%) recording a birth weight under 2500 g, 107 (8%) infants were born pre-term with gestational age < 37 weeks, and 37 (3%) were discharged from hospital at a different time to their mother (see Table 1).

At the 6-week interview, the 1376 infants had a median age of 7 weeks and 95% of interviews were completed with infants aged between 5 and 14 weeks. Hospital discharge information on infant feeding was available for 1260 (92%) of these infants. The 12-month interview was conducted on 1223 infants; their median age was 12.3 months and 95% of interviews were completed with infants aged between 11.9 and 17.1 months. Finally, the 24-month interview was conducted on 1142 infants; their median age was 24.1 months and 95% of interviews were completed with infants aged between 23.8 and 26.6 months.

Exclusive breast-feeding

At the 6-week interview, 731 (53%) mothers declared that they were exclusively breast-feeding yet of these 26 (2%) were complementary feeding or fully formula-feeding at hospital discharge and a further 22 (2%) declared that they had introduced complementary liquid foods before 6 weeks. The status of these 48 responses was changed to non-exclusive breast-feeding. At hospital discharge, the exclusive breast-feeding rate was estimated as 84% (95% confidence interval (CI): 80–88%), declining to 49% (95% CI: 43–55%) at 6 weeks postpartum, 37% (95% CI: 32–42%) at 3 months postpartum and 9% (95% CI: 7–11%) at 6 months postpartum. No mother reported exclusively breast-feeding at the 12-month or 24-month interview. Figure 1 depicts the overall Turnbull non-parametric survival curve of exclusive breast-feeding for this sample.

There was a significant difference in the survival curves for exclusive breast-feeding between the self-identified major ethnic affiliations ($P = 0.04$), see Fig. 2. Of the three largest ethnic groups, Samoan mothers had exclusive breast-feeding rates that were significantly higher than Tongan mothers ($P = 0.002$). However, the exclusive breast-feeding rates of the Cook Island Maori mothers were not significantly different from either the Samoan mothers ($P = 0.10$) or the Tongan mothers ($P = 0.28$), see Fig. 2.

Exclusive breast-feeding rates were also significantly associated with maternal smoking ($P < 0.001$), maternal employment ($P < 0.001$), having a low-birth-weight baby ($P = 0.001$) and whether the mother and baby were discharged from hospital together ($P = 0.008$), see Table 1.

At the 6-week interview, 214 (16%) infants had not been visited at home by a Plunket nurse (in New Zealand, child health nurses are called Plunket nurses and are employed by the Royal New Zealand Plunket Society²⁰). No statistically significant difference existed between the Turnbull non-parametric survival curves for exclusive breast-feeding between those with and without Plunket visits ($P = 0.40$). The exclusive breast-feeding rate at hospital discharge, 6 weeks, 3 months and 6 months was estimated at 84%, 50%, 38% and 10%, respectively, for

Table 1 Frequencies, percentages and exclusive breast-feeding rate estimates derived from the Turnbull non-parametric survival analysis at 6 weeks, 3 months and 6 months postpartum partitioned by maternal and infant characteristics measured at 6 weeks

	n (%)	Exclusive breast-feeding rate (%)			P-value
		6 weeks	3 months	6 months	
Mother's age (years)*					0.27
< 25	465 (34)	51	37	10	
25–35	430 (31)	51	37	8	
> 35	480 (35)	46	37	9	
Mother's parity†					0.22
1	374 (28)	51	35	10	
2–4	768 (57)	50	39	8	
≥ 5	215 (16)	41	34	10	
Mother's ethnicity‡					0.04
Samoan	650 (47)	55	43	10	
Tongan	289 (21)	40	25	7	
Cook Island Maori	232 (17)	46	34	10	
Niuean	59 (4)	53	41	6	
Other Pacific	47 (3)	50	37	3	
Non-Pacific	99 (7)	46	33	5	
Mother's marital status					0.83
Partnered	1107 (80)	49	37	8	
Single	269 (20)	50	35	11	
Mother's highest level of education					0.59
Primary	535 (39)	49	36	7	
Secondary	464 (34)	51	39	10	
Post-secondary	377 (27)	49	35	8	
Mother's smoking status§					<0.001
Non-smoker	1029 (75)	54	41	11	
Smoker	343 (25)	36	26	3	
Mother's employment status					<0.001
Not working	1292 (94)	51	39	10	
Part-time	28 (2)	18	11	4	
Full-time	56 (4)	21	11	0	
Plunket visited home postpartum¶					0.40
Yes	1159 (84)	50	38	10	
No	214 (16)	45	31	8	
Infant's sex					0.40
Female	662 (48)	49	38	10	
Male	714 (52)	50	36	7	
Gestation (weeks)					0.31
≥ 37	1248 (92)	50	38	9	
< 37	107 (8)	40	28	14	
Birth weight (g)†					0.001
≥ 2500	1292 (95)	50	38	10	
< 2500	65 (5)	30	14	7	
Hospital discharge of mother and infants					0.008
Together	1339 (97)	50	38	10	
Separately	37 (3)	24	15	6	

* One observation missing.

† Nineteen observations missing.

‡ 'Other Pacific' includes mothers identifying equally with two or more ethnic groups and 'non-Pacific' includes mothers who were eligible through the Pacific ethnicity of the father.

§ Four observations missing.

¶ Three observations missing.

|| Twenty-one observations missing.

those with visits and 85%, 45%, 31% and 8%, respectively, for those without such visits.

The reasons mothers introduced complementary liquid foods into infants' diets were many and diverse. For the 1085 mothers providing such reasons, the 10 most common appear in Table 2.

While many of these reasons or perceptions were surmountable, 691 (50%) sought no advice about concerns they had with infant feeding within the first six weeks of life. Of the 685 mothers who did seek advice, 594 (87%)

mothers consulted midwives, 244 (36%) consulted other women in the family, 241 (35%) consulted Plunket nurses, 103 (15%) consulted general practitioners and 77 (11%) consulted practice nurses about concerns they had about infant feeding.

Any breast-feeding

No inconsistencies in any breast-feeding responses were found between interviews for any mothers. The percentage of infants receiving at least some breast milk at

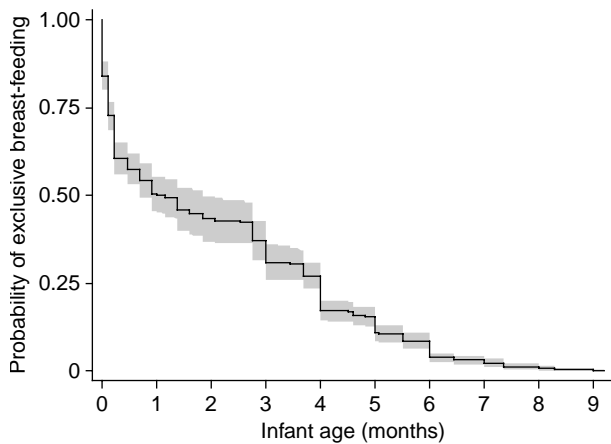


Fig. 1 Turnbull non-parametric survival curve estimates for exclusive breast-feeding and associated 95% confidence intervals (given by the shaded region)

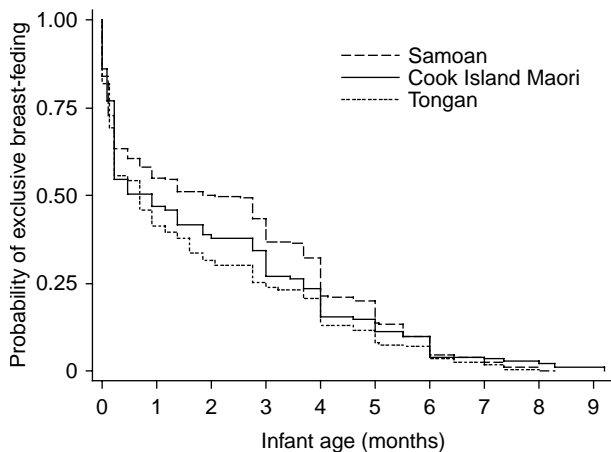


Fig. 2 Turnbull non-parametric survival curve estimates for exclusive breast-feeding for the three largest Pacific ethnicities

hospital discharge, 6 weeks, 12 months and 24 months was 96% (95% CI: 94–97%), 95% (95% CI: 94–96%), 31% (95% CI: 28–34%) and 15% (95% CI: 13–17%), respectively. There were no ethnic differences between the any

breast-feeding rates at hospital discharge ($P = 0.46$) or at the 6-week interview ($P = 0.48$). However, significant ethnic differences emerged at the 12-month interview (Samoan 39%, Cook Island Maori 25%, Tongan 23%, $P < 0.001$) and at the 24-month interview (Samoan 21%, Cook Island Maori 18%, Tongan 14%, $P < 0.001$).

Of those lost to follow-up at the 12-month interview, 96% were breast-fed and 4% were formula-fed at the 6-week interview, no different from those remaining in the study ($P = 0.69$). Similarly, of those lost to follow-up at the 24-month interview, 94% were breast-fed and 6% were formula fed at the 6-week interview, no different from those remaining in the study ($P = 0.51$).

Discussion

In this large prospective study of Pacific infants resident within the Auckland region, New Zealand, we report exclusive breast-feeding rates at hospital discharge, 6 weeks, 3 months and 6 months that have fallen by an absolute percentage difference of up to 17% on those reported over a decade earlier⁸. In the intervening years, data gathered by Plunket also demonstrate a decline in national rates for full breast-feeding at 6 weeks: from 75% in 1994 to 64% in 1996–97²¹. More recent 2001 figures from the New Zealand Ministry of Health suggest that the national fully breast-feeding rates for Pacific infants at 5–6 weeks, 3 months and 4–6 months were 57%, 43% and 17%, respectively²². These Ministry figures were largely static over the 5-year reporting period from 1997 to 2001. Within Auckland, the July to December 2001 Ministry figures for full breast-feeding at 6 weeks and 11–15 weeks were 55% and 41%, respectively; 2% less than the national figures²².

Our reported exclusive breast-feeding rates for Pacific infants during 2001 are lower, and some considerably lower, than the published Ministry figures; although the Ministry's use of age bracket makes direct comparison and interpretation difficult. For instance, if we consider the exclusive breast-feeding rates within our sample, we find 27% are breast-feeding at 4 months declining to 9% at 6

Table 2 The 10 most common reasons cited by mothers for introducing complementary liquid foods into infants diets. More than one reason may have been given

Rank	Reason for introducing complementary liquid foods	<i>n</i> (%)
1	Unsure about adequate milk supply from breast-feeding	604 (56)
2	Problems with breasts (cracked nipples, infections, etc.)	324 (30)
3	Difficulties with breast-feeding due to return to work or study	281 (26)
4	Baby refused to feed or had sucking difficulties with breast	260 (24)
5	Baby was unsettled	198 (18)
6	Concern about lack of weight gain in baby	167 (15)
7	Lack of freedom or inconvenience of breast-feeding	144 (13)
8	Felt too tired or stressed to breast-feed	131 (12)
9	Formula-fed so that partner could share feeding of baby	122 (11)
10	Healthiest way to feed my baby	92 (8)

months. Thus, the quoted Ministry figure of 17% fully breast-feeding at 4–6 months has little utility, and changes in the Ministry figures may simply result from fluctuations in the infant age profile of the captured mothers. This limitation is explicitly acknowledged by the Ministry, as are the inconsistencies in breast-feeding definitions used between various information sources and the percentage of the population from whom the data are captured²².

Differences between the Ministry's figures and our estimates may also result from discrepancies between sampling-frame coverage. Specifically, the Ministry's 5–6 weeks Pacific figures are derived from an estimated 71–75% of Pacific births, while 3 months and 6 months Pacific figures cover an estimated 82–90% of Pacific births²². The PIF study used an inception cohort of all mothers giving birth to Pacific infants at Middlemore Hospital between 15 March and 17 December 2000, and there was no important differential attrition noted across a range of sociodemographic variables investigated¹⁵ or in the breast-feeding frequencies at the 6-week interview between those who dropped out and those who continued in the study. The PIF study sample thus covers an additional 25–29% of Pacific births at the 6-week interview compared with that of the Ministry. Unfortunately, the Ministry's sampling frame for the 5–6 week estimates is not specified beyond public health, maternity and Well Child services (a service that provides screening, surveillance, education and support services to all New Zealand infants and their families which is linked to, and follows on from, the care provided by the lead maternity carer) and so the magnitude of the selection bias cannot be precisely quantified²³. However, it might be opined that those not captured within the Ministry's sampling frame are likely to have lower breast-feeding rates than those captured due to a number of factors including socio-economic²⁴ and educational^{25,26} disparity, employment and workplace support differences²⁷, and behavioural and childcare practice variations²⁶. Thus, the selection bias inherent within the Ministry's data collection process is likely to result in overestimated exclusive breast-feeding rates.

While the Ministry's coverage improves for the 3-month and 6-month Pacific estimates, there remains inherent selection bias. In 2001, the Plunket Management Information System was used to report breast-feeding at 4–6 months. However, as reported previously from a multivariable logistic model, Pacific mothers not receiving a visit from Plunket within the first six weeks postpartum had significantly lower exclusive breast-feeding rates than those who received such a visit⁹. The Turnbull non-parametric survival estimates of exclusive breast-feeding rates at 6 weeks, 3 months and 6 months for those receiving a Plunket visit were 50%, 38% and 10%, respectively, somewhat higher than the 45%, 31% and 8%, respectively, of those Pacific mothers not receiving such a visit (see Table 1). Thus reliance on data solely collected from Plunket may overestimate Pacific exclusive

breast-feeding rates by an absolute percentage difference of approximately 5–7% in the first three months postpartum, declining to 2% by 6 months.

Another source of difference results from the Ministry of Health's use of successive cross-sectionally derived estimates from infant age bands compared with the survival analysis using longitudinal data undertaken in our analyses. Providing follow-up rates are acceptable, as achieved in this Pacific study¹⁵, longitudinal data provide more robust estimates of time-dependent measures. Moreover, in longitudinal studies, inconsistencies in elicited responses across measurement waves and between different questions can be identified and appropriately accommodated within the analyses. For example, at the 6-week interview, 731 mothers declared that they were exclusively breast-feeding yet of these 26 were complementary feeding or fully formula-feeding at hospital discharge and a further 22 declared that they had introduced complementary liquid foods before 6 weeks. In each of these cases, mothers' breast-feeding elicitation responses were altered and censored in the manner described in the statistical methods. Had these responses arisen from a cross-sectional survey that elicited breast-feeding from one question, then it is likely they would have been treated as valid responses, thereby yielding overestimated rates of exclusive breast-feeding. Indeed, by treating these responses as valid observations, the proportion of mothers claiming to be exclusive breast-feeding at 6 weeks in the PIF study equalled 53%, slightly less than the 55% reported by the Ministry²². The survival approach used in the current study also allows rate estimation to be measured at precisely defined time slices rather than broad time bands which diminish the utility of the cross-sectionally derived estimates.

A key finding in this study is the persistent difference in exclusive breast-feeding rates over infant age between Samoan and Tongan mothers, a finding first identified and reported at 6 weeks¹². This has two important implications: first, an understanding of the barriers to breast-feeding and strategies to increase breast-feeding rates should target Tongan mothers in particular¹²; and second, breast-feeding rates need to be monitored within the Pacific Island ethnic groups separately rather than collapsed under a 'Pacific' banner. Not only does the Pacific label serve to disguise the heterogeneity of the Pacific population in New Zealand, it is offensive to some Pacific people who value the uniqueness of their different cultures and languages as much as other ethnic groups²⁸. Similar ethnic differences emerged in the any breast-feeding rates at the 12-month and 24-month interviews. At these time points, the Samoan breast-feeding rates were substantially higher than the Tongan rates, with the Cook Island Maori rates being intermediary. Consistent with the literature, maternal smoking, return to employment, low birth weight and separate hospital discharge were all associated with early cessation of exclusive breast-feeding^{9,22,24–27}.

Another key finding presented in this paper is that inadequate education of mothers about the management of breast-feeding problems and the perceived lack of support from employers or educational facilities remain the principal reasons for mothers discontinuing exclusive breast-feeding. The same issues and recommendations for increasing exclusive breast-feeding rates that were manifest over a decade ago⁸ are just as pertinent today^{1,3,13,29}. Over half of the Pacific mothers reported introducing complementary liquid foods into their infants' diets because they were unsure about the adequacy of their milk supply, considerably higher than the 33% recently reported from a recent New Zealand study of Caucasian women¹³. As concerns about insufficient breast milk supply are commonly due to mothers' poor understanding of effective techniques to increase their milk supply¹³, then addressing these misunderstandings during prenatal classes or visits to health-care professionals could substantially improve exclusive breast-feeding rates amongst the Pacific people.

Our presented analysis has strengths and limitations. The PIF study is a large, representative, longitudinal study with relatively small attrition rates. However, the reliance on maternal recall for the age at which complementary liquid or solid foods were introduced into infants' diets is not ideal, particularly since for half the infants these were introduced between the 6-week and 12-month interviews. In an effort to increase consistency and reliability, information gleaned about infant nutrition between and within interview surveys was cross-checked against each other. Different definitions of the exclusivity of breast-feeding can also be problematic in making comparisons between studies. The Plunket National Child Study conducted during 1990–91 defined exclusive breast-feeding as infants receiving only breast milk⁸ while the Ministry matched the WHO exclusive breast-feeding rate indicator⁴ and defined full breast-feeding as infants taking breast milk only, and no other liquids or solids except a minimal amount of water or prescribed medicines, in the past 48 hours²². The definition of exclusive breast-feeding adopted for the PIF study was directly based on this WHO indicator, making national and international comparisons easily undertaken. Thus exclusive breast-feeding rates between the reported studies use very similar definitions. Moreover, the design of the Plunket National Child Study was longitudinal and survival analyses were also undertaken to estimate exclusive breast-feeding rates at various time points⁸, suggesting that the rates derived in the 1990–91 study are directly comparable to those reported for our population, after allowing for geographical differences.

Internationally, New Zealand's Pacific infant breast-feeding rates compare favourably with many of those listed in the WHO Global Data Bank⁴. However, in the New Zealand context, declines since the 1990s and breast-feeding rates that fall well short of WHO and other

international organisations' recommendations^{1,3} herald the need to engage in a more concerted approach in the promotion of breast-feeding and its culture, and to dealing with the barriers or perceived barriers to breast-feeding. Mothers of Pacific infants in 2001 reported reasons for the discontinuation of breast-feeding that were largely unaltered from those cited over a decade ago. Only with the understanding of the barriers to breast-feeding within the various cultural contexts can culturally appropriate targeting, education and concerted implementation of the Ministry of Health's Action Plan for Breastfeeding effectively be undertaken. With appropriate implementation and monitoring, New Zealand may see Pacific breast-feeding rates improve and approach the recommendations of WHO and other international organisations.

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