

1 **Objectives:** To investigate the effect of public hospitals in Hong Kong not accepting free
2 infant formula from manufacturers on in-hospital formula supplementation rates and
3 breastfeeding duration.

4 **Design:** Prospective cohort study.

5 **Setting:** In-patient postnatal units of four public hospitals in Hong Kong.

6 **Subjects:** Two cohorts of breastfeeding mother-infant pairs (n=2560). Cohort 1 (n=1320)
7 was recruited before implementation of the policy to stop accepting free infant formula and
8 Cohort 2 (n=1240) was recruited after policy implementation. Participants were followed
9 prospectively for 12 months or until they stopped breastfeeding.

10 **Results:** The mean number of formula supplements given to infants in the first 24 hours was
11 2.7 in Cohort 1, and 1.17 in Cohort 2 (SD=3.11 and 1.94, respectively, $P<0.001$). The
12 proportion of infants who were exclusively breastfed during the hospital stay increased from
13 17.7% in Cohort 1 to 41.3% in Cohort 2 ($P<0.001$), and the risk of breastfeeding cessation
14 was significantly lower in Cohort 2 (HR=0.81; 95% CI, 0.73 to 0.9). Participants who non-
15 exclusively breastfed during the hospital stay had a significantly higher risk of stopping any
16 or exclusive breastfeeding. Higher levels of formula supplementation also increased the risk
17 of breastfeeding cessation in a dose–response pattern.

18 **Conclusions:** After implementation of a hospital policy to pay market price for infant
19 formula, rates of in-hospital formula supplementation were reduced and the rates of in-
20 hospital exclusive breastfeeding and breastfeeding duration increased.

21

22

23 **Introduction**

24 The recommendation for exclusive breastfeeding for the first six months of life is based
25 on the nutritional and immunological importance of breastfeeding for optimal health, growth
26 and development^(1; 2) and the well documented risks of infant formula feeding^(3; 4). Although
27 breastfeeding initiation rates have increased substantially in most developed countries over
28 the past several decades, early breastfeeding cessation is common and rates of exclusive
29 breastfeeding remain low^(5; 6). Many healthy breastfeeding newborns are supplemented with
30 infant formula before leaving hospital, with rates ranging from 23 to 82%^(7; 8; 9; 10; 11; 12; 13).
31 Supplements are often given for non-medical reasons⁽¹⁴⁾ such as maternal fatigue,
32 instrumental or operative deliveries, and perceived insufficient milk^(7; 8; 11). Early infant
33 formula supplementation disrupts the establishment of breastfeeding by reducing the
34 frequency of breastfeeding and the amount of breast milk removed from the breasts, which
35 often necessitates further supplementation⁽¹⁵⁾.

36 Excessive marketing and promotion of infant formula, including the provision of free or
37 heavily discounted products to hospitals and medical providers, may contribute to the high rates
38 of in-hospital formula supplementation and the subsequent reduced rates of exclusive
39 breastfeeding⁽¹⁶⁾. In 1989, the World Health Organization (WHO) and UNICEF developed a set
40 of guidelines for maternity care facilities to protect, promote and support breastfeeding⁽¹⁷⁾.
41 The WHO later launched the Baby Friendly Hospital Initiative (BFHI), which outlined
42 minimum global criteria for accreditation as a Baby-Friendly Hospital. The BFHI stipulates
43 that hospitals should not accept free or heavily discounted infant formula products from
44 manufacturers, and must pay market price for all breast milk substitutes⁽¹⁸⁾. Despite this BFHI
45 guideline, financial incentives mean many hospitals that are not BFHI accredited continue to
46 accept infant formula products from the manufacturers⁽¹⁶⁾. Research has highlighted that early
47 infant formula supplementation is one of the strongest predictors of early breastfeeding
48 cessation^(8; 11; 19; 20; 21). Providing mothers with infant formula samples upon hospital discharge

49 has also been shown to shorten breastfeeding duration^(22; 23). It is widely believed that
50 hospitals' acceptance of free infant formula encourages non-medically indicated
51 supplementation^(24; 25). Although a number of studies have found that the BFHI improves
52 hospital practices^(26; 27; 28) and breastfeeding outcomes^(21; 29; 30), none have specifically
53 examined the impact of hospitals stopping the acceptance of free infant formula. This
54 suggests that there is no direct evidence to support this belief. Given the pervasiveness of
55 infant formula promotion globally, it would be beneficial to have further evidence of the
56 benefits to breastfeeding mothers and infants when hospitals stop the acceptance of free infant
57 formula.

58 Breastfeeding initiation rates in Hong Kong are above 85%⁽³¹⁾. However, overall
59 breastfeeding duration remains short and rates of exclusive breastfeeding are low⁽³²⁾.
60 Historically, all Hong Kong hospitals have accepted free infant formula from manufacturers.
61 In 2006, all public and most private hospitals adopted a policy to purchase infant formula at
62 market price as a step toward becoming more baby-friendly. This was a significant change
63 and provided a unique opportunity to study the effect of the policy on hospital practices and
64 breastfeeding outcomes. The present study aimed to assess the effect of stopping free infant
65 formula in public hospitals on (1) the number of supplemental feeds given to breastfeeding
66 babies during their hospital stay, (2) the proportion of infants who are given formula
67 supplements during their hospital stay, and (3) the overall duration and exclusivity of
68 breastfeeding. Additionally, in a pooled analysis we aimed to assess the overall effect of the
69 amount of in-hospital infant formula supplementation on the duration of any or exclusive
70 breastfeeding.

71 **Methods**

72 *Design, Setting and Participants*

73 The present study employed a prospective cohort design. Two cohorts of
74 breastfeeding mothers in the immediate postpartum period were recruited from four public

75 hospitals in Hong Kong, one before and the second after the change in the infant formula
76 policy. All Hong Kong residents have access to free, high-quality antenatal, postnatal, and
77 well-child health care, and maternal and infant mortality rates are some of the lowest in the
78 world⁽³³⁾. Hong Kong has eight public and ten private hospitals that offer obstetric services,
79 none of which are BFHI accredited. The normal length of postnatal stay in public hospitals is
80 approximately 48 hours for a vaginal birth and 72 hours for a caesarean birth. The Hong Kong
81 Hospital Authority (HA), a subvented government organization, manages all public hospitals;
82 while private hospitals are managed by various charitable, philanthropic and religious
83 organizations. Public hospitals accounted for 67.8% of all births to Hong Kong mothers in
84 2011⁽³⁴⁾. Over the past decade, a high proportion of patients who gave birth in private
85 hospitals in Hong Kong were birth tourists from Mainland China⁽³⁵⁾. Participant recruitment
86 was therefore limited to public hospitals.

87 The HA proposed the infant formula policy change in 2006, with implementation
88 planned for 2007. However, other constraints on the obstetrics services in Hong Kong
89 hospitals⁽³⁵⁾ meant implementation was delayed until April 2010. The first cohort of
90 breastfeeding mothers (Cohort 1) were recruited in 2006-07, before the planned
91 implementation of the new infant formula policy, and served as the pre-policy baseline group.
92 Following the policy implementation, a second cohort of breastfeeding mothers (Cohort 2)
93 were recruited in 2011-12, as the post-policy group. All study protocols, including selection
94 criteria, participant recruitment, data collection procedures, and follow-up intervals were
95 exactly the same for both cohorts. Eligibility criteria were: (1) An intention to breastfeed; (2)
96 a singleton pregnancy; (3) Cantonese speaking; and, (4) no serious medical or obstetric
97 complications. Further exclusion criteria for the newborn were: (1) Less than 37 weeks
98 gestation; (2) a five-minute Apgar score less than 8; (3) birth weight less than 2500 grams; (4)
99 severe medical conditions or congenital malformations; (5) admission to the special care baby

100 unit for 48 hours or more after delivery; or, (6) admission to the neonatal intensive care unit
101 after delivery.

102 ***Data Collection***

103 Data were collected directly from participants while in hospital, and through telephone
104 follow-up after discharge. Data collection included: (1) Baseline demographic data; (2)
105 maternal and infant data; (3) in-hospital infant feeding data; (4) follow-up infant feeding data
106 at 1, 2, 3, 6, 9, and 12 months postpartum or until the participant stopped breastfeeding
107 completely; and, (5) final breastfeeding status data.

108 ***Study Variables***

109 During the postnatal hospitalization, infants were considered exclusively breastfed if
110 they received no solids, no breast milk substitutes, and no water or other liquids (other than
111 vitamins or medications)⁽³⁶⁾. For non-exclusively breastfeeding infants, the proportion of total
112 daily feeds that were breast milk was computed. As most new mothers were discharged after
113 48 hours, in-hospital feeding data were collected for the first 48 hours of admission. Non-
114 exclusively breastfed infants supplemented with infant formula or other milk substitutes were
115 classified as either high-partial breastfeeding (>80% to <100% of feeds were breastfeeds),
116 medium-partial breastfeeding (20 to 80% of feeds were breastfeeds), or low partial
117 breastfeeding (<20% of feeds were breastfeeds)⁽³⁷⁾.

118 After hospital discharge, breastfeeding status was assessed at the intervals outlined
119 above through telephone interviews. Participants were asked about the amount and type of
120 feedings given to the infant in the 24-hour period before the interview⁽³⁶⁾. Infants were
121 categorized as exclusive breastfeeding, partial breastfeeding or exclusive formula feeding.
122 Exclusive breastfeeding was defined according to the definition outlined above⁽³⁶⁾. If the
123 participant had stopped breastfeeding altogether during that follow-up interval, she was asked
124 to report the total duration of any and exclusive breastfeeding in weeks. As the present study
125 aimed to examine the effect of in-hospital formula supplementation on the duration of any and

126 exclusive breastfeeding, exclusive breastfeeding duration was computed based on how the
127 mother reported feeding her baby after leaving the hospital and did not include in-hospital
128 formula supplementation⁽³⁸⁾.

129 *Sample Size Calculation*

130 The sample size calculation was based on primary comparisons of the duration of
131 exclusive or any breastfeeding over a 12-month period. To account for multiplicity, the
132 nominal level of significance for calculating the sample size for each outcome was taken as
133 2.5% (by Bonferroni adjustment) to control the overall false positive error rate to within 5%.
134 The results of a previous Hong Kong study⁽³⁹⁾ indicated the median duration of exclusive
135 breastfeeding was 3.5 weeks and that of any breastfeeding was 6 weeks. Based on other
136 research⁽⁴⁰⁾, an increase of 1.5 weeks in the median duration of both exclusive and any
137 breastfeeding was estimated to indicate a clinically significant improvement in breastfeeding
138 outcomes. This means that to detect such a difference with 80% power by a log-rank test, 170
139 women per group were needed to compare exclusive breastfeeding 510 women per group to
140 compare any breastfeeding. Factoring in a loss-to follow-up rate of 25%, approximately 700
141 to 800 mother-infant pairs were needed in each cohort to obtain a final sample size of 510 per
142 group.

143 *Statistical Analyses*

144 Descriptive statistics were used to compare the sociodemographic characteristics of
145 the two study cohorts. The effect of the policy on in-hospital formula supplementation rates
146 and on overall patterns of breastfeeding were assessed using t-tests for continuous variables
147 and chi-square tests for categorical variables. Kaplan-Meier survival curves were constructed
148 to compare the overall duration of any or exclusive breastfeeding between the two cohorts,
149 and to assess any dose-response relationship between the amount of in-hospital formula
150 supplementation and the time to cessation of any or exclusive breastfeeding in the total
151 sample. All Kaplan-Meier survival curves were compared using a log-rank test of equality or

152 a trend test of the survival functions, whichever was appropriate⁽⁴¹⁾. Finally, to assess
153 independent associations between the infant formula policy, the amount of in-hospital
154 formula supplementation, and the duration of any or exclusive breastfeeding, unadjusted and
155 fully adjusted multivariable Cox proportional hazards regression analyses were performed⁽⁴²⁾.
156 The proportional hazards assumption was tested by assessing the log-log plots of estimated
157 survival curves. For the multivariable analyses, three models were constructed with potential
158 confounders added in turn based on subject matter relevance⁽⁴³⁾. Model 1 adjusted for key
159 socio-demographic variables (maternal age and education, family income, length of residence in
160 Hong Kong, returning to work postpartum and study site), Model 2 further adjusted for
161 maternal and birth data (parity, attendance at antenatal childbirth and breastfeeding classes,
162 and delivery type), and Model 3 further adjusted for breastfeeding-related variables (intention
163 to exclusively breastfeed, participant's own breastfeeding status, previous breastfeeding
164 experience, and husband's infant feeding preference). The variables entered into the
165 multivariable models were selected because they were factors that have been shown to
166 significantly affect breastfeeding duration in this population^(32; 39) or they were characteristics
167 that significantly differed between the two study cohorts ($P < 0.05$). In multivariable models
168 using the pooled sample of participants, further adjustment was made for study cohort. For all
169 analyses, participants who were lost to follow-up were censored at the time of last contact. All
170 data were analysed using Stata version 13.1 statistical software (Stata Corp, College Station,
171 Tx, USA) with a 5% level of significance used in all statistical tests.

172 In all multivariable models we adjusted for key sociodemographic variables (maternal
173 age, education, family income, length of residence in Hong Kong, parity, previous breastfeeding
174 experience, planning to exclusively breastfeed, husband's feeding preference, and returning to
175 work postpartum) that have been shown to significantly affect breastfeeding duration in this
176 population

177 **Results**

178 From June 2006 to July 2007, 1417 mother-infant pairs were recruited from four study
179 sites to form Cohort 1 baseline sample. Following policy implementation in April 2010, a
180 second cohort of 1287 mother-infant pairs were recruited from the same four study sites. A
181 total of 2560 mother-infant pairs were included in the final analysis (Figure 1).

182 The sociodemographic characteristics of both cohorts are presented in Table 1. There
183 were no differences in participant age and the education levels of the two cohorts. Participants
184 in Cohort 2 were more likely to be multiparous, have previous breastfeeding experience, and
185 be planning to exclusively breastfeed. Cohort 2 participants were also less likely to have
186 attended antenatal childbirth and breastfeeding classes and be intending to return to work
187 within 6 months postpartum. The husbands of participants in Cohort 2 were less likely to
188 explicitly prefer exclusive breastfeeding for the infant and more likely to have no particular
189 infant feeding preference.

190 The mean number of infant formula supplements given to infants in the first 24 hours
191 of life was 2.62 (standard deviation; SD=2.43) before policy implementation and 1.17
192 (SD=1.94) after implementation ($P<0.001$). In Cohort 1, the mean proportions of breast milk
193 feeds given to infants in the first 24 hours of life, in the second 24 hours of life, and for the
194 total hospital stay were 64.4% (SD=34.7), 72.0% (SD=27.0), and 68.2% (SD=27.0),
195 respectively. In Cohort 2, the mean proportions of breast milk feeds given to infants were
196 83.3% (SD=29.1), 86.2% (SD=23.0), and 84.2% (SD=23.2), respectively. All comparisons
197 were statistically significant at a level of $P<0.001$. After implementation of the infant formula
198 policy, more mothers (41.3% versus 17.7%) exclusively breastfed during hospitalization
199 (Figure 2).

200 The median duration of breastfeeding increased from 8 to 12.5 weeks after policy
201 implementation. Figure 3 shows that the risk of breastfeeding cessation was significantly
202 lower after the policy implementation ($P<0.001$), but that there was no significant change in

203 the risk of stopping exclusive breastfeeding ($P=0.58$). Even after adjusting for potential
204 confounding variables (Table 2), infants in Cohort 2 had an approximately 20% lower risk of
205 cessation of any breastfeeding (hazard ratio; HR=0.81; 95% confidence interval; CI, 0.73 to
206 0.90) but there was no change in the risk of stopping exclusive breastfeeding (HR=1.01; 95%
207 CI, 0.93 to 1.11).

208 In the pooled sample, infants who were supplemented with infant formula had an
209 increased risk of cessation of any and exclusive breastfeeding with higher levels of
210 supplementation than infants who received no in-hospital formula supplementation (exclusive
211 breastfeeding) (Figure 4). In the fully adjusted model, infants who received high-partial
212 breastfeeding during the hospital stay (<20% infant formula) had an approximately 30%
213 increased risk of breastfeeding cessation (HR=1.29, 95% CI, 1.15 to 1.46) and infants who
214 received medium-partial (20-80% infant formula) and low-partial breastfeeding (>80% infant
215 formula) had a 65% to 75% increased risk discontinuing breastfeeding (Table 3) than infants
216 who were exclusively breastfed. The effect of in-hospital formula supplementation on the
217 overall duration of exclusive breastfeeding was similar. Infants who were high-, medium- and
218 low-partially breastfed had an increased risk of breastfeeding cessation of approximately
219 20%, 50% and 75%, respectively. The log-log plots for all Cox regression models showed
220 that the proportional-hazards assumption was not violated.

221 **Discussion**

222 After public hospitals implemented a policy of paying market price for infant formula,
223 in-hospital formula supplementation of breastfeeding babies significantly decreased, the
224 overall risk of breastfeeding cessation decreased, and the median duration of breastfeeding
225 increased from 8 to 12.5 weeks. Overall, breastfeeding duration was significantly longer after
226 policy implementation, even after adjusting for confounding variables. However, the overall
227 duration of exclusive breastfeeding was unchanged, despite the finding that significantly more
228 participants in Cohort 2 had intended to exclusively breastfeed. Over the first 6 months, only

229 about one-half of all breastfeeding mothers in both cohorts were breastfeeding exclusively.
230 Similarly, Feldman-Winter et al.⁽²³⁾ also found that removing free infant formula samples
231 from discharge packs given to new mothers increased overall breastfeeding duration but failed
232 to increase exclusive breastfeeding duration. Although breastfeeding intention is a strong
233 predictor of the overall duration of any breastfeeding^(44; 45), exposure to hospital practices that
234 are consistent with the BFHI has been shown to strongly affect women's achievement of their
235 exclusive breastfeeding goals^(38; 46). Thus, further improvement in hospital practices that
236 support breastfeeding would likely help to improve exclusive breastfeeding rates. It is also
237 possible that breastfeeding mothers do not receive enough support once back in their
238 communities⁽⁴⁷⁾, and formula supplements provide reassurance to anxious new parents⁽⁴⁸⁾.
239 High rates of maternal employment may also affect rates of exclusive breastfeeding, with
240 infant formula often introduced in preparation for a return to work⁽⁴⁹⁾. In addition, infant
241 formula companies have successfully perpetuated and reinforced the now widely accepted
242 myth that many mothers do not produce sufficient breast milk to exclusively breastfeed and
243 that some formula supplementation is required to meet infant nutritional needs⁽¹⁶⁾.

244 The present study highlighted that infants supplemented during postpartum
245 hospitalization are substantially less likely to breastfeed at any time point compared with
246 exclusively breastfed infants. Evidence of a dose-response relationship between the amount of
247 in-hospital formula supplementation and the overall duration of any or exclusive
248 breastfeeding was also found; a finding that has not previously been shown. This pattern
249 suggests that protecting infants from formula supplementation in the early postpartum period
250 may substantially improve breastfeeding duration, which is consistent with previous
251 research^(50; 51; 52). However, some researchers have suggested that early supplementation with
252 infant formula may be an indicator rather than a cause of breastfeeding difficulties⁽⁵³⁾.
253 Nevertheless, infant formula supplementation occurs too frequently in healthy breastfeeding
254 newborns, and even after implementation of the policy, almost 60% of infants received

255 formula before hospital discharge. Few infants in this study would meet the criteria for
256 medically indicated supplementation^(14; 54) as they were all full-term, healthy newborns
257 without any major medical complications. Many supplements were given in the first 24 hours
258 after birth, earlier than most medical indications for supplementation would be apparent (i.e.,
259 excess weight loss, delayed lactogenesis, hyperbilirubinemia, or significant dehydration)⁽¹⁴⁾.
260 Therefore, further reductions in the in-hospital formula supplementation rates of breastfeeding
261 newborns are required to meet the BFHI standard of only providing supplements when
262 medically necessary. In addition, new mothers and health workers should be clearly informed
263 of the health risks associated with formula supplements and the negative effect of these
264 supplements on breastfeeding continuation⁽⁵⁵⁾.

265 The infant formula policy implementation was widely discussed and publicized during
266 the extended interval between the decision and the actual implementation. Although there
267 were no other major breastfeeding policy changes implemented in public hospitals during the
268 interval between data collection, there were many discussions at the institutional level about
269 how to make public hospitals more baby-friendly and about the process of obtaining BFHI
270 accreditation. Thus, it is possible that the increased awareness about the reasons for the policy
271 and the negative consequences of indiscriminate infant formula supplementation contributed
272 more to the changes observed than the perceived financial incentives. However, removing
273 free infant formula from hospitals communicates to all staff that the hospital supports
274 breastfeeding. It also reinforces the message that infant formula is not harmless and that
275 breastfeeding babies should only be provided with supplements when medically necessary. It
276 is also important to note that removing the free supply of infant formula necessitates
277 improving other hospital practices that support breastfeeding. In another separate study⁽⁵⁶⁾,
278 there was also substantial improvement in the early initiation of breastfeeding after the infant
279 formula policy change. Although cause and effect cannot be established in observational
280 studies such as this, we believe the findings of this current study do support the WHO

281 position that the provision of free infant formula to hospitals encourages and promotes
282 formula supplementation⁽¹⁸⁾.

283 To the knowledge of the authors, this is the first study to specifically evaluate the
284 effect of stopping free infant formula on in-hospital formula supplementation rates and
285 breastfeeding duration. Participant dropout rates in the present study were low in both
286 cohorts, and breastfeeding follow-up data were collected on 95.4% of the sample. However,
287 the present study has some limitations. First, participation was voluntary and it is possible that
288 women who had a more positive view of breastfeeding were more willing to take part. Data
289 on those who refused to participate, or the proportion of eligible mothers who chose not to
290 participate are not available. However, the pattern of refusal was observed to be similar in
291 both cohorts. Second, breastfeeding continuation data were collected by maternal self-report
292 and it is possible that mothers did not accurately report the duration of any or exclusive
293 breastfeeding. The regular follow-up in the present study is likely to have minimized any
294 recall bias and previous research has found that maternal reporting of breastfeeding initiation
295 and duration is accurate for up to 20 years after the period of breastfeeding^(57; 58). Third, the
296 lack of a comparison group does limit the attribution of observed changes directly to the new
297 formula policy. However, as the policy was implemented in all public and most private
298 hospitals at the same time, recruiting participants for a comparison group was not possible.
299 Finally, because this study evaluated breastfeeding rates in two different time periods, and the
300 5-year period between recruitment of the two study cohorts also limits the ability to attribute
301 the changes in breastfeeding practices directly to the change in infant formula policy.

302 Although implementation of the policy was first scheduled in 2007, numerous delays meant
303 that there was an unexpected extended interval between pre- and post-policy data collection.
304 It is possible that breastfeeding practices may have naturally improved over this time period,
305 independent of the policy change. However, breastfeeding data collected for another study⁽⁵⁹⁾
306 from the same hospitals with the same participant selection criteria, immediately prior to the

307 policy implementation, show that there was no change in breastfeeding duration in the time
308 interval between planned and actual policy implementation (see Figure S1). Furthermore, as
309 previously highlighted, the delay in policy implementation did provide public hospital
310 management and staff with more time to have in-depth discussions about the rationale for the
311 policy, how to improve hospital breastfeeding practices, and how to become more baby-
312 friendly.

313 **Conclusion**

314 The present study shows that rates of formula supplementation were significantly
315 reduced and breastfeeding duration increased after hospitals stopped accepting free infant
316 formula from manufacturers. However, the duration of breastfeeding in Hong Kong mothers
317 still remains far short of the recommended 6 months of exclusive breastfeeding and continued
318 breastfeeding thereafter for up to 2 years. To further improve hospital practices, institutional
319 commitment is required to ensure that all new mothers receive adequate postnatal
320 breastfeeding support consistent with WHO guidelines. Evidence-based guidelines on
321 indicators for introducing infant formula that are consistent with the BFHI ten steps will also
322 help to further decrease the rates of formula supplementation to expected levels.

323

324 **Figure Caption List**

325 **Fig. 1** Participant recruitment flow diagram

326 **Fig. 2** In-hospital pattern of breastfeeding by study cohort

327 **Fig. 3** Kaplan-Meier survival estimates of the duration of (a) any breastfeeding and (b)
328 exclusive breastfeeding by study cohort

329 **Fig. 4** Kaplan-Meier survival estimates of the duration of (a) any breastfeeding and (b)
330 exclusive breastfeeding by the amount of in-hospital breastfeeding

331 **Fig. S1** Kaplan-Meier survival estimates of the duration of any breastfeeding in the two study
332 cohorts and during the interval between the planned and actual policy implementation

333 Note: The 2006-7 and 2011-12 cohorts are Cohort 1 and Cohort 2 in the study, respectively.

334 The 2010 cohort (n=499) were recruited in a study conducted during the A/H1N1 pandemic

335 to investigate influenza like illness and influenza vaccine uptake in pregnant women and

336 respiratory infections in infants up to 6 months of age ⁽⁵⁹⁾. Breastfeeding data were collected

337 up to 6 months postpartum but have not been previously published.

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Table 1 Comparison of the characteristics of the two study cohorts

Demographic Variable	Total N (%) N=2560	Cohort 1 N (%) N= 1320	Cohort 2 N (%) N= 1240	p value
Maternal age				.193
18-24 years	161 (6.3)	88 (6.7)	73 (5.9)	
25-29 years	611 (23.9)	303 (23.0)	308 (24.5)	
30-34 years	1138 (44.5)	609 (46.1)	529 (42.7)	
≥ 35 years	650 (25.4)	320 (24.2)	330 (26.6)	
Maternal education				.181
Primary	78 (3.1)	47 (3.6)	31 (2.5)	
Secondary	1464 (57.2)	763 (57.8)	701 (56.5)	
University degree or above	1018 (39.8)	510 (38.6)	508 (41.0)	
Monthly family income (HKD) [†]				.004
<\$15,000	499 (19.8)	287 (22.4)	212 (17.1)	
\$15,000-\$29,999	873 (34.6)	430 (33.5)	443 (35.7)	
≥ \$30,000	1152 (45.6)	567 (44.2)	585 (47.2)	
Length of Residence in Hong Kong				<.001
< 5 years	239 (9.3)	147 (11.1)	92 (7.4)	
5 to ≥ 15 years	740 (28.9)	329 (24.9)	411 (33.2)	
Since birth	1581 (61.8)	844 (63.9)	737 (59.4)	
Return to work ≤ 6 months post-partum				<.001
No	788 (30.8)	347 (26.3)	441 (35.6)	
Yes	1772 (69.2)	973 (73.7)	799 (64.4)	
Parity				.012
Primiparous	1471 (57.5)	790 (59.9)	681 (54.9)	
Multiparous	1089 (42.5)	530 (40.2)	559 (45.1)	
Attended antenatal childbirth class				<.001
No	1140 (44.5)	459 (34.8)	681 (54.9)	
Yes	1420 (55.5)	861 (65.2)	559 (45.1)	
Attended antenatal breastfeeding class				<.001
No	1440 (56.3)	614 (46.5)	826 (66.6)	
Yes	1120 (43.8)	706 (53.5)	414 (33.4)	
Delivery type				<.001
Spontaneous vaginal delivery [§]	1929 (75.4)	953 (72.2)	976 (78.7)	
Assisted vaginal delivery	164 (6.4)	104 (7.9)	60 (4.8)	
Planned caesarean delivery	217 (8.5)	114 (8.6)	103 (8.3)	
Emergency caesarean delivery	250 (9.8)	149 (11.3)	101 (8.2)	
Planning to exclusively breastfeed				<.001
No	745 (29.1)	474 (35.9)	271 (21.9)	
Yes	1815 (70.9)	846 (64.1)	969 (78.2)	
Participant breastfed as a child				.039
No	1435 (56.1)	714 (54.1)	721 (58.2)	
Yes	1125 (44.0)	606 (45.9)	519 (41.9)	
Previous breastfeeding experience				.001
No	1621 (63.3)	877 (66.4)	744 (60.0)	
Yes	939 (36.7)	443 (33.6)	496 (40.0)	
Husband's Infant feeding preference				<.001
Breastfeeding only	1343 (52.5)	815 (61.7)	528 (42.6)	
Infant Formula & mixed feeding	340 (13.3)	255 (19.3)	85 (6.9)	
No preference	877 (34.3)	250 (18.9)	627 (50.6)	
Study site				<.001
Hospital A	716 (28.0)	394 (29.9)	322 (26.0)	
Hospital B	609 (23.8)	339 (25.7)	270 (21.8)	
Hospital C	627 (24.5)	290 (22.0)	337 (27.2)	
Hospital D	608 (23.8)	297 (22.5)	311 (25.1)	

HKD, Hong Kong Dollar; [†]1 HKD = 7.78 USD; [§] Spontaneous vaginal delivery refers to a birth without the use of drugs or other methods to induce labor and delivery, and a birth without the use of forceps or vacuum extraction.

Table 2 Association between study cohort and duration of any and exclusive breastfeeding

Study cohort	Any Breastfeeding			
	Unadjusted HR (95% CI)	Model 1 HR (95% CI) [†]	Model 2 HR (95% CI) [‡]	Model 3 HR (95% CI) [§]
Cohort 1	1	1	1	1
Cohort 2	0.81 (0.74-0.88)	0.82 (0.74-0.90)	0.79 (0.72-0.87)	0.81 (0.73-0.90)
Exclusive Breastfeeding				
Cohort 1	1	1	1	1
Cohort 2	0.98 (0.91-1.06)	0.99 (0.91-1.08)	0.98 (0.90-1.07)	1.01 (0.93-1.11)

HR, hazard ratio; CI, confidence interval

[†] Adjusted for maternal age, maternal education, family income, length of residence in Hong Kong, returning to work, and study site

[‡] Further adjusted for parity, childbirth class attendance, breastfeeding class attendance and delivery type

[§] Further adjusted for intention to exclusively breastfeed, participant's own breastfeeding status, previous breastfeeding experience and husband's infant feeding preference.

Table 3 Association between in-hospital proportion of breastfeeding and duration of any and exclusive breastfeeding

Amount of in-hospital breastfeeding	Prevalence (%)	Any Breastfeeding			
		Unadjusted HR (95% CI)	Model 1 HR (95% CI) [†]	Model 2 HR (95% CI) [‡]	Model 3 HR (95% CI) [§]
Exclusive	29.1	1	1	1	1
High-partial	27.5	1.34 (1.20-1.51)	1.34 (1.19-1.51)	1.34 (1.19-1.51)	1.29 (1.14-1.46)
Medium-partial	37.9	1.75 (1.57-1.95)	1.75 (1.56-1.96)	1.79 (1.59-2.02)	1.68 (1.49-1.90)
Low-partial	5.5	1.86 (1.53-2.27)	1.81 (1.48-2.21)	1.97 (1.58-2.44)	1.73 (1.39-2.16)
Exclusive Breastfeeding					
Exclusive	29.1	1	1	1	1
High-partial	27.5	1.26 (1.14-1.40)	1.28 (1.15-1.42)	1.28 (1.15-1.42)	1.22 (1.10-1.36)
Medium-partial	37.9	1.44 (1.31-1.58)	1.52 (1.37-1.68)	1.56 (1.40-1.73)	1.47 (1.32-1.64)
Low-partial	5.5	1.74 (1.45-2.09)	1.80 (1.49-2.17)	1.91 (1.56-2.33)	1.69 (1.38-2.07)

HR, hazard ratio; CI, confidence interval

[†]Adjusted for maternal age, maternal education, family income, length of residence in Hong Kong, returning to work, study site and study cohort

[‡]Further adjusted for parity, childbirth class attendance, breastfeeding class attendance and delivery type

[§]Further adjusted for intention to exclusively breastfeed, participant's own breastfeeding status, previous breastfeeding experience and husband's infant feeding preference.