

1 **Determinants of low breastfeeding self-efficacy amongst mothers of children**
2 **aged less than six months old: Results from the BADUTA Study in East Java,**
3 **Indonesia**

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65 **Abstract**

66 **Background**

67 Despite the increasing rate of exclusive breastfeeding practice in Indonesia, supportive
68 interventions are still required. Breastfeeding self-efficacy of mothers is a key factor positively
69 associated with optimum breastfeeding practices. Our analysis aims to assess the determinants of
70 low breastfeeding self-efficacy amongst a sample of women with children aged under six months
71 in Malang and Sidoarjo Districts, East Java, Indonesia.

72 **Methods**

73 We used information from 1210 mothers of children aged <6 months recruited in the BADUTA
74 study conducted in 2015-2016 in Malang and Sidoarjo Districts. The outcome variable in this
75 analysis was mothers' self-efficacy for breastfeeding using the 14 statements in the Breastfeeding
76 Self Efficacy-Short Form. In total, 17 potential predictors of breastfeeding self-efficacy were
77 evaluated, categorised into six sub-groups: (1) context/demographic variables; (2) household
78 characteristics; (3) maternal characteristics; (4) child characteristics; (5) breastfeeding
79 characteristics; and (6) antenatal and delivery care characteristics. Logistic regression analyses
80 were employed to examine factors associated with mothers' self-efficacy with breastfeeding.
81

82 **Results**

83 More than half of the women had a low level of self-efficacy. Factors associated with low
84 breastfeeding self-efficacy were low levels of education, i.e. completed primary school or lower
85 (aOR=1.95, 95%CI: 1.20-3.15), completed junior high school aOR=2.30; 95%CI: 1.44-3.69),
86 and completed senior high school (aOR=2.01, 95%CI: 1.34-3.00); working outside the house
87 (aOR=1.72, 95% CI: 1.26-2.35); never received any advice on breastfeeding (aOR=1.37, 95%CI:
88 1.04-1.81) and low knowledge of breastfeeding (aOR=1.38, 95%CI: 1.04-1.85). Problems
89 encountered with breastfeeding was also emerged as a significant predictor for low breastfeeding
90 self-efficacy, either for mothers receiving solutions (aOR=2.16, 95%CI: 1.58-2.95) or those not
91 receiving any solutions (aOR=2.65, 95% CI: 1.91-3.67). Furthermore, mothers who had cesarean
92 section deliveries were more likely to have low breastfeeding self-efficacy (aOR=1.33, 95%CI:
93 1.06-1.68); while mothers exposed to three or more breastfeeding interventions were more likely
94 to have a high level of breastfeeding self-efficacy (aOR=1.84, 95%CI: 1.03-3.27).
95

96 **Conclusions**

97 Multipronged breastfeeding education programs and support are required to improve women's
98 self-efficacy with breastfeeding. Improved access to breastfeeding counsellors, active support for
99 mothers following cesarean delivery, and increased supporting facilities at workplaces are
100 essential to improve self-efficacy with breastfeeding.
101

102
103 **Keywords:** breastfeeding; self-efficacy; children aged <6 months; BADUTA study; Malang
104 District; Sidoarjo District; Indonesia

105

106 **Introduction**

107 The importance of breastfeeding for both babies and mothers has been widely acknowledged [1].
108 For infants, exclusive breastfeeding is strongly recommended in their first six months of life to
109 provide the ideal nutrition for optimal growth and development [2]. After this period, infants
110 should continue to receive breast milk along with appropriate complementary feeding until
111 reaching at least two years of age [3]. The short-term and long-term effects of breastfeeding for
112 babies include the short-term effects of reductions in the risk of diarrhea and respiratory
113 infections [4], the long-term effects of protection against overweight and obesity, as well as a
114 positive effect on intelligence [5]. For mothers, breastfeeding helps to increase child spacing, and
115 reduce the risk of mastitis, postpartum haemorrhage, depression, as well as ovarian and breast
116 cancer [3, 6, 7].

117

118 In Indonesia, the rate of exclusive breastfeeding is increasing, although supportive interventions
119 are still required. Based on the last two Indonesia Demographic and Health Survey data, the
120 national rate of exclusive breastfeeding has increased from 32.4% in 2007 [8] to 41.5 % in 2012
121 [9] and to 52.0% in 2017 [9]. However, the 2018 Basic Health Survey from the Ministry of
122 Health reported the national rate of exclusive breastfeeding amongst infants aged 0-5 months
123 was 74.5%, ranging from 72.7% in urban areas to 76.6% in rural areas [10].

124

125 There is a range of different factors associated with breastfeeding practices, including the
126 intention to breastfeed, maternal age, maternal education, smoking status, economic status,
127 knowledge of breastfeeding, advice from health professionals, problems encountered during

128 breastfeeding, or child's birth weight [11]. One of the factors also reported positively associated
129 with breastfeeding is the mothers' breastfeeding self-efficacy. Self-efficacy, an element of the
130 social cognitive theory of Bandura [12], is a predictor of health-related behaviours [13]. Self-
131 efficacy consists of two components: (1) the outcome expectancy or the belief that a given
132 behaviour will produce a particular outcome, and (2) self-efficacy expectancy or an individual's
133 conviction that they can successfully perform certain tasks or behaviours to produce the desired
134 outcome [12, 13]. We defined breastfeeding self-efficacy as the mothers' beliefs and confidence
135 in their ability to successfully breastfeed their infants [14]. Breastfeeding self-efficacy is an
136 important predictor of the duration [15] as well as the exclusivity of breastfeeding [16, 17]. Thus,
137 the assessment of mothers' breastfeeding self-efficacy will help in identifying those women who
138 need more support for breastfeeding during the postnatal period [15].

139

140 The Global Alliance for Improved Nutrition (GAIN) and the University of Sydney, in
141 collaboration with the Centre for Health Research, Universitas Indonesia (CHR-UI), SEAMEO-
142 RECFON, and the London School Hygiene and Tropical Medicine, conducted the BADUTA
143 Study, an impact evaluation of the BADUTA Program, in 2015 to 2017 in East Java, Indonesia
144 [18]. Our analysis used the cross sectional surveys conducted as part of the BADUTA Program
145 evaluation with the aim of examining factors associated with low breastfeeding self-efficacy
146 amongst the sample of women with children aged under six months in Malang and Sidoarjo
147 Districts, East Java, Indonesia.

148

149 **Methods**

150 **Data source and study sites**

151 This analysis used data derived from the BADUTA study conducted in 2015-2016 in Sidoarjo
152 and Malang District of East Java, Indonesia. In both districts, we selected six sub-districts to
153 conduct the trial. The sub-districts in Sidoarjo District were Tulangan, Wonoayu, Sidoarjo,
154 Prambon, Taman, and Krian; and in Malang District were Dampit, Turen, Tumpang,
155 Poncokusumo, Gondanglegi, and Jabang. We have presented detailed information about the
156 BADUTA study protocol elsewhere [18]. We used data for this analysis from two independent
157 cross-sectional surveys conducted in 2015 at the beginning, and in 2017 at the end of the project.
158 To assess breastfeeding self-efficacy amongst mothers, we only used information collected from
159 mothers of children less than six months of age.

160

161 **Background information on study sites**

162 East Java Province is one of the provinces in Indonesia located in Java Island, and the capital is
163 Surabaya City, the second-largest city in Indonesia. The total population of East Java is
164 approximately 37 million people, the second-most populous province in the country [19].
165 Malang District, located in the centre-south region of East Java Province, has an estimated total
166 population in 2017 of 2,576,596 people [20]. Most of the people were working as labourers or
167 private employees (37.63%) [20]. Sidoarjo District, located north of Surabaya City, has an
168 estimated total population in 2017 of 2,207,600 people [21].

169

170

171 **Study design and samples of the study**

172 We conducted an observational epidemiological study to examine factors associated with low
173 breastfeeding self-efficacy. For our analysis, we combined the data from the baseline and endline
174 cross-sectional surveys, for both the intervention and comparison groups. In the baseline survey,
175 the sample size was 409 pregnant women and 2435 children under two years old [18]. In the
176 endline survey, the sample for pregnant women and children under two years old was 642 and
177 2740, respectively. For this analysis, we only used information from 1210 women of children
178 under six months (575 from the baseline and 635 from the endline survey).

179

180 **Survey instruments and field personnel**

181 House-to-house interviews were carried out using pre-tested and structured questionnaires. The
182 information collected in this study included socioeconomic and demographic characteristics;
183 infant feeding practices as well as the intention of the mother to breastfeed and self-efficacy for
184 breastfeeding of the mothers; child morbidity, reported by mother/caregiver; as well as contact
185 with the health system and exposure to the interventions. Information about the mothers' self-
186 efficacy for breastfeeding was collected using the Breastfeeding Self-Efficacy Scale-Short Form
187 questionnaire developed by Dennis [13], a 14-item instrument aimed at measuring breastfeeding
188 confidence.

189

190 At the baseline, we established eight fieldwork teams in each district. However, in the endline
191 study, we established ten fieldwork teams to shorten the duration of data collection. For

192 interviews, each team consisted of one field coordinator, one assistant field coordinator, and ten
193 enumerators. All field coordinators, assistant field coordinators, and enumerators attended a
194 training program for a week, including two days of supervised field practice. The training aimed
195 to familiarise the enumerators, and their coordinators, with the questionnaire, sampling
196 methodology, as well as interview techniques.

197

198 Data were collected electronically on hand-held devices using CommCare system developed by
199 Dimagi [22]. Information was recorded on structured, error detecting forms on tablets and then
200 dispatched directly to a server for cleaning and merging. Field supervisors and a data manager
201 monitored the data quality on a regular basis.

202

203 **Outcome variable**

204 The outcome variable in this analysis was mothers' self-efficacy for breastfeeding as a binary
205 variable (low or high self-efficacy on breastfeeding). For each of the 14 statements in the
206 Breastfeeding Self Efficacy-Short Form, mothers were asked to give a score from 1 to 5 that
207 offered a range of answer options from "strongly disagree" to "strongly agree," respectively. All
208 scores were then added to calculate the total score. As in other studies, we based the
209 classification of breastfeeding self-efficacy on the median of the total score [23, 24]. The use of
210 median was supported by previous studies using either mean and or median as the cut-off point
211 to categorise low and high breastfeeding self-efficacy [24-26]. We classified mothers who scored
212 less than the median as having a low self-efficacy on breastfeeding, mothers who scored equal to
213 or above the median as having a high self-efficacy.

214

215 **Potential predictors**

216 The potential predictors were selected using the analytical framework shown in Figure 1. In
217 total, there were 17 potential predictors of breastfeeding self-efficacy included in the analyses,
218 categorised into six sub-groups: (1) context/demographic variables; (2) household
219 characteristics; (3) maternal characteristics; (4) child characteristics; (5) breastfeeding
220 characteristics; and (6) antenatal and delivery care characteristics.

221 ---Figure 1 to be inserted here---

222

223 In the group of contextual and intervention variables, we constructed a composite variable
224 indicating the total number of interventions from 13 variables representing breastfeeding-related
225 interventions in the BADUTA study. Those 13 interventions were: (1) discussing breastfeeding
226 with cadres on a home visit during pregnancy; (2) discussing exclusive breastfeeding in pregnant
227 women's class during pregnancy; (3) did not receive any free formula milk after delivery (part of
228 the Baby Friendly Hospital Initiative); (4) discussing breastfeeding with a village facilitator
229 during pregnancy; (5) watching a breastfeeding-related video shown by the village facilitator
230 during pregnancy; (6) discussing the topic of breastfeeding in emo-demo sessions; (7) receiving
231 mobile phone messages on early initiation of breastfeeding; (8) receiving mobile phone
232 messages on the benefits of colostrum; (9) receiving mobile phone messages on exclusive
233 breastfeeding; (10) receiving mobile phone messages on exclusive breastfeeding problems and
234 how to handle them; (11) receive breastfeeding counseling by midwives during pregnancy; (12)
235 receive breastfeeding counseling by cadres during pregnancy; and (13) watching TV

236 commercials about breastfeeding. For each question, answers were scored "1 (one)" if the
237 mothers answered "yes," and scored "0 (zero)" if answered otherwise. All scores were then
238 summed to obtain a total intervention score. The total intervention score for each individual was
239 further categorized into "no intervention" (total score = 0); "one intervention" (total score = 1);
240 "two interventions" (total score = 2), and "three or more intervention" (total score is ≥ 3). The
241 total intervention score was calculated for all women from both the intervention and comparison
242 groups included in this analysis. Our purpose was to assess the impact of any breastfeeding
243 intervention, whether from the study interventions or routine programs on breastfeeding self-
244 efficacy. We have documented a detailed explanation of the interventions in the BADUTA study
245 elsewhere [18].

246

247 In household characteristics, the household wealth index variable was constructed using
248 Principal Component Analysis (PCA) [27] using an inventory of the household's facilities and
249 assets, i.e., ownership of electricity, drinking water, toilet facility, type of toilet facility, fecal
250 final disposal and ownership of bicycle, television, water heater, 12kg of LPG, fridge, and car.
251 This index was used to rank households and classify them into five quintiles, i.e., poorest, poor,
252 middle, rich, and richest categories of households.

253

254 In the breastfeeding group, one composite variable was developed to represent mothers' level of
255 knowledge about breastfeeding. We constructed this variable from five questions: (1) the best
256 food or liquid to be provided to children aged < 6 months; (2) the duration for exclusively
257 breastfeeding a child; (3) the duration a child should receive breast milk; (4) the benefits of

258 giving breast milk to children; and (5) the time a child should receive complementary feeding.
259 For each question, score "1 (one)" was assigned to all correct answers, and "0 (zero) for all
260 incorrect answers. All scores were summed to get the total knowledge score, and we calculated
261 the median value. Two categories of knowledge were developed: (1) high level of knowledge,
262 for those whose total knowledge score was greater or equal to the median, and (2) a low level of
263 knowledge for those whose total knowledge score was less than the median. To test if previous
264 experience with feeding infants influenced breastfeeding self-efficacy, we also used an indicator
265 for previous live births as we did not specifically ask the mothers about their earlier
266 breastfeeding experiences.

267

268 **Data analysis**

269 Contingency tables were used to examine the characteristics of all variables (outcome variables
270 and potential predictors) used in the analysis. This was followed by logistic regression analyses
271 to determine factors associated with all outcome variables using ORs (odds ratios) as the
272 estimated measures of association. We used Stata survey commands (svyset) to adjust for the
273 clustering from the cluster randomisation. All estimates presented in this analysis considered the
274 complex sample design.

275

276 In the first step of logistic regression, bivariate analyses were used to assess the relationship
277 between outcome variables and their potential predictors independently. In the second step, we
278 performed multivariate analyses using a backward elimination method to remove all variables
279 not significantly related to the study outcome, with a significance level of 0.05. Two variables

280 selected a priori and retained in the final model regardless of the significance level, were: (1)
281 Period of the survey (baseline or endline) and (2) the fulfilment of the minimum requirement of
282 four antenatal care visits by trimester (met or did not met). In the final model, we obtained the
283 adjusted ORs (aOR) and 95% confidence intervals (95% CIs) for all variables in the model.

284

285 In multivariate analysis, we used the number of breastfeeding interventions as a composite
286 variable. After obtaining the final model (Model #1), we developed the second model by
287 replacing this variable with all the individual exposure to intervention indicators (Model #2). We
288 then retained the other variables in the final model of Model #1 in Model #2. We used Stata/MP
289 software (version 13.1; Stata Corp) for all analyses.

290

291 **Collaborating institutions**

292 This study was conducted by an International Research Consortium that comprises of highly
293 experienced researchers from the University of Sydney (Australia), the London School of
294 Hygiene and Tropical Medicine (LSHTM) (United Kingdom), the Center for Health Research
295 Universitas Indonesia (CHR-UI), the Indonesia Nutrition Foundation for Food Fortification
296 (KFI), and the Southeast Asian Ministers of Education Organization (SEAMEO), Regional
297 Center for Food and Nutrition (RECFON).

298

299

300 **Results**

301 Table 1 shows the frequency distribution of mothers with children under six months by
302 households, mothers, child characteristics, breastfeeding experience and knowledge, antenatal
303 and delivery care services, as well as for women with low breastfeeding self-efficacy.
304 Approximately three-quarters of the mothers were aged 20-34 years, and the majority were
305 housewives. Slightly more than half reported ever receiving some advice on breastfeeding.
306 Almost 32% of mothers reported having a problem during breastfeeding, yet 12% had problems
307 but did not receive any solution. Around 25% of mothers had a low level of knowledge regarding
308 breastfeeding. The characteristics of women with low breastfeeding self-efficacy were similar to
309 all the women in the study except more worked outside their house, more had low levels of
310 knowledge about breastfeeding, and more had experienced problems with breastfeeding. From
311 the six knowledge components used in this analysis, the lowest percentage of correct answers
312 was regarding the time to start complementary feeding (71.7%), followed by the minimum
313 duration children should receive breast milk (74.3%) (Figure 2).

314 ---Table 1 to be inserted here---

315 ---Figure 2 to be inserted here---

316

317 Table 2 presents the distribution of 1210 (575 from the baseline and 635 from the endline
318 surveys) mothers of children aged less than six months who were interviewed in the BADUTA
319 study by contextual, intervention, and breastfeeding characteristics against low self-efficacy
320 status. Based on the interventions received, 40% received at least one intervention on
321 breastfeeding, but less than 8% received three or more interventions. The low percentage of

322 mothers receiving BADUTA interventions is due to the pooled dataset from baseline and endline
323 surveys. At the endline survey, around 33% of women in the comparison group did not receive
324 any breastfeeding interventions, while 67% received at least one type of intervention (47%
325 received one; 17% received two, and 4% received three or more). In the intervention group, 13%
326 of women did not receive any breastfeeding interventions, and 87% received at least one
327 intervention (36% received one; 24% received two, and 27% received three or more
328 interventions).

329 ---Table 2 to be inserted here---

330

331 Over half the women (56%) in the study had low breastfeeding self-efficacy. The median score
332 of breastfeeding self-efficacy in mothers with low efficacy was 35 (SD: 6.33) and in mothers
333 with high self-efficacy was 43 (SD=4.31). As shown in Figure 3, there was a significant
334 difference in the percentage of women with low breastfeeding self-efficacy related to how they
335 were feeding their infants under six months of age ($p < 0.001$). There was no significant
336 difference between the percentage of mothers with low breastfeeding self-efficacy who
337 exclusively or predominantly breastfed their infants. However, the percentage of mothers with
338 low breastfeeding self-efficacy was significantly higher among women who were exclusively or
339 predominantly breastfeeding compared with women feeding with breast milk and formula, or
340 with breast milk and solids/semi-solids, or not breastfeeding at all (Figure 3).

341 ---Figure 3 to be inserted here---

342

343 Figure 4 presents the distribution of the respondents' answers to each component of the
344 Breastfeeding Self-Efficacy Scale. Overall more than 50% of the mothers answered either agree

345 or strongly agree to all components of the Breastfeeding Self-Efficacy Scale score. The highest
346 percentage of agreement was found in mothers who felt able to tell when their baby finished
347 breastfeeding (80%), and the lowest was in mothers who felt they could deal with breastfeeding
348 being time-consuming. As shown in Table 1, low breastfeeding self-efficacy was highest
349 amongst women with lower levels of education, of younger age, and working outside the house.
350 Low breastfeeding efficacy declined as the number of breastfeeding interventions the women
351 received increased.

352 ---Figure 4 to be inserted here---

353

354 Table 3 presents the results of the analysis of factors associated with low breastfeeding self-
355 efficacy. The adjusted odds of low breastfeeding self-efficacy in mothers with a low education
356 level was approximately two times the odds of mothers who have graduated from university or
357 an academy. The odds of having low breastfeeding self-efficacy was higher amongst mothers
358 working outside the house than mothers doing housework (aOR=1.72, 95%CI: 1.26-2.35,
359 p=0.001). All breastfeeding knowledge and experience variables were significant predictors of
360 breastfeeding self-efficacy. We observed significantly higher odds of low breastfeeding self-
361 efficacy amongst mothers who did not receive any advice on breastfeeding (aOR=1.37, 95%CI:
362 1.04-1.81, p=0.025) and amongst those with low knowledge of breastfeeding (aOR=1.38,
363 95%CI: 1.04-1.85, p=0.028). Mothers who reported they had problems with breastfeeding were
364 more likely to have higher odds of low breastfeeding self-efficacy.

365 ---Table 3 to be inserted here---

366

367 Furthermore, this study found that mothers who had a cesarean section delivery had higher odds
368 of having low breastfeeding self-efficacy (aOR=1.33, 95%CI: 1.06-1.68, p=0.015). As expected,
369 the likelihood of having low breastfeeding self-efficacy reduced as the number of interventions
370 the women received increased. In the analysis shown in the supplementary table (Table S1), we
371 replaced the total number of interventions by an indicator of exposure to each specific
372 intervention. It is interesting to see that in general, there was no significant association between
373 each intervention and self-efficacy, except for mothers who were visited by a cadre at home to
374 talk about breastfeeding (aOR=0.32, 95%CI: 0.10-0.99, p=0.048).
375

376 **Discussion**

377 **Main findings**

378 Our study found that more than half of the women with children under six months had a low
379 level of breastfeeding self-efficacy. This was also confirmed in exclusive breastfeeding status of
380 mothers, as a significantly higher percentage of mothers with high breastfeeding self-efficacy
381 exclusive breastfed their babies than those with low breastfeeding self-efficacy. The significant
382 predictors of low breastfeeding self-efficacy included low education level, working outside the
383 house, never receiving any advice on breastfeeding, low knowledge about breastfeeding, and
384 problems encountered with breastfeeding. Mothers who had a cesarean section delivery also had
385 a low self-efficacy for breastfeeding. As expected, the odds of having low self-efficacy were
386 lower as the number of breastfeeding interventions received increased. The findings of this study
387 should assist decision-makers and program managers in designing and implementing supportive
388 interventions to increase mothers' self-efficacy with breastfeeding. Increased self-efficacy will
389 promote optimal breastfeeding practices to the benefit of both mothers and their children.

390

391 **The role of knowledge and education in breastfeeding self-efficacy**

392 We confirmed the relationship between knowledge and breastfeeding self-efficacy in our study.
393 Firstly, mothers with a low level of knowledge regarding breastfeeding were more likely to have
394 lower self-efficacy than those with a high level of knowledge. Secondly, we found that low self-
395 efficacy was associated with lower educational attainments. The level of education mirrors
396 mothers' level of knowledge and awareness, not only about breastfeeding but also health in
397 general, the possibility of having more exposure to health-related information, and

398 comprehension about health information received. A study has reported that mothers with
399 secondary and high school education are more likely to have a higher self-efficacy score than
400 those graduating from university [28]. The difference was assumed due to the mother's
401 occupation, as highly educated mothers were more likely to have a job and work outside the
402 house. However, in our analysis, we have adjusted the association between education or
403 knowledge and breastfeeding self-efficacy for the maternal occupation to remove the
404 confounding of the effects by occupation.

405

406 **Education-based interventions and support to improve breastfeeding self-efficacy**

407 The important role of knowledge and education found in our study indicates the importance of
408 promoting strategies to enhance mothers' and other family members' awareness of breastfeeding.
409 Previous literature has reported the benefits of both prenatal [29-32] and postnatal education and
410 the support mothers received for breastfeeding [33, 34]. It is also important to consider the type,
411 timing, setting, and frequency of education interventions [31]. A systematic review highlighted
412 the importance of support-based initiatives during postnatal care through interaction with
413 lactation experts [35]. The use of combined settings (health facility and community) for health
414 education, not solely in hospitals or community, was reported to be more beneficial than
415 education merely in a health facility [31, 36].

416

417 Furthermore, we found that mothers who had never received any advice on breastfeeding were
418 more likely to have lower breastfeeding self-efficacy than those who had ever received any
419 advice. Interactive and face-to-face education, in addition to the consistent delivery of

420 breastfeeding messages, will increase self-efficacy. Previous literature revealed that combined
421 individual and group counselling is more effective than individual or group counselling only
422 [36]. Multiple intervention contacts, rather than only a single contact intervention, have more
423 favourable outcomes [31, 37]. Thereby, health workers should effectively use every contact
424 opportunity with mothers and other family members, from antenatal to postnatal period, to
425 improve mothers' awareness and self-efficacy with breastfeeding.

426

427 One review found that peer support interventions were also effective in promoting optimum
428 breastfeeding [37], suggesting an opportunity to encourage health-volunteers and mothers, who
429 have successfully breastfed, to support other mothers breastfeeding their children. This analysis
430 found that mothers with breastfeeding problems, particularly those who did not receive any
431 solutions, had a lower self-efficacy than those who never experienced any problems. Peer
432 support will assist first-time mothers to build their confidence in breastfeeding through
433 experience sharing sessions. It will also help support mothers to overcome their breastfeeding
434 challenges and problems.

435

436 Other intervention channels for providing education and support are the use of telephone
437 contacts for discussion or counselling or production of promotional materials such as leaflets,
438 flip charts, DVDs, or workbooks. An experimental study in Brazil found that mothers who
439 received educational interventions, enhanced by a flip chart with illustrations of breastfeeding
440 themes, showed increased breastfeeding self-efficacy [33]. The use of checklists, pamphlets, and

441 audiovisual materials on breastfeeding among recently delivered mothers in hospitals also
442 improved the mothers' self-efficacy for breastfeeding [34].
443 Mothers who delivered by cesarean section in this study were more likely to have low
444 breastfeeding self-efficacy. A finding similar to other studies where women who had delivered
445 by cesarean section were less likely to breastfeed or to delay breastfeeding initiation [38, 39].
446 The problems related to lactogenesis due to abdominal surgery or stress response as a result of
447 delivery complications are hypothesised to contribute to increased difficulty with or early
448 cessation of breastfeeding [38, 40]. Consequently, interventions targeting mothers, both with
449 planned or emergency cesarean section, are required. Support and counselling programs by
450 health workers and lactation counsellors, including postpartum home visits, might be beneficial
451 for these women.

452

453 Previous research reported the critical role of family support to help mothers to breastfeed their
454 children [41]. Women who received praise from other family members had higher scores of
455 breastfeeding self-efficacy than those receiving praise from friends [42]. Thus, the involvement
456 of family members, particularly husbands in educational programs, for example, during prenatal
457 classes, is vital for promoting optimal breastfeeding practices.

458

459 The odds of high self-efficacy with breastfeeding amongst women in this study increased as the
460 number of breastfeeding interventions received by the mothers increased. Many of BADUTA
461 interventions were related to strengthening the existing health system, which is also available in
462 the comparison group. Consequently, in the endline survey, we found a high percentage of

463 women from the comparison group also received breastfeeding interventions. These
464 breastfeeding interventions heavily relied on awareness-raising and education strategies to
465 improve the community's knowledge and skills in breastfeeding. The combined effect of
466 different interventions might reflect a dose-response effect of increasing odds of higher
467 breastfeeding self-efficacy with an increasing number of breastfeeding intervention services
468 received by mothers [43, 44].

469

470 To ensure the quality of support and educational interventions received by mothers, interventions
471 to increase knowledge and skills of health workers, lactation counsellors, community health
472 workers (cadres), particularly concerning their counselling skills, are essential. Trained birth
473 attendants, whose services are still widely used by the community in some settings for mother
474 and childcare, could be trained by health workers to promote breastfeeding amongst pregnant
475 and recently delivered mothers.

476

477 **The role of maternal occupation on breastfeeding self-efficacy**

478 We found a low level of breastfeeding self-efficacy in women working outside their homes.
479 Secondary analysis using nationally representative survey data for Indonesia found that a mother
480 working outside her home was a barrier for optimal breastfeeding practices [45]. A strong reason
481 for this could be the short duration of maternity leave in Indonesia. In the formal sector, only 1.5
482 months of maternity leave is given before and after delivery [46], while in the informal sector,
483 this regulation is often not fully applied. Although the Act of the Republic of Indonesia stated
484 that female workers still breastfeeding their children should be given appropriate opportunities to

485 breastfeed even during working hours [46], supportive breastfeeding facilities are limited or even
486 unavailable. Advocacy, in addition to the development of supportive policy and regulations, to
487 ensure the availability of lactation space and breastfeeding breaks in the workplace is therefore
488 crucial for women working outside their homes [44].

489 **Strengths and limitations**

490 This study has several strengths. It has a large sample size, giving adequate power to analyse the
491 role of different predictors on breastfeeding self-efficacy. It is the first study in Indonesia to
492 examine self-efficacy with breastfeeding in mothers of children aged less than six months. Some
493 limitations are worth noting when interpreting the results. Our results were based on mothers'
494 recall ability, and information provided by respondents was not validated. Another limitation
495 was how mothers responded to breastfeeding self-efficacy questions will be influenced by their
496 current feeding practices, particularly amongst those who decided not to breastfeed their infants.
497 There are other possible determinants of mothers' self-efficacy with breastfeeding that were not
498 analysed as they were not available in the dataset, such as the mothers' previous breastfeeding
499 experience or the level of family support. To partially address previous breastfeeding experience,
500 we examined the association of having had a previous live birth on the odds of low
501 breastfeeding self-efficacy in mothers, and we found no association between them.

502

503

504 **Conclusions**

505 Overall, our study found maternal education, knowledge of breastfeeding, occupation, and mode
506 of delivery as predictors of mothers' breastfeeding self-efficacy. Consequently, multipronged
507 breastfeeding education and support are required to improve women's self-efficacy with
508 breastfeeding. The use of combined settings, individual and group counselling with multiple
509 contact opportunities should be considered by program managers. Effective education strategies
510 and support programs targeting not only mothers but also other family members are required.

511

512 Additionally, efforts to ensure the availability and access to breastfeeding counsellors or peer
513 counsellors will help mothers to increase their confidence in breastfeeding. Training of cadres
514 and traditional birth attendants to provide necessary counselling on breastfeeding will be
515 beneficial to provide continuous support to women. Furthermore, home visits, including those
516 women who delivered with cesarean section, will ensure mothers have ongoing support and
517 overcome challenges or barriers in breastfeeding. Interventions to increase the availability of
518 supporting facilities in the workplace are also required to enhance optimum breastfeeding
519 practices amongst women working outside their homes.

520

521

522 **Declarations**

523 **Ethics approval and consent to participate**

524 We obtained ethics approval from the Faculty of Public Health, Universitas Indonesia
525 (323/H2.F10/PPM.00.02/2016) and Human Research Ethics Committee of the University of
526 Sydney, Australia (Protocol number: 2015/115). We also secured a research clearance from the
527 Ministry of Internal Affairs at the central level, the Office of National Unity, and from the
528 Community Protection branch at the provincial and district levels. We took written informed
529 consent from all respondents before the interview. All individuals included in this research are
530 18 years or older.

531

532 **Consent for publication**

533 Not applicable

534

535 **Availability of data and materials**

536 The datasets used and/or analysed during the current study are available from the corresponding
537 author on reasonable request.

538

539 **Competing interests**

540 The authors declare no conflict of interest. The funders had no role in the design of the study; in
541 the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the
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543

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552

553 **Author Contributions**

554 CRT and MJD designed the study; CRT, MJD, IA and AM performed data analyses; CRT and
555 MJD wrote the original draft of the manuscript; AA, RD, TDT, EF, HK, LM, AA, UF provided
556 data analysis advice; MJD, IA, AA, RD, TDT, EF, HK, LM, AA, UF reviewed the manuscript.
557 All authors read and approved the manuscript.

558

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571

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709 **Figure 2.** Distribution of mothers of children under six months by their answers to each
710 breastfeeding knowledge component, The BADUTA Study in East Java, Indonesia,
711 2015-2016

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713 **Figure 3.** Distribution of mothers with low breastfeeding self-efficacy by the feeding patterns
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715 Indonesia, 2015-2016

716

717 Note: A chi-square statistic was performed to examine the distribution of infants who were
718 exclusively breastfed based on mothers' self-efficacy level. The bars represent 95% CI. Svy
719 commands were used to adjust for the cluster sampling design.

720

721 **Figure 4.** Distribution of mothers of children under six months by their answers to each
722 component of breastfeeding self-efficacy short form (BSES-SF), The BADUTA
723 Study in East Java, Indonesia, 2015-2016

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725 Note: For each question, a score of 1 to 5 was assigned to the responses from "strongly disagree" to
726 "strongly agree." BF=breastfeeding.

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731

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734 knowledge, antenatal and delivery care services as well as breastfeeding self-
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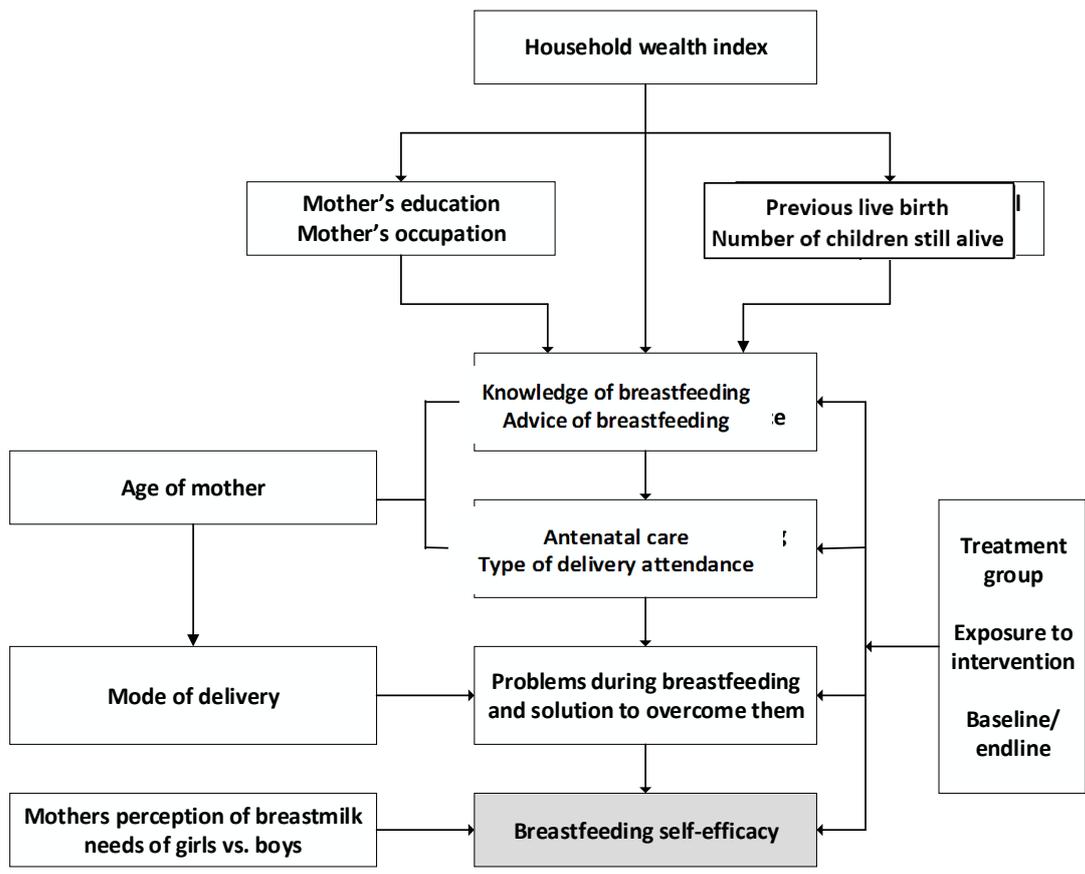
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737 and intervention characteristics and breastfeeding and self-efficacy status, The
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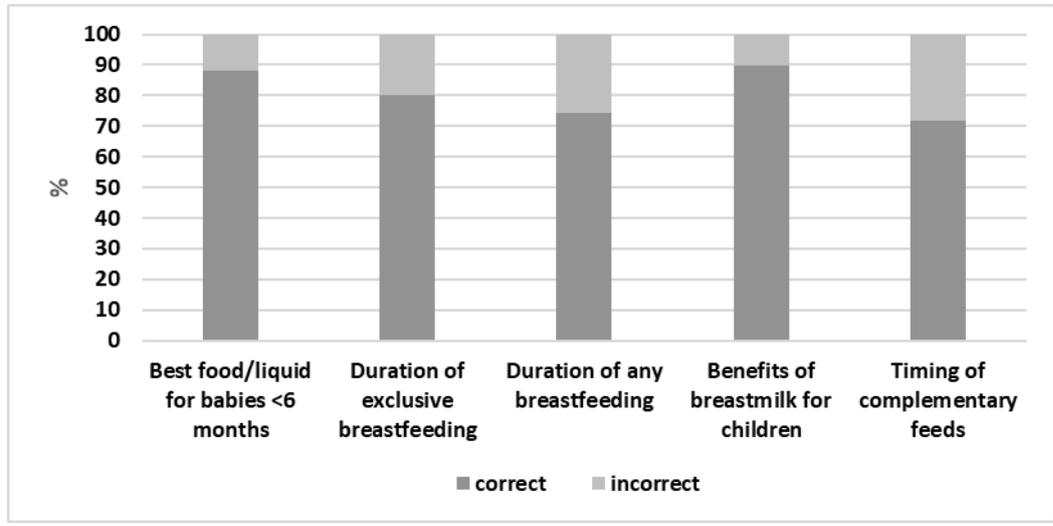
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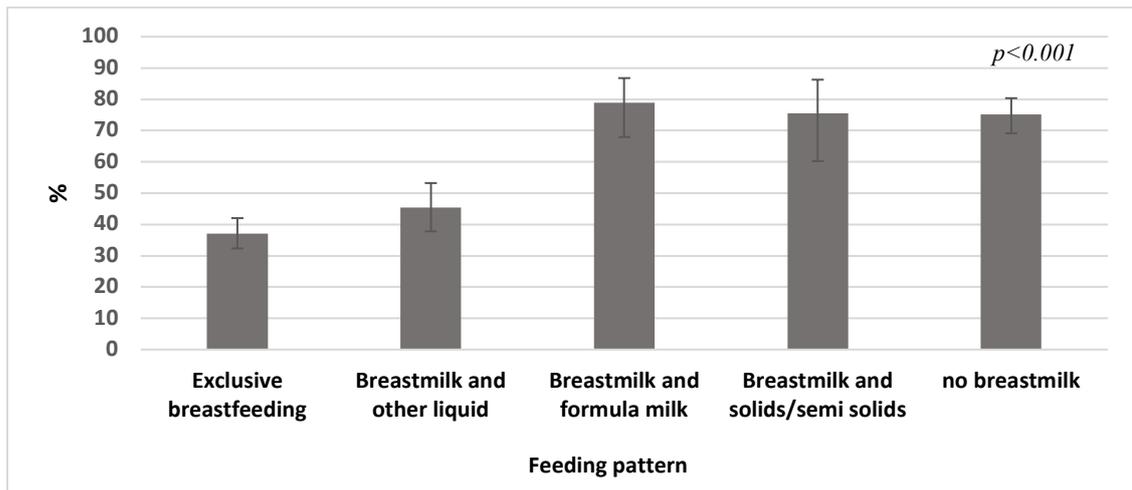
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Figure 1. The analytical framework used to examine factors associated with mothers' low self-efficacy on breastfeeding, The BADUTA Study in East Java, Indonesia, 2015-2016



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Figure 2. Distribution of mothers of children under six months by their answers to each breastfeeding knowledge component, The BADUTA Study in East Java, Indonesia, 2015-2016.



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Figure 3. Distribution of mothers with low breastfeeding self-efficacy by the feeding patterns of their infants under six months of age, The BADUTA Study in East Java, Indonesia, 2015-2016.

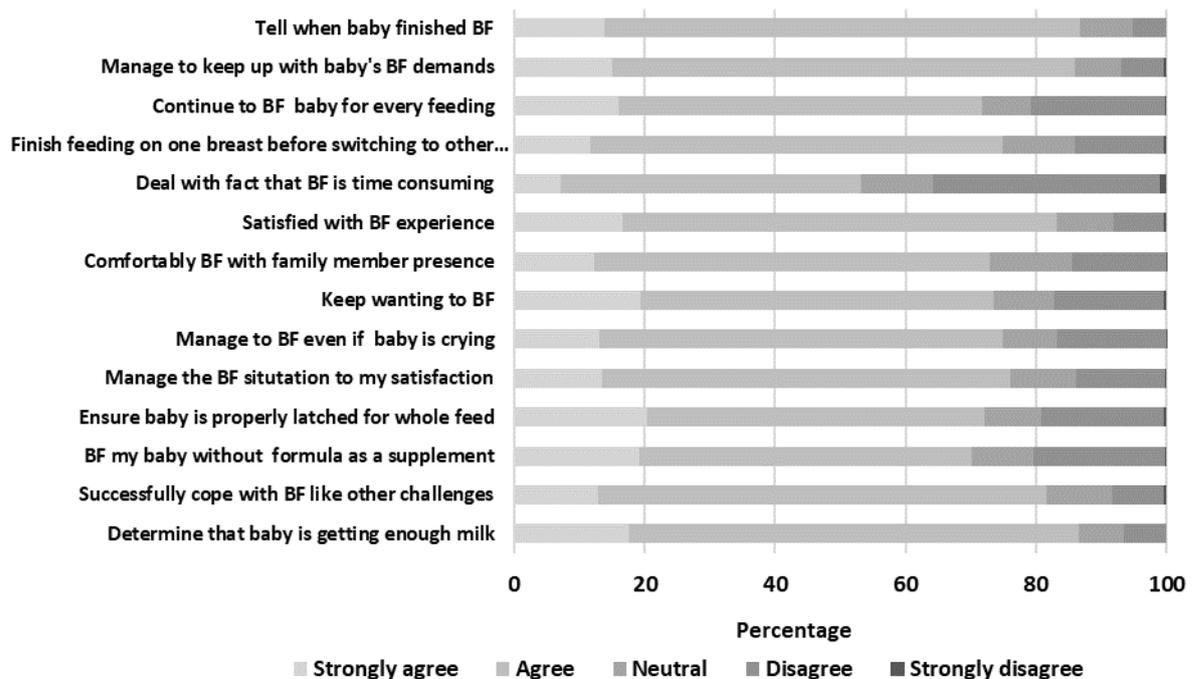
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Note: A chi-square statistic was performed to examine the distribution of infants who were exclusively breastfed based on mothers' self-efficacy level. The bars represent 95% CI. Svy commands were used to adjust for the cluster sampling design.

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Figure 4. Distribution of mothers of children under six months by their answers to each component of breastfeeding self-efficacy short form (BSES-SF)The BADUTA Study in East Java, Indonesia, 2015-2016

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Note: For each question, a score of 1 to 5 was assigned to the responses from "strongly disagree" to "strongly agree." BF=breastfeeding

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Table 1. Frequency distribution of mothers with children under six months old by households, mothers, child characteristics, breastfeeding experience, and knowledge, antenatal and delivery care services as well as breastfeeding self-efficacy status, The BADUTA Study in East Java, Indonesia, 2015-2016

Variables	Total Sample		Breastfeeding Self-Efficacy ¹		
	n	%	Low (%)	High (%)	p
Household characteristics					
Household wealth index					
Poorest	243	20.1	54.7	45.3	0.086
Poor	281	23.2	54.5	45.5	
Middle	236	19.5	59.8	40.2	
Rich	268	22.2	61.9	38.1	
Richest	182	15.0	50.0	50.0	
Maternal characteristics					
Maternal age					
≤19 years	85	7.0	64.7	35.3	0.280
20-34 years	913	75.5	56.1	43.3	
35+ years	212	17.5	55.2	44.8	
Maternal education					
University/Academy	154	12.7	44.2	55.8	0.008
Completed senior high school	495	40.9	57.2	42.8	
Completed junior high school	334	27.6	60.5	39.5	
No school/incomplete primary/completed primary school	227	18.8	57.7	42.3	
Maternal occupation					
Housewife	963	79.6	54.9	45.1	0.027
Working outside the house	247	20.4	62.8	37.2	
Number of children still alive					
1	534	44.1	56.6	43.4	0.993
2	477	39.4	56.2	43.8	
3	156	12.9	57.1	42.9	
4+	43	3.6	58.1	41.9	
Previous live birth					
None	520	43.0	56.4	43.6	0.911
Any	690	57.0	56.7	43.3	
Antenatal, delivery care					
Minimum antenatal care visits²					
Completed (4+ visits)	858	71.6	54.6	45.4	0.057
Incomplete (<4 visits)	340	28.4	60.6	39.4	
Mode of delivery					
Normal	821	67.9	55.2	44.8	0.168
Caesarea	389	32.2	59.4	40.6	
Birth attendant					
General Practitioner/OBGYN	483	39.9	57.1	42.3	0.772
Midwife/nurse	708	58.5	55.9	44.1	
Traditional birth attendant/family/friend	19	1.6	63.2	36.8	
Child's characteristics					
Sex of the child					
Male	582	48.7	56.0	44.0	0.792
Female	613	51.3	56.8	43.2	
Birth weight according to monitoring card					

Variables	Total Sample		Breastfeeding Self-Efficacy ¹		
	n	%	Low (%)	High (%)	p
Larger than average	275	22.8	62.6	37.4	0.062
Average	831	69.0	54.5	45.5	
Smaller than average	99	8.2	54.6	45.4	
Breastfeeding experience and knowledge					
Ever received any advice on breastfeeding					
Yes	638	52.7	52.7	47.3	0.004
No	572	47.3	60.8	39.2	
Knowledge about breastfeeding					
High ³	909	75.1	53.8	46.2	0.001
Low ⁴	301	24.9	64.8	35.2	
Problems during breastfeeding					
No problem	824	68.1	50.5	49.5	<0.001
Yes, received	240	19.8	67.1	32.9	
Yes, but did not have any solutions	146	12.1	73.3	26.7	

*Note:*¹Low breastfeeding self-efficacy was mothers whose total self-efficacy score was less than the median value. ²Minimum Antenatal Care refers to the recommendation of at least four antenatal visits, i.e., once in trimester one to three, and twice in trimester three. ³High level of knowledge was mothers whose total knowledge score was greater or equal to the median value. ⁴Low level of knowledge was mothers whose total knowledge score was less than the median distribution.

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Table 2. Frequency distribution of mothers with children under six months by contextual and intervention characteristics and breastfeeding and self-efficacy status, The BADUTA Study in East Java, Indonesia, 2015-2016

Variables	Total Sample		Breastfeeding Self-Efficacy ¹		
	n	%	Low (%)	High (%)	p
Exposure to interventions					
Exposed to intervention ²	286	23.6	49.7	50.3	0.007
Not exposed to intervention ³	924	76.4	58.7	41.3	
Number of breastfeeding interventions mothers were exposed to					
No intervention	726	60.0	60.2	39.8	<0.001
One intervention	266	22.0	56.4	43.6	
Two interventions	127	10.5	48.8	51.2	
Three or more interventions	91	7.5	38.5	61.5	
Period					
Baseline	575	47.5	60.5	39.5	0.008
Endline	635	52.5	52.9	47.1	
Ever visited by village facilitator at home					
Yes	22	1.8	36.4	63.6	0.054
Ever attended "emo-demo."					
Yes	50	4.1	44.0	56.0	0.068
Ever received SMS Bunda messages					
Yes	20	1.7	35.0	65.0	0.050
Ever visited by cadre at home					
Yes	17	1.4	29.4	70.6	0.023
Ever attended pregnancy class					
Yes	40	3.3	40.0	60.0	0.032
Roomed in with baby after delivery					
Yes	363	30.0	48.2	51.8	<0.001
Ever received counselling by a midwife					
Yes	188	15.5	52.1	47.9	0.185
Ever received counselling by a cadre					
Yes	24	2.0	37.5	62.5	0.058
Ever seen "Rumpi Sehat" TV commercials					
Yes	123	10.2	43.9	56.1	0.003

Note: ¹Low self-efficacy was mothers whose total self-efficacy score was less than the median value. ²Exposed to intervention refers to respondents living in the intervention sub-districts at the endline survey. ³Not exposed to intervention referred to all respondents from the baseline survey and those living in the control sub-districts at the endline survey.

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Table 3. Factors associated with low breastfeeding self-efficacy amongst mothers of children under six months old, The BADUTA Study in East Java, Indonesia, 2015-2016

Variables	Univariate			Multivariate ¹		
	aOR	95% CI	<i>p</i>	aOR	95% CI	<i>p</i>
Contextual and intervention characteristics						
Exposure to intervention						
Exposed to intervention ²	1.00					
Not exposed to intervention ³	1.44	1.13 1.83	0.003			
Number of breastfeeding interventions mothers exposed to						
No intervention	1.00			1.00		
One intervention	0.86	0.64 1.14	0.290	1.47	0.73 2.96	0.283
Two interventions	0.63	0.47 0.85	0.002	1.84	0.98 3.46	0.059
Three or more interventions	0.41	0.24 0.71	0.001	1.84	1.03 3.27	0.039
Period						
Baseline	1.00			1.00		
Endline	0.73	0.55 0.97	0.032	0.87	0.59 1.29	0.495
Household characteristics						
Household wealth index						
Poorest	1.00					
Poor	0.99	0.70 1.39	0.948			
Middle	1.23	0.86 1.75	0.257			
Rich	1.35	0.93 1.95	0.118			
Richest	0.83	0.52 1.32	0.426			
Mother's characteristics						
Maternal age						
≤19 years	1.00					
20-34 years	0.70	0.41 1.17	0.172			
35+ years	0.67	0.40 1.14	0.138			
Maternal education						
University/Academy	1.00			1.00		
Completed senior high school	1.69	1.19 2.39	0.003	2.01	1.34 3.00	0.001
Completed junior high school	1.94	1.31 2.86	0.001	2.30	1.44 3.69	0.001
No school/incomplete primary/completed primary school	1.73	1.12 2.67	0.014	1.95	1.20 3.15	0.007
Maternal occupation						
Housework	1.00			1.00		
Working outside the house	1.38	1.06 1.81	0.018	1.72	1.26 2.35	0.001
Number of children still alive						
1	1.00					
2	0.99	0.77 1.26	0.904			
3	1.02	0.69 1.52	0.920			

Variables	Univariate			Multivariate ¹			
	aOR	95% CI	<i>p</i>	aOR	95% CI	<i>p</i>	
4+	1.07	0.55	2.07	0.847			
Previous live birth							
None	1.00						
Any	1.01	0.82	1.26	0.906			
Antenatal and delivery care							
Minimum antenatal care visits⁴							
Completed (4+ visits)	1.00				1.00		
Incomplete (<4 visits)	1.28	0.98	1.68	0.073	1.27	0.94	1.71 0.116
Mode of delivery							
Normal	1.00				1.00		
Caesarean	1.19	0.96	1.47	0.108	1.33	1.06	1.68 0.015
Birth attendant							
General practitioner/OBGYN	1.00						
Midwife/nurse	0.95	0.78	1.165	0.631			
Traditional birth attendant/family/friend	1.29	0.54	3.082	0.572			
Child's characteristics							
Sex of the child							
Male	1.00						
Female	1.03	0.82	1.30	0.791			
Birth weight from monitoring card							
Larger than average	1.00						
Average	0.72	0.51	1.00	0.053			
Smaller than average	0.72	0.44	1.17	0.183			
Breastfeeding knowledge & experience							
Ever received any breastfeeding advice							
Yes	1.00				1.00		
No	1.40	1.09	1.78	0.007	1.37	1.04	1.81 0.025
Knowledge about breastfeeding							
High level ⁵	1.00				1.00		
Low level ⁶	1.58	1.19	2.10	0.002	1.38	1.04	1.85 0.028
Problems during breastfeeding							
No problem	1.00				1.00		
Yes, and received solutions	2.00	1.51	2.64	0.000	2.16	1.58	2.95 <0.001
Yes, but don't receive any solutions	2.69	1.88	3.86	0.000	2.65	1.91	3.67 <0.001

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Note: ¹Multivariate logistic regression using the backward elimination method to select significant predictors of low breastfeeding self-efficacy. The variable for the minimum requirement of four antenatal care visits by trimester was selected a priori to be retained in the final model regardless of its significance level. ²"Exposed to intervention," refers to respondents living in the intervention sub-districts at the endline survey ³Not exposed to intervention referred to all respondents from the baseline survey and those living in the control sub-districts at the endline survey. ⁴Minimum Antenatal Care refers to the recommendation of at least four antenatal visits, i.e., once in trimester one to three, and twice in trimester three. ⁵High level of knowledge -total knowledge score was

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equal to or greater than the median distribution. ⁶Low level of knowledge was mothers whose total knowledge score was less than the median distribution.

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Table S1: Factors associated with low breastfeeding self-efficacy amongst mothers of children under six months old, The BADUTA Study in East Java, Indonesia, 2015-2016

Variables	Univariate			Multivariate ¹		
	aOR	95% CI	<i>p</i>	aOR	95% CI	<i>p</i>
Contextual and intervention characteristics						
Exposure to intervention						
Exposed to intervention ²	1.00					
Not exposed to intervention ³	1.44	1.13 1.83	0.003			
Number of breastfeeding interventions mothers exposed to						
No intervention	1.00					
One intervention	0.86	0.64 1.14	0.290			
Two interventions	0.63	0.47 0.85	0.002			
Three or more interventions	0.41	0.24 0.71	0.001			
Period						
Baseline	1.00			1.00		
Endline	0.73	0.55 0.97	0.032	0.98	0.64 1.48	0.907
Ever visited by village facilitator at home						
No	1.00			1.00		
Yes	0.43	0.17 1.12	0.084	0.84	0.29 2.44	0.746
Ever attended "emo-demo."						
No	1.00			1.00		
Yes	0.59	0.35 1.00	0.049	1.11	0.58 2.13	0.759
Ever received SMS Bunda messages						
No	1.00			1.00		
Yes	0.41	0.15 1.14	0.087	0.57	0.17 1.95	0.371
Ever visited by cadre at home						
No	1.00			1.00		
Yes	0.32	0.12 0.84	0.22	0.32	0.10 0.99	0.048
Ever attended pregnancy class						
No	1.00			1.00		
Yes	0.50	0.21 1.21	0.125	0.93	0.35 2.47	0.877
Roomed in with baby after delivery						
No	1.00			1.00		
Yes	0.62	0.49 0.78	0.000	0.75	0.54 1.03	0.072
Ever received counselling by a midwife						
No	1.00			1.00		
Yes	0.81	0.59 1.11	0.185	1.16	0.81 1.65	0.411
Ever received counselling by a cadre						
No	1.00			1.00		
Yes	0.45	0.22 0.95	0.035	0.78	0.36 1.67	0.531
Ever seen "Rumpi Sehat" TV commercials						

Variables	Univariate			Multivariate ¹			
	aOR	95% CI	<i>p</i>	aOR	95% CI	<i>p</i>	
No	1.00			1.00			
Yes	0.57	0.38 0.84	0.005	0.73	0.43 1.25	0.251	
Household characteristics							
Household wealth index							
Poorest	1.00						
Poor	0.99	0.70 1.39	0.948				
Middle	1.23	0.86 1.75	0.257				
Rich	1.35	0.93 1.95	0.118				
Richest	0.83	0.52 1.32	0.426				
Mother's characteristics							
Maternal age							
≤19 years	1.00						
20-34 years	0.70	0.41 1.17	0.172				
35+ years	0.67	0.40 1.14	0.138				
Maternal education							
University/Academy	1.00			1.00			
Completed senior high school	1.69	1.19 2.39	0.003	1.98	1.32 2.96	0.001	
Completed junior high school	1.94	1.31 2.86	0.001	2.18	1.40 3.42	0.001	
No school/incomplete primary/completed primary school	1.73	1.12 2.67	0.014	1.91	1.20 3.04	0.007	
Maternal occupation							
Housework	1.00			1.00			
Working outside the house	1.38	1.06 1.81	0.018	1.74	1.28 2.38	<0.001	
Number of children still alive							
1	1.00						
2	0.99	0.77 1.26	0.904				
3	1.02	0.69 1.52	0.920				
4+	1.07	0.55 2.07	0.847				
Previous live birth							
None	1.00						
Any	1.01	0.82 1.26	0.906				
Antenatal and delivery care							
Minimum antenatal care visits⁴							
Completed (4+ visits)	1.00			1.00			
Incomplete (<4 visits)	1.28	0.98 1.68	0.073	1.25	0.92 1.70	0.146	
Mode of delivery							
Normal	1.00			1.00			
Caesarean	1.19	0.96 1.47	0.108	1.36	1.08 1.72	0.009	
Birth attendant							

Variables	Univariate			Multivariate ¹			
	aOR	95% CI	<i>p</i>	aOR	95% CI	<i>p</i>	
General practitioner/OBGYN	1.00						
Midwife/nurse	0.95	0.78	1.165	0.631			
Traditional birth attendant/family/friend	1.29	0.54	3.082	0.572			
Child's characteristics							
Sex of the child							
Male	1.00						
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Birth weight from monitoring card							
Larger than average	1.00						
Average	0.72	0.51	1.00	0.053			
Smaller than average	0.72	0.44	1.17	0.183			
Breastfeeding knowledge & experience							
Ever received any breastfeeding advice							
Yes	1.00				1.00		
No	1.40	1.09	1.78	0.007	1.44	1.08	1.91 0.013
Knowledge about breastfeeding							
High level ⁵	1.00				1.00		
Low level ⁶	1.58	1.19	2.10	0.002	1.39	1.04	1.87 0.027
Problems during breastfeeding							
No problem	1.00				1.00		
Yes, received	2.00	1.51	2.64	0.000	2.19	1.57	3.04 <0.001
Yes, but don't receive any solutions	2.69	1.88	3.86	0.000	2.71	1.94	3.77 <0.001

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Note: ¹Multivariate logistic regression using the backward elimination method to select significant predictors of low breastfeeding self-efficacy. The variable for the minimum requirement of four antenatal care visits by trimester was selected a priori to be retained in the final model regardless of its significance level. ²"Exposed to intervention," refers to respondents living in the intervention sub-districts at the endline survey ³Not exposed to intervention referred to all respondents from the baseline survey and those living in the control sub-districts at the endline survey. ⁴Minimum Antenatal Care refers to the recommendation of at least four antenatal visits, i.e., once in trimester one to three, and twice in trimester three. ⁵High level of knowledge -total knowledge score was equal to or greater than the median distribution. ⁶Low level of knowledge was mothers whose total knowledge score was less than the median distribution.