

1 **Grandmothers' knowledge positively influences maternal knowledge and infant and young**
2 **child feeding practices in Nepal**

3 **ABSTRACT**

4 **Objective:** To examine associations between grandmothers' knowledge and IYCF practices and to
5 test whether the associations are independent or operate via maternal knowledge.

6 **Design:** Cross-sectional household survey data from households with a child under 5 years
7 (n=4080). We used multivariate regression analyses, adjusted for child, maternal, grandmother, and
8 household characteristics, and district-level clustering to test associations between grandmothers'
9 knowledge and IYCF practices for children 6 to 24 months living with a grandmother. We used
10 causal mediation to formally test the direct effect of grandmothers' knowledge on IYCF practices
11 versus maternal knowledge mediating these associations.

12 **Setting:** 240 rural communities, 16 districts of Nepal.

13 **Subjects:** Children 6 to 24 months of age (n=1399), including those living with grandmothers
14 (n=748)

15 **Results:** We found that the odds of optimal breastfeeding practices were higher - early BF initiation
16 (2.2 times; p=0.002) and colostrum feeding (4.2 times; p<0.001) - in households where
17 grandmothers had correct knowledge versus those with incorrect knowledge. The same pattern was
18 found for correct timing of introduction of: water (2.6), milk (2.4), semi-solids (3.2), solids (2.9),
19 eggs (2.6) and meat (2.5) times (p<0.001). For the two pathways we were able to test, mothers'
20 correct knowledge mediated these associations between grandmothers' knowledge and IYCF
21 practices: colostrum feeding (b=10.91, p<0.001) and the introduction of complementary foods
22 (b=5.18, p<0.001).

23 **Conclusions:** Grandmothers' correct knowledge translated into mothers' correct knowledge and
24 therefore, optimal IYCF practices. Given grandmothers' influence in childcare, engagement of
25 grandmothers in health and nutrition interventions could improve mothers' knowledge and facilitate
26 better child feeding.

1 **INTRODUCTION**

2 Nepal has experienced some of the fastest rates of reduction in child undernutrition globally:
3 between 1996 and 2011, the prevalence of stunting (height-for-age z-score < 2 SD) among children
4 under two years of age fell from 48% to 27%. **Improvements in health service access and**
5 **utilization, sanitation, and education coupled with reductions in poverty drove this stunting**
6 **reduction over time in Nepal (1, 2, 3).** However, child undernutrition remains a significant public
7 health burden, with more than one in four Nepali children under 2 years of age stunted (1, 2).

8 Infant and young child feeding (IYCF) practices, which did not improve between 1996 and 2011,
9 might be a key contributor to persistent child undernutrition in Nepal (1–5). IYCF practices are
10 important for child survival, child growth and development (6,7). The World Health Organization
11 (WHO)-recommended IYCF practices cover both breastfeeding and complementary feeding of
12 children under two years of age (4). According to the 2011 Demographic Health Survey (DHS),
13 about 80 percent of mothers reported to have exclusively breastfed their children under six months
14 of age. Complementary feeding practices continue to be suboptimal: not even one in three children
15 aged 6 to 24 months consumed foods from at least four of seven food groups, the standard for
16 minimum dietary diversity. Also, contrary to the WHO recommendation of introducing children to
17 complementary foods at six months of age, nearly one in four children four to five months of age
18 are fed solid or semisolid foods and at least 40 percent of children six to eight months still do not
19 consume solid or semi-solid foods (8). This highlights that complementary foods are sometimes
20 introduced too late and other times, too early.

21 Maternal and household demographic and socio-economic factors likely drive poor IYCF practices.
22 Prior studies in Nepal have found maternal employment, education, age, and media exposure as
23 determinants of IYCF practices (6,7, 3). Cultural beliefs, knowledge, and perceptions have all been
24 shown to influence complementary feeding, including which types of foods to introduce first, the
25 timing of their introduction, and who should feed young children (9). Behavior change interventions
26 often target mothers with the aim of improving their IYCF-related beliefs, attitudes, and knowledge
27 and ultimately, their IYCF practices. However, in much of South Asia, including Nepal,
28 grandmothers are also childcare providers who influence maternal decisions regarding child
29 feeding. Judi Aubel highlights the central role grandmothers play in child feeding in Bangladesh,
30 Pakistan, and Nepal: grandmothers advise mothers on caregiving, including child feeding, and they
31 are often direct caregivers for young children (10,11).

32 In South Asia, grandmothers are considered storehouses of knowledge and wisdom on a wide-array
33 of household topics. Given their revered status, grandmothers often serve as advisors and

34 supervisors to the next generation, playing an influential role in child health and nutrition (10). In a
35 qualitative study about the role of Tamang mothers-in-law in Mwakanpur, Masvie found that most
36 mothers were assisted by their mothers-in-law for young child feeding in Makwanpur, Nepal (12).
37 Another qualitative study in Nepal reported that mothers were obliged to obey their mothers-in-law
38 and follow local practices even when the mother wanted to follow a doctor's recommendations:
39 although mothers were responsible for food preparation, grandmothers had primary decision-
40 making power over which foods the child would receive and when (13). Furthermore, in Nepal,
41 about 4 out of 5 women residing in rural areas are engaged in agricultural labor; many mothers
42 depend on grandmothers to provide care for their young children while they work in the fields (14).
43 Locks *et al.* found that 55% of mothers and 39% of grandmothers are primary child caretakers in
44 Baitadi, Nepal (14). In rural Nepal, grandmothers provide childcare in part because of the heavy
45 workloads of mothers and authoritative cultural space that grandmothers occupy in the Nepali
46 households, but also because of the drastic increase in labor emigration of both men and women.
47 The number of labor permits issued to men increased from 211,371 in 2008 to 492,724 in 2014, a
48 133% increase, but the number of labor permits issued to women grew even more drastically from
49 8,594 in 2008 to 29,154 in 2014, a steep incline of 239% (15). If this trend continues, grandmothers
50 may play an increasingly significant role in child health and nutrition.

51 Studies on the role of grandmothers in IYCF practices in South Asia are limited; those conducted to
52 date are primarily qualitative and the quantitative studies were based on small sample sizes. There
53 are no prior quantitative studies on this topic in Nepal. In this study, we investigate the associations
54 between grandmothers' correct knowledge and correct practices for the following IYCF indicators:
55 breastfeeding initiation, colostrum feeding, and timing of introduction of six types of
56 complementary foods - water, milk (and milk products other than breast milk), semi-solid foods,
57 solid foods, meat, and eggs - for children 6 to 24 months of age residing in rural Nepal. We also
58 investigate whether any found association is direct or whether maternal knowledge mediates the
59 association.

60 **METHODS**

61 *Survey design and sampling*

62 We use data collected for a baseline survey of a quasi-experimental impact evaluation of *Suaahara*,
63 an integrated nutrition program to improve maternal and child nutrition in rural Nepal. Data was
64 collected from mid-June to early October (rainy season) of 2012 across Nepal's three agro-
65 ecological zones – mountains, hills, and *terai* (8). Households were selected through a multi-stage
66 cluster design. First, 16 districts were purposively selected to include 8 intervention districts and 8

67 comparison districts, matched based on various agro-ecological and socio-demographic
68 characteristics. Second, 5 village development committees (VDCs) per district were selected and
69 third, 3 wards per VDC were selected; both VDCs and wards were selected using probability
70 proportional to size (PPS) techniques. Lastly, within each ward, 17 households with a child under 5
71 years of age were randomly selected from a census carried out by study enumerators. The total
72 sample included 4,080 households across 240 wards, including 1,399 children between the ages of 6
73 and 24 months of age.

74 ***Ethical approval***

75 Ethical approval was obtained from the Nepal Health Research Council (NHRC), Nepal's ethical
76 review board, and the internal review board of the International Food Policy Research Institute
77 (IFPRI) in 2012. For the additional analysis in this publication, ethical approval was also obtained
78 from the London School of Hygiene and Tropical Medicine (LSHTM) in 2015.

79 ***Data collection***

80 The baseline household survey involved interviewing three household members: 1) the mother of a
81 randomly selected child under 5 years of age (the index child), 2) a major adult economic decision-
82 maker (the mother's husband or adult male, when available) and 3) the child's grandmother, if she
83 resided in the same household. These household surveys included asking the primary female and
84 male respondents a diverse set of questions regarding household socio-demographics and
85 knowledge and practices relating to maternal and child health and nutrition; water, sanitation and
86 hygiene (WASH); agriculture; family planning; and empowerment. The grandmothers'
87 questionnaire included questions regarding their knowledge and beliefs on key maternal and child
88 health and nutrition topics, including IYCF.

89 ***Data analysis***

90 All statistical analyses were performed using STATA version 13.0 (2013). For this IYCF-focused
91 study, we restricted our analysis to households with at least 1 child 6 to 24 months of age (n=1399)
92 and for our regression analysis, we focused on index children in this age range, residing with a
93 grandmother (n=748).

94 The primary outcome variables were IYCF practices, as reported by mothers: whether or not the
95 child was fed colostrum (yes/no); whether or not there was early initiation of breastfeeding, defined
96 as the child receiving breast milk within the first hour of birth (yes/no); and whether or not the
97 child was introduced to water, milk (and milk products other than breast milk), semi-solid foods,
98 solid foods, eggs, and meat at the appropriate age, defined as mothers who reported introducing
99 each of the 6 complementary foods between 6 to 9 months of age (yes/no). These specific IYCF

100 variables were selected based on both the research question and data availability from the
101 grandmothers' survey for construction of the parallel primary explanatory variables.

102 The primary explanatory variables were grandmothers' knowledge and beliefs on these three IYCF
103 practices. Grandmothers were asked whether or not a child should be given colostrum; when
104 breastfeeding should start; and when (in months) they believed each of the six complementary
105 foods should be introduced. Binary variables were created for both the breastfeeding variables to
106 denote correct knowledge: 1) child should be fed colostrum (yes/no) and 2) child should receive
107 breast milk within the first hour of birth (yes/no). Binary variables were also created for correct
108 knowledge on the timing for introduction of complementary foods, defined as grandmothers who
109 reported they would introduce each of the 6 complementary foods between 6 to 9 months (yes/no).

110 We used Analysis of Variance (ANOVA) and chi-squared tests to explore characteristics of
111 households with (N=748) and without (N=651) a grandmother in residence. Next, multivariate
112 logistic regression models were used to test the associations between grandmothers' IYCF
113 knowledge and parallel IYCF practices. Lastly, we empirically tested the direct versus indirect
114 effects for grandmother's correct knowledge and the actual practices, via mother's correct
115 knowledge as the hypothesized mediator for colostrum feeding and timely introduction of
116 complementary foods. We were unable to test pathways for early initiation of breastfeeding, as the
117 dataset did not include a maternal knowledge variable for this. Given the binary nature of our child
118 feeding outcome variables, we used generalized structural equation modelling (GSEM) for our
119 mediation analysis.

120 In all adjusted models, we controlled for various potential confounding factors at the child, mother,
121 grandmother, and household levels, based on our knowledge of the local setting and prior studies
122 regarding IYCF in Nepal (13,14,16–19). Child variables included age in months, sex (male or
123 female), and decision-maker regarding child feeding (mother, grandmother or other) . Maternal
124 characteristics included age in years, level of education (years of formal schooling completed),
125 whether participated in wage or salary employment in the year prior to the survey (yes or no),
126 number of sources from which nutrition information was ever heard (newspaper/magazine, radio,
127 television, brochure/banner/poster, billboard, flipchart, counseling card, announcements in
128 loudspeakers, community/village gatherings, religious gathering/meetings, mother's group, street
129 drama, health facility, female community health volunteers), and residency with her own mother
130 (yes or no). Grandmother characteristics included age in years and level of education (years of
131 education completed). Household characteristics included the number of children <5y residing in
132 the household, the agro-ecological zone of residency (mountains, hills, or *terai*), caste/ethnicity

133 (*Dalit*, disadvantaged *Janajatis*, disadvantaged non-*Dalit terai*, religious minorities, relatively
134 advantaged *Janajatis*, *Brahmin/Chhetri/Sanyasi*), level of food security (food secure, mildly food
135 insecure, moderately food insecure, or severely food insecure) measured by the household food
136 insecurity access scale (HFIAS) (20), and wealth quintile (poorest, second poorest, middle income,
137 second wealthiest, or wealthiest), calculated using principal component analysis. We also controlled
138 for potential clustering at the district level and included a variable identifying whether the district
139 was an intervention or comparison area, given the purposive selection of intervention areas by
140 degree of need and how this may influence the results.

141 **RESULTS**

142 Table 1 presents key descriptive statistics for the child, mother, grandmother, and household; these
143 statistics are presented for both types of households: those with (N=748) and without a grandmother
144 (N=651) in residence. Among those living with a grandmother in the household, half were male and
145 the mean age was 14 months. Mothers were on average 24 years old, with ages ranging from 15 to
146 42 years. Mean maternal education was six years of formal schooling. Among surveyed mothers,
147 only 5% resided with their own mothers and only 13% claimed to participate in wage or salary
148 employment in the past year. On average, women received nutrition information from only one
149 source of a possible ten sources. Mean age of the grandmothers was 55 years, but the ages ranged
150 from 35 to 85 years. On average, these grandmothers had less than half a year of formal schooling.
151 Around half of the households resided in hill districts, with residency for the other half split fairly
152 evenly between mountains and *terai* districts. About half of the households were from most
153 advantaged ethnic group while 17% were *Dalit*, the most disadvantaged caste group in Nepal. The
154 average number of children under five years of age per household was one. More than 8 out of 10
155 surveyed households were food secure.

156 Table 1 also presents some statistically significant differences we found between characteristics of
157 households with and without grandmothers. Households with grandmothers tend to have mothers
158 that are younger ($p<0.001$) and more highly educated ($p<0.001$); however, these mothers are less
159 likely to have participated in wage/salary employment in the past 12 months ($p=0.01$). Compared to
160 those households without a grandmother present, higher proportion of households with
161 grandmothers are from the Brahmin/Chhetri/Thakuri/Sanyasi caste and ethnicity group and more
162 have achieved food security, as measured by the HFIAS ($p<0.001$).

163 Table 2 summarizes both grandmothers' and mothers' IYCF knowledge and household IYCF
164 practices included in the analysis. Most grandmothers had correct breastfeeding knowledge:
165 breastfeeding should be initiated within one hour of birth (71%) and colostrum should be given to

166 the baby (83%). While slightly less than half of the grandmothers had correct knowledge that water
167 and meat products should be introduced at 6 to 9 months of age, a majority of the grandmothers had
168 correct knowledge on when semi-solid foods and solid foods should be introduced (71% and 75%
169 respectively). Half of the grandmothers had correct knowledge regarding timing of introduction of
170 milk and eggs. Only 17% of the grandmothers reported correctly (6 to 9 months of age) for when all
171 six of these complementary foods should be introduced.

172 Mothers' knowledge was higher than grandmothers' knowledge for all IYCF variables analyzed.
173 Mothers reported that six of ten children were breastfed within the first hour of birth and that about
174 9 of 10 children received colostrum. Thirty-seven percent of the mothers, in households with
175 grandmothers, reported feeding water, and milk and milk products at the correct time while 64%
176 and 70% of the mothers reported feeding semi-solid foods and solid foods at the correct time. Half
177 of the mothers reported correct practice of introducing eggs and meat at 6 to 9 months of age. None
178 of the differences in maternal knowledge or IYCF practices between household with and without
179 grandmothers were statistically significant.

180 Table 3 shows results from the regression analysis of grandmothers' correct knowledge and optimal
181 household practices for breastfeeding initiation, colostrum feeding and timing of introduction of
182 each complementary food. When adjusting only for district-level clustering, the odds of correct
183 IYCF practices were about two to four times higher in households where grandmothers had correct
184 knowledge compared to households where grandmothers had incorrect knowledge. In the adjusted
185 models, the odds of appropriate breastfeeding initiation and colostrum feeding were 2.2 and 4.2
186 times higher ($P: 0.002, P<0.001$) in households where grandmothers had correct knowledge
187 compared to households where grandmothers had incorrect knowledge. Similarly, in the adjusted
188 models, correct household timing of introducing water, milk, semi-solid foods, solid foods, eggs
189 and meat were all 2 to 3 times higher in households where grandmothers had appropriate
190 knowledge compared to households where grandmothers did not have appropriate knowledge
191 ($p<0.001$). Results were also robust when checked for clustering at the ward level (results available
192 upon request).

193 Tables 4 and 5 present results from our GSEM, based on our hypothesized models (Figures 1 and
194 2), of how grandmothers' knowledge may influence IYCF practices directly as well as indirectly via
195 maternal knowledge. Our results show that grandmother's correct knowledge on feeding colostrum
196 mostly influences the actual practice via influencing maternal knowledge. The direct effect is
197 almost zero (Figure 3), whereas there is a large, significant indirect effect: grandmothers' correct
198 knowledge improves the odds of mothers' having correct knowledge by 2.1 times ($P<0.001$) and

199 mothers' correct knowledge improves the odds by 5.3 times of colostrum being fed ($P<0.001$).
200 Similarly, grandmother's correct knowledge on timely introduction of complementary foods has
201 almost no direct effect (Figure 4), but the indirect effect is positive and significant: the odds of
202 maternal correct knowledge are 2.1 times higher in households where grandmothers had correct
203 knowledge ($P<0.001$) and correct maternal knowledge improves the odds of complementary foods
204 being introduced at the right time by 2.5 times ($P<0.001$).

205 **DISCUSSION**

206 The present study explored the association between grandmothers' knowledge and select IYCF
207 practices of children under 2 years of age: initial breastfeeding, feeding colostrum, and the
208 appropriate timing of introduction of water, milk, semi-solid foods, solid foods, meat, and eggs as
209 complementary foods. The results of the cross-sectional dataset that included children 6 to 24
210 months of age ($N=1399$) of which 748 lived with grandmothers and 651 did not live with
211 grandmothers, showed that more than half initiated breastfeeding within the first hour of birth,
212 nearly all were given colostrum, and the percent of households with appropriate timing of
213 introduction of complementary foods varied among the six types of food – water, milk, semi-solid
214 foods, solid foods, meat, and eggs. Using logistic regression model, we found that, among
215 households with grandmothers in residence, the odds of appropriate IYCF practice was at least 2
216 times or more likely in households where grandmothers had correct knowledge compared to
217 households where grandmothers had incorrect knowledge and these results were statistically
218 significant. Our mediation analyses showed that almost all of the association between
219 grandmothers' practice-specific IYCF knowledge and actual practice is mediated by maternal
220 knowledge: grandmothers' IYCF-related knowledge influences maternal IYCF knowledge and in
221 turn household IYCF practices.

222 In this study, the variation across IYCF practices even among the same population was substantial.
223 Although more than 90% of children in rural Nepal were given colostrum, initial breastfeeding in
224 the first hour after birth only happened in about two-thirds of households. This prevalence was
225 higher than Nepal's most recent DHS, which showed that less than 45% of children in rural areas
226 born in the previous two years were breastfed within one hour of birth. Similarly, the timing of
227 introduction of complementary foods varied substantially by type of food, with water and milk
228 given too early and eggs and meat given too late, both in this study and other studies in Nepal. A
229 previous study noted that this is in part because of a belief that complementary foods should be soft
230 to avoid diarrhea and stomach aches and that animal-sourced foods should only be introduced once
231 the child develops teeth and the ability to digest appropriately (13,14). Attention to each of these
232 IYCF practices is important given their importance for ensuring optimal child nutrition.

233 This study highlights the potential role of other adult household members, specifically
234 grandmothers, in child feeding and nutrition. The positive associations between grandmothers'
235 knowledge and IYCF practices are consistent with earlier, albeit scant, literature in South Asia.
236 Sharma and Kanani, in a study in Vadodara, India found that households in which a grandmother
237 resided, in comparison to households without a grandmother, delayed initiation of complementary
238 feeding to beyond six months of age and called for future child nutrition interventions in South Asia
239 to include all family members who are childcare providers (21). In a mixed-methods study in rural
240 Haryana, India, Kausal et al. found that grandmothers believed that complementary foods should
241 only be introduced when the infant starts walking or asking for food, while the mothers believed
242 complementary feeding should be introduced much earlier. This is consistent with our findings and
243 underscores that IYCF-related knowledge may differ among adult childcare providers in the same
244 household and highlights the need for ensuring that grandmothers are also aware of optimal IYCF
245 practices, given their influential role in child feeding in South Asia (22,23). Analyzing a cross-
246 sectional dataset from the Young Lives study in Andhra Pradesh, India, Moestue and Huttly found
247 independent associations between maternal, paternal, and grandmother characteristics and child
248 nutritional status, further highlighting the need for programs to target other family and community
249 members, rather than just mothers (24). Studies from outside of South Asia have also emerged
250 showing the important role of grandmothers for child health and nutrition and the need for targeting
251 them with behavior change communication interventions (25–27).

252 As mentioned, commonly in South Asia and in Nepal, senior women are highly revered and hold
253 the top position in the family hierarchy, often having power and authority over younger women,
254 including relating to infant feeding (27,28). A study in Maharashtra, India shows that grandmothers
255 take care of infants and teach first-time, inexperienced mothers about breastfeeding, prelacteal
256 feeding, complementary feeding, and feeding during child illness. This study found that mothers
257 often follow practices that their mothers and mothers-in-law suggests, perhaps due to their own
258 inexperience or to avoid conflict and maintain tradition (23). Mothers generally consult
259 grandmothers regarding infant and young child feeding and some grandmothers feel that it is their
260 responsibility to teach mothers and pass on their knowledge, perceiving themselves as “providers of
261 perinatal care” (12), a perception strengthened by first-time mothers relying on them for expertise
262 and knowledge regarding IYCF practices.

263 The present study suffers from a few limitations. First, this study is based on a cross-sectional
264 dataset and thus, our regression results cannot be interpreted as causal. Second, this was not a
265 nationally representative sample; the 16 districts of Nepal included in this survey were purposively
266 selected for an impact evaluation baseline. Third, there may be residual unaccounted for

267 confounders not available in the dataset **or biases, which are inevitable in self-reported practices,**
268 **e.g. IYCF.** We asked mothers of children up to two years of age to remember child feeding
269 practices since birth and acknowledge potential **recall bias as a study limitation (29–34).** Finally, in
270 this dataset, the grandmother data are limited and certain interesting data points, such as whether the
271 grandmothers had been exposed to nutrition-related counseling or other inputs, are unavailable.

272 Despite these limitations, this study is the first empirical study in Nepal, and one of few globally, to
273 investigate associations between grandmothers' knowledge and IYCF practices. Our study adds to
274 prior studies, which were mostly qualitative or had very small sample sizes, failed to adjust for
275 potential confounding and clustering, and only looked at either breastfeeding or complementary
276 feeding. Furthermore, our study disaggregates the complementary foods rather than lumping the
277 various food types, which is important given variation in use of these foods for child feeding. The
278 mediation analysis also allowed us to explore how grandmothers' knowledge may influence
279 nutritional practices, compared to traditional regression analysis which only answers whether
280 associations exist or not. Therefore, our study suggests additional hypotheses around how
281 household factors influence IYCF practices in South Asia.

282 *Future research and program and policy implications*

283 Globally, most child nutrition policies and programs target mothers of young children, aiming to
284 increase their awareness and motivation to engage in optimal IYCF practices. In South Asia,
285 grandmothers' roles as decision-makers and advisors on child health and nutrition suggests that they
286 should be integrated into existing programs or that interventions designed specifically for
287 grandmothers and other adult household members could prove beneficial. **One way of addressing**
288 **knowledge gaps may be to improve health workers' knowledge and their counselling skills for**
289 **communicating accurate ICYF knowledge and ensure that health workers are reaching childcare**
290 **providers at large with this information, rather than just mothers.** Different child nutrition
291 approaches and programs may be needed to target households with and without grandmothers, since
292 we observed differences in demographics between these two types of households.

293 Additional studies could analyze factors that may shape grandmothers' knowledge, pathways and
294 mechanisms for how this influences child feeding and the nutritional status of the child, and how
295 these differ by various demographic (e.g. caste) and socioeconomic (e.g. wealth) characteristics.
296 **Detailed attention should be given to which household member undertakes which specific childcare**
297 **roles and how often to inform the design of future interventions.** Rigorous experimental studies are
298 needed to investigate how grandmothers, and other adult household members, affect change in
299 IYCF practices. While the focus on this study was infant and young child feeding, a similar analysis

300 for other nutrition-related practices including diet for women during pregnancy and lactation, food
301 hygiene, and water, sanitation, and hygiene behaviors would also be informative.

302 The Government of Nepal's National Multi-sector Nutrition Plan and the various nutrition sensitive
303 and nutrition specific interventions (35), aiming to address the high prevalence of stunting, wasting,
304 and micronutrient deficiencies, are all important steps in the right direction. Our findings suggest
305 these efforts may be more effective in improving IYCF practices and reducing undernutrition if
306 other adult household members, such as grandmothers, are also explicitly targeted (24,36,37). In
307 rural Nepal, this is now particularly important in light of increasing exit migration for women in
308 Nepal and young children being left behind to be cared for by grandparents. Nepal's present climate
309 of commitment to nutrition and to addressing the burden of undernutrition, particularly among
310 children in the first '1000 days' of life, must be pushed forward. This is an ideal time to adopt
311 innovative approaches to nutritional obstacles so that further reductions in child nutrition can be
312 seen and to engage in rigorous research studies to assess the effectiveness of these approaches and
313 build a stronger evidence base for how to address persistent under nutrition.

References

1. Cunningham K, Headey D, Singh A, Karmacharya C, Rana PP. Maternal and Child Nutrition in Nepal: Examining drivers of progress from the mid-1990s to 2010s. *Glob Food Sec.* 2017.
2. Cunningham, Kenda; Singh, Akriti; Headey, Derek D.; Pandey Rana, Pooja; and Karmacharya, Chandni. 2016. Reaching new heights: 20 years of nutrition progress in Nepal. In *Nourishing millions: Stories of change in nutrition*. Gillespie, Stuart; Hodge, Judith; Yosef, Sivan; and Pandya-Lorch, Rajul (Eds.) Ch. 13 Pp. 115-123. Washington, D.C.: International Food Policy Research Institute (IFPRI).
3. D. Headey, J. Hoddinott. Understanding the rapid reduction of undernutrition in Nepal, 2001–2011. *PLoS One* (2015), p. 10
4. Devkota MD, Adikari RK, Upreti S. Stunting in Nepal: looking back, looking ahead. *Matern Child Nutr.* 2016;12:257–9.
5. Headey D, Hoddinott J, Park S. Drivers of nutritional change in four South Asian countries: a dynamic observational analysis. *Matern Child Nutr.* 2016 May;12 Suppl 1:210–8.
6. Pan American Health Organization & World Health Organization. Guiding principles for complementary feeding of the breastfed child. Washington, DC/ Geneva, Switzerland; 2003.
7. Black RE, Allen LH, Bhutta Z a., Caulfield LE, de Onis M, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet.* 2008;371(9608):243–60.
8. Ministry of Health and Population (Nepal), New Era, ICF International. Nepal Demographic and Health Survey. Kathmandu, Nepal and Calverton, Maryland, U.S.A; 2011.
9. Stewart CP, Iannotti L, Dewey KG, Michaelsen KF, Onyango AW. Contextualising complementary feeding in a broader framework for stunting prevention. *Matern Child Nutr.* 2013;9(S2):27–45.
10. Aubel J, Alvarez M. The roles and influence of grandmothers and men: Evidence supporting a family-focused approach to optimal infant and young child nutrition, 2011. USAID. Washington, DC, U.S.A
11. Aubel J, Project TG. Grandmothers: A Learning Institution, 2005. USAID. Washington, DC, U.S.A.
12. Masvie H. The role of Tamang mothers-in-law in promoting breast feeding in Makwanpur District, Nepal. *Midwifery.* 2006;22(1):23–31.
13. Seckel L. Factors that constrain or prevent optimal infant and young child feeding practices in rural Nepal: Findings from a formative research study in three districts. 2011.
14. Locks LM, Pandey PR, Osei AK, Spiro DS, Adhikari DP, Haselow NJ, et al. Using formative research to design a context-specific behaviour change strategy to improve infant

- and young child feeding practices and nutrition in Nepal. *Matern Child Nutr.* 2013;1–15.
15. Government of Nepal. Labour Migration for Employment A Status Report for Nepal : 2013 / 2014. Kathmandu, Nepal; 2014.
 16. Pandey S, Tiwari K, Senarath U, Agho KE, Dibley MJ. Determinants of infant and young child feeding practices in Nepal: secondary data analysis of Demographic and Health Survey 2000. *Food Nutr Bull.* 2010;31(2):352–65.
 17. Pokhrel S, Sauerborn R. Household decision-making on child health care in developing countries: The case of Nepal. *Health Policy Plan.* 2004;19(4):218–33.
 18. Cunningham K, Ploubidis GB, Menon P, Ruel M, Kadiyala S, Uauy R, et al. Women’s empowerment in agriculture and child nutritional status in rural Nepal. *Public Health Nutr.* 2015;(25):1–12.
 19. Joshi N, Kingsley EA, Dibley MJ, SereSenarath U, Tiwari K. Determinants of inappropriate complementary feeding practices in young children in Nepal: Secondary data analysis of Demographic and Health Survey 2006-2007. *Matern Child Nutr.* 2012;8(SUPPL. 1):60–77.
 20. Coates J, Bilinsky P, Coates J. Household food insecurity access scale (HFIAS) for measurement of food access: indicator guide. Washington, DC; 2007.
 21. Sharma M, Kanani S. Grandmothers’ influence on child care. *Indian J Pediatr.* 2006;73(4):295–8.
 22. Kaushal M, Aggarwal R, Singal A, Shukla H, Kapoor SK, Paul VK. Breastfeeding practices and health-seeking behavior for neonatal sickness in a rural community. *J Trop Pediatr.* 2005;51(6):366–76.
 23. Aubel J. The role and influence of grandmothers on child nutrition: Culturally designated advisors and caregivers. *Matern Child Nutr.* 2012;8(Stokols 1996):19–35.
 24. Moestue H, Huttly S. Adult education and child nutrition: the role of family and community. *J Epidemiol Community Health.* 2008;62(2):153–9.
 25. Ahrari M, Houser RF, Yassin S, Mogheez M, Hussaini Y, Crump P, et al. A positive deviance-based antenatal nutrition project improves birth-weight in Upper Egypt. *J Heal Popul Nutr.* 2006;24(4):498–507.
 26. Aubel J, Touré I, Diagne M. Senegalese grandmothers promote improved maternal and child nutrition practices: The guardians of tradition are not averse to change. *Soc Sci Med.* 2004;59:945–59.
 27. Aubel J, Alvarez M. The roles and influence of grandmothers and men: evidence supporting a family-focused approach to optimal infant and young child nutrition: literature review. Washington, DC; 2011.
 28. Simkhada B, Porter M a, van Teijlingen ER. The role of mothers-in-law in antenatal care

- decision-making in Nepal: a qualitative study. *BMC Pregnancy Childbirth*. 2010;10:34.
29. Natland ST, Andersen LF, Nilsen TIL, Forsmo S, Jacobsen GW. Maternal recall of breastfeeding duration twenty years after delivery. *BMC Med Res Methodol*. 2012;12(1):179.
 30. Li R, Scanlon KS, Serdula MK. The validity and reliability of maternal recall of breastfeeding practice. *Nutr Rev*. 2005 Apr;63(4):103–10.
 31. Karkee R, Lee AH, Khanal V, Binns CW. Infant feeding information, attitudes and practices: a longitudinal survey in central Nepal. *Int Breastfeed J*. 2014;9(1):14.
 32. Bailey S, Hedlund K. *The Impact of Cash Transfers on Food Consumption in Humanitarian Settings : A review of evidence*. London; 2012.
 33. Bai DL, Fong DYT, Lok KYW, Wong JYH, Tarrant M. Practices, predictors and consequences of expressed breast-milk feeding in healthy full-term infants. *Public Health Nutr*. 2016; 2017 Feb;20(3):492-503.
 34. Gibson RS. *Principles of nutritional assessment*. Oxford University Press; 2005.
 35. Government of Nepal (National Planning Commission). *Multi-sectoral nutrition plan for accelerating the reduction of maternal and child undernutrition in Nepal*. Kathmandu, Nepal; 2012.
 36. Moestue H, Huttly S, Sarella L, Galab S. “The bigger the better”--mothers’ social networks and child nutrition in Andhra Pradesh. *Public Health Nutr*. 2007;10(11):1274–82.
 37. Duffield A, Abdullah-Al-Harun, Hossain M, Kaziba R, Mursal H, Rahman M, et al. *Thin on the Ground. Questioning the evidence behind World Bank-funded community nutrition projects in Bangladesh, Ethiopia and Uganda*. London; 2003.