University of Massachusetts Amherst

From the Selected Works of Kalpana Poudel-Tandukar

2006

Availability of Childcare Support and Nutritional Status of Children of Non-working and Working Mothers in Urban Nepal

Shinji Nakahara

Krishna C. Poudel

Milan Lopchan

Masao Ichikawa

Kalpana Poudel-Tandukar, *University of Massachusetts - Amherst*, et al.

Available at: <https://works.bepress.com/kalpana-poudel-tandukar/3/>

Availability of Childcare Support and Nutritional Status of Children of Non-working and Working Mothers in Urban Nepal

SHINJI NAKAHARA, KRISHNA C. POUDEL, MILAN LOPCHAN, MASAO ICHIKAWA,
KALPANA POUDEL-TANDUKAR, MASAMINE JIMBA, AND SUSUMU WAKAI

ABSTRACT In many developing countries, poor women have multiple roles, and often their time constraints are so severe that their participation in income-generating activities results in reduced childcare time, which in turn affects child health. Previous studies have tended to investigate how childcare support influences nutrition of children with working mothers' based on comparisons with non-working mothers. However, non-working mothers are not a homogeneous group, and we therefore need to distinguish between those who need not work and those who wish to but cannot, for example, due to a lack of substitute caregivers. We examined the association between availability of childcare support and the nutritional status of children of both non-working and working mothers in poor areas of Pokhara, a submetropolitan city in Nepal. We recruited 150 children of age 10–24 months from the waiting lists of 17 daycare centers and measured their weights and heights. Those with height-for-age and weight-for-age *Z* scores of less than -2 were defined as stunted and underweight, respectively. To collect information on childcare practices and socioeconomic characteristics, mothers were interviewed using a pre-tested structured questionnaire. Unavailability of adult childcare support was associated with increased risk of malnutrition among children of both non-working and working mothers. Peer childcare was not significantly associated with child malnutrition among children of non-working mothers, but it was associated with an increased risk of malnutrition among children of working mothers. Although further longitudinal research is required, we suggest that childcare support from adult substitute caregivers is essential for children of non-working mothers with limited resources.

In poor households in the majority of developing countries, childcare responsibilities fall on women who execute multiple domestic roles such as meal preparation, house cleaning, shopping, water collection, fuel gathering, and care of the sick and elderly. In urban areas where people tend to live in nuclear families, the situation is worse because support from relatives is difficult to obtain. Since leisure time is limited, these women need to divert time from other activities if they intend to indulge in any new opportunities (Coreil, 1991; Devin and Erickson, 1996; McGuire and Popkin, 1990). Maternal participation in income-generating activities outside the home therefore reduces the time available for childcare. With this in mind, previous research has focused on the time conflicts between mothers' market activities and childcare, revealing that appropriate substitute care, such as support

from adult family members, reduces risk of malnutrition among children under age 3 with working mothers by compensating for reduced maternal care (Engle, 1991; Engle and Pederson, 1989; Lamontagne et al., 1998); this is also true for older children up to age 6 (Shah et al., 1979; Tucker and Sanjur, 1988). However, most of these studies compared the nutritional status of children of working mothers with those of non-working mothers, and in doing so, assumed that non-working mothers are a homogeneous group able to provide adequate childcare.

A distinction therefore needs to be made between affluent women who need not work and women who wish to work but cannot because of, for example, time constraints or unavailability of substitute childcare (Basu, 1996; Jokes, 1989). Non-working women in developing countries engage in more tasks than men, and most of these tasks involve household maintenance (Acharya and Bennett, 1983; Apps, 2004; Ilahi, 2000; McGuire and Popkin, 1990). Consequently, their workload does not differ from that of working women (Dufour et al., 2003). Hence, non-working mothers who have less access to resources might be even worse off than working mothers who are able to work because of available substitute care (Doan and Popkin, 1993); however, few studies have addressed this issue. Moreover, reduced maternal time for childcare or fewer household assets has a larger negative impact on the nutritional status of children of non-working mothers than those of working mothers (Jain and Choudhry, 1993; Tucker and Sanjur, 1988). We therefore hypothesized that the unavailability of substitute childcare has a negative impact on child nutrition regardless of maternal working status.

Thus, instead of comparing the children of working mothers with those of non-working mothers, we investigated the intra-group effects of childcare support provided by adult substitute caregivers on the respective nutritional status of children of non-working and working mothers in urban Nepal where child malnutrition still prevails.

CONCEPTUAL FRAMEWORK

As indicated in the United Nations Children's Fund (UNICEF) model of child development (Engle et al., 1996; UNICEF, 1998), child malnutrition develops from multiple inter-related causes: inadequate dietary intake and high disease exposure are immediate causes; childcare practices and access to food or health care are underlying factors that directly influence the immediate causes; and resources such as availability of time, appropriate workload, maternal energy intake, childcare support, and knowledge all affect the underlying causes. Poor mothers in developing countries have to make the best use of limited resources to maximize their child's health and perform other domestic chores.

As childcare practices require numerous resources, conflict over resource allocation between childcare and maternal productive activities occurs, and is often intensified by the local environments of poor countries (McDade, 2001; Popkin, 1980). Poor sanitary conditions with higher risks of disease and injury raise the cost of childcare, prolonging breastfeeding and the need for frequent care. Moreover, economic difficulties increase maternal workload and decrease maternal energy intake, resulting in reduced childcare time and nutrient-poor breast milk.

Studies have shown that a heavy maternal workload and subsequent minimal time for childcare are associated with poor feeding practices and poor child nutrition. In Tanzania and Iran, for example, a heavy maternal workload and longer labor time in the field are associated with lower energy intake and less frequent feeding of children (Rabiee and Geissler, 1992; Wandel and Holmboe-Ottesen, 1992). Conversely, studies in the Philippines and India have shown that when mothers spend more time caring for their children the nutritional status of their children is better (Jain and Choudhry, 1993; Popkin, 1980). Further, women with an increased number of children might spend less time on each child, and in such cases, the nutritional status of the first child is often better than that of subsequent children (Kamau-Thuita et al., 2002).

Support from other family members and the community can alleviate the conflict over resource allocation between childcare and maternal activities and lessen the negative effects of maternal time constraints (McDade, 2001). Substitute adult caregivers can compensate for decreased maternal input (Tucker and Sanjur, 1988), although maternal childcare is thought to be more beneficial to child growth than non-maternal care (Jain and Choudhry, 1993). Sharing domestic tasks other than childcare also promotes child development. For example, mothers in nuclear families reportedly spend less time in childcare than mothers in joint families, possibly because domestic responsibilities and childcare tasks are shared (Jain and Choudhry, 1993). Moreover, Bégin et al. (1999) indicated that infants and preschool children of mothers receiving various types of domestic support,

not only childcare, showed better heights for their ages.

When childcare support from adults is unavailable, working mothers, especially those in a nuclear family, have to care for young children by themselves at their workplace, rely on older siblings (usually preteen), or leave the children at home unattended, which is obviously poor practice (Hernandez et al., 1996; Kamau-Thuita et al., 2002; Lamontagne et al., 1998; Lawrence et al., 1985; Panter-Brick, 1992; Shah et al., 1979). Although in subsistence farming communities it might not be a bad choice to take young children into the field, where a peer childcare giver can easily provide support and food intake often increases through sharing snacks with the mother (Lawrence et al., 1985; Panter-Brick, 1992), caregiving in urban workplaces has been shown to result in poor child health (Hernandez et al., 1996; Lamontagne et al., 1998). Researchers have consistently indicated that peer childcare during the mothers' absence is a risk factor for poor nutrition among children of working mothers (Engle, 1991; Engle and Pederson, 1989; Lamontagne et al., 1998; Leslie, 1989; Popkin, 1980; Shah et al., 1979) because preteen children are not capable of taking appropriate care of younger children.

METHODS

We used data collected as baseline information for a longitudinal study that examined the impact of attendance of a daycare center with a supplementary feeding facility on child development. The baseline survey was conducted in Pokhara, a submetropolitan—the second largest—city in Nepal, from November to December 2003.

Study setting

Nepal is one of the least-developed countries in the world. It has a population of 24 million, a per capita national gross income of USD 230, an infant mortality rate of 66 per 1,000 live births, a female illiteracy rate of 75%, and a labor work force with a female population of 40.5%. The prevalence of underweight and stunted children under 5 years of age is 48% and 51%, respectively (World Bank, 2003).

Pokhara, which has a population of 156,312 according to a 2001 census, is located 200 km west of Kathmandu. With the aid of UNICEF, Pokhara runs 17 daycare centers targeted mainly at poor people in slum areas. In each

center, two staff members care for 25 preschool children under 5 years of age from 10 AM to approximately 4 PM. They provide the children with light meals, such as porridge and noodles at noon. Each center has a management committee consisting of center staff and community people that select children from needy households. They give priority to children from households where both parents are working and to children from deprived households, especially those that are female-headed. The children are placed on a waiting list and, according to the immediacy of their needs, admitted when a vacancy arises.

Participants

We recruited 15 children from the waiting list of each center in order of increasing age. When the number of listed children was less than that required, all children on the list were recruited. For analysis, a total of 155 children of age 10–24 months were selected from 249 recruited children of age 10–44 months. In all centers, the number of children of age 24 months or younger was less than 15, and all were included because the most vulnerable period for growth impairment in Nepal is between weaning and 24 months: nutritional status consistently starts to decline after 6 months of age (Costello, 1989; Goto et al., 2002; Moffat, 1998; Panter-Brick, 1997), and growth rates return to near normal at around 24 months of age (Costello, 1989; Moffat, 2003). Because these centers do not accept infants, the minimum age of listed children was 10 months. Of the 155 children selected for analysis, 4 did not participate in the survey and 1 was excluded because the substitute caregiver was the mother's sister and her age was unknown. Further respective analyses excluding households with a weekly income of more than 2000 NRs ($n = 137$) and including children up to age 36 months ($n = 227$) were also performed. We obtained written informed consent from the mothers of all children after explaining the objectives of the study and the procedures. Illiterate mothers were requested to seal the consent sheet with their thumbprint, a commonly used signature substitute in Nepal. Both Pokhara government and the Institutional Review Board of the University of Tokyo approved the study protocol.

Data collection

For 2 days during August 2003 and on two additional occasions in August and November,

the daycare center staff were trained to accurately measure the children's weight and height and to interview the mothers. During training, the weights and heights of the attending children were measured by the daycare staff then compared with measurements obtained for 5 children by the first and second authors to check for accuracy.

Child anthropometric measurements followed standard procedures (WHO, 1983). The children were weighed unclothed to the nearest 100 g using a Salter spring scale (Model 235 6s, Salter, England), and their heights were measured to the nearest 1 mm using locally constructed measuring boards. Children aged between 10 and 23 months were measured in a supine position and children of age 24 months or older were measured in an upright position.

Households were visited by the daycare center staff, and mothers were interviewed using a structured questionnaire. When mothers were not at home, substitute caregivers were not interviewed, but rather the households were revisited. The questionnaire was pre-tested during a pilot study of 26 children from one of the study sites. Information collected in the interview included sociodemographic characteristics (child's age and sex, mother's age, maternal education level, number of adult family members, number of living children), economic characteristics (maternal job, weekly income-related work hours, maternal income, total household income, type of cooking stove, type of toilet), and childcare practices (immunization record, feeding frequencies, current breastfeeding status, age of introduction of complementary food, main substitute caregiver while mother is working).

Definition of variables

Anthropometric measurements. The weight-for-age *Z* scores (WAZ) and height-for-age *Z* scores (HAZ) from the National Center of Health Statistics (NCHS) reference data (1978 NCHS/CDC/WHO Growth Reference) were used in the assessment of child nutrition. The measures were converted from raw anthropometric measures using Epi Info 2002 software. An underweight child was defined as having scored a WAZ of ≤ -2 and a stunted child as having scored a HAZ of ≤ -2 .

Childcare arrangements. We defined childcare support as the availability of an adult

substitute caregiver, a family member or otherwise. Although very few mothers received support from non-family members, and although such support has been shown to be associated with poor nutrition (Jain and Choudhry, 1993), we assumed that this type of support is better than peer childcare or leaving the children unattended, and thus, in this study, we combined family and non-family support. When the children were cared for by an older sibling or the mother's sister or sister-in-law, the age of the caregiver was also noted. We defined peer childcare as care by older siblings, family members, or servants under age 15. When the mother cared for the child herself or left the child unattended, the child was defined as receiving no childcare support.

Mothers' working status. As the study site was an urban area where farming is uncommon, working mothers were defined as those currently engaged in activities generating cash income. The exception was one mother who was a student and did not earn an income. As our focus was on how childcare support compensates for maternal absence rather than maternal cash income, this mother was included in the working mother group as she was away from home for similar periods of time as working mothers. Maternal work was classified into three categories: formal, informal, and domestic. Specialized workers such as office employees or those running a business were categorized as formal, unskilled workers such as manual laborers and street vendors were categorized as informal, and home craft workers were categorized as domestic. In multivariate analyses, formal workers rather than non-working mothers were used as the reference category because of our assumption that affluent mothers can provide better care than informal workers or non-working mothers who have fewer resources.

Underlying factors and potential confounding factors. The indicator of economic status was total household cash income. The percentage of total household income contributed by the mother was also calculated as it has been shown to be associated with child nutrition (Engle, 1991, 1993). The number of maternal working hours each week was also included in the analysis. As an indicator of health care utilization, we used completion of all necessary vaccinations (BCG, DPT, OPV, and mea-

sles). Mothers' age and level of education and children's age and sex were all used as control variables.

Immediate factors. Feeding practice variables included the daily feeding frequency of solid food (i.e., exclusive of breast milk), current breastfeeding status, milk formula use, and the age that the child started complementary feeding. Experiences of diarrhea and fever during the previous week were reported by the mothers as disease variables.

Data analysis

Firstly, childcare practices and child health status were compared between the non-working and working mother groups. We used the chi-square test for analysis of categorical data, Fisher's exact test for analysis of categorical data with frequencies of less than five, the *t*-test for analysis of numerical data with a normal distribution, and the Mann–Whitney test for analysis of numerical data with a non-normal distribution. Subsequently, we examined the associations between the availability of childcare support and child nutrition in both groups using logistic regression analysis with the children's WAZ (underweight or not) and HAZ (stunted or not) as dependent variables. To investigate the independent associations between the availability of childcare support and child nutrition, we conducted multivariate analysis including resources and sociodemographic characteristics as potential confounding factors. We selected these variables based on a literature review and the UNICEF model (Engle et al., 1996; UNICEF, 1998). As both feeding practices and disease variables are perhaps intermediate factors of child nutrition and childcare support availability, we developed two models, one including and one excluding these factors. Moreover, as more than 90% of participants were still breastfeeding and had completed all vaccinations, these variables were excluded from the multivariate models as their inclusion would widen the confidence intervals considerably. No caste/ethnic category was included in the models because of the degree of heterogeneity, which results in a small number in one category, and the assumption that caste/ethnic differences are reflected in socio-economic and/or behavior differences (Panter-Brick, 1992). We chose not to use linear regression analysis because the interpretation of intervals of *Z* scores below

and above -2 is different; that is, an interval between -3 and -2 is clinically meaningful whereas the same interval between 0 and $+1$ is negligible. SPSS version 11.0 was used for all analyses.

RESULTS

Of the 150 children of age 10–24 months that participated in this study, 66 were male and 72 had working mothers (Table 1). All children of both non-working and working mothers were of a similar age distribution. Children of non-working mothers were more likely to be female. Non-working mothers were younger than working mothers, more educated, and less likely to be illiterate. Paternal education levels did not differ significantly between groups. Non-working mothers were more likely to live in extended families with three or more adult members than working mothers, and the children of non-working mothers had more siblings. Median total household income per week among the non-working mothers was 700 Nepali Rupees (NRs) (equivalent to about 9.4 USD) compared to 1025 NRs (13.7 USD) among the working mothers. Of the working mothers, 10% were from female-headed households. Caste/ethnic compositions did not differ between groups: Indo-Aryan caste/ethnic groups accounted for the majority, Tibeto-Burmese for one quarter, and a small number of minority groups for the remainder.

The majority of working mothers were engaged in informal work, such as manual labor ($n = 40$) and street vending ($n = 7$). Some mothers were engaged in domestic work, such as wool making ($n = 8$), sewing ($n = 3$), and Raksi (Nepali liquor) making ($n = 2$), and the remainder were engaged in formal work, such as office employment ($n = 5$), running businesses ($n = 5$), hotel work ($n = 1$), and study ($n = 1$). The median income of working mothers was 400 NRs (5.3 USD), and the median number of income-related work hours was 42 h per week.

Table 2 presents the childcare and health care practices of each group. Working mothers tended to rely on peer childcare, whereas non-working mothers were more able to utilize adult substitute caregivers. Among the non-working mothers, mothers-in-law were most commonly the adult substitute caregiver ($n = 18$), followed by husbands ($n = 8$) and neighbors ($n = 7$). All peer caregivers were older siblings ($n = 13$), and of these, 11 were female. Among the working mothers, the husband

TABLE 1. Sociodemographic characteristics of the participants

	Non-working (total = 78)	Working (total = 72)	U^b or χ^2	P value
	Median (IQR) ^a or n (%)	Median (IQR) ^a or n (%)		
Child age	20 (15.75–23)	19 (16–21)	2494 ^b	0.24
Child sex (male)	26 (33%)	40 (56%)	7.50	0.006
Mother's age	24 (22–28)	28 (24–34.25)	1750.5 ^b	<0.001
Years of mother's education	5 (3–8.25)	3 (0–7)	2079 ^b	0.005
Illiterate mother	13 (17%)	33 (46%)	15.0	<0.001
Years of father's education	7 (4–10)	5.5 (0–10)	2536.5 ^b	0.30
No. of adult family members	2 (2–3)	2 (2–2)	183.5 ^b	0.008
Living with an extended family ^c	32 (41%)	15 (21%)	7.10	0.008
No. of children	2 (1–2)	2 (1–3)	2126 ^b	0.007
Total household income ^d	700 (500–1050)	1025 (785–1387.5)	1965 ^b	0.001
Mother's income ^d	—	400 (242.5–500)	—	—
Mother's work hours per week	—	42 (24–54.5)	—	—
Female headed household	0 (0%)	7 (10%)	— ^e	0.005
Mother's occupation ^e				
Informal	—	47 (65%)	—	—
Domestic	—	13 (18%)	—	—
Formal	—	12 (17%)	—	—
Caste/ethnic group ^f				
Karni, Damai, or Sarki	29 (37%)	33 (46%)		
Brahmin or Chetti	26 (33%)	14 (19%)		
Gurung, Magar, Tamang, or Rai	19 (24%)	20 (28%)		
Others	4 (5%)	5 (7%)	3.76	0.29

^aInterquartile range.^bMann–Whitney test.^cA family with three or more adult family members.^dSelf-reported weekly cash income in Nepali Rupees; USD 1 was equivalent to about NRs 75.^eInformal work includes manual laborers and street vendors; domestic work includes home craft workers; formal work includes office employees and business owners.^fKarni, Damai, Sarki, Brahmin, and Chetti are in the Indo-Aryan groups; Gurung, Magar, Tamang, and Rai are Tibeto-Burruese;

“Others” include Newar, Muslim, and Giri.

^gFisher's exact test was used.

was most commonly the adult substitute caregiver ($n = 8$), followed by mothers-in-law ($n = 6$), neighbors ($n = 3$), and no caregiver ($n = 3$), which suggests that the children were left unattended. Most of the peer caregivers were older siblings ($n = 20$), and of these, 13 were female. One mother's sister-in-law, one mother's sister, and one female servant were also included as peer caregivers.

The non-working mothers fed their children more frequently, and working mothers tended to start complementary feeding earlier. The majority of both non-working and working mothers had completed their child's vaccinations, were still breastfeeding, and did not use milk formula.

Approximately one-third of children of both the non-working and working mothers experienced a fever during the week prior to data collection (Table 2), and less than one-fifth of children experienced diarrhea. The prevalence of underweight and stunted children did not differ between working and non-working mothers. Of the 78 children of non-working mothers, 25 were underweight and 33 were stunted,

while of the 72 children of working mothers, 29 were underweight and 31 were stunted.

The unavailability of childcare support for non-working mothers was significantly associated with a 3-fold and 4-fold higher risk of children being underweight and stunted, respectively. Peer care also tended to be associated with underweight children (Table 3). The unavailability of childcare support for working mothers was significantly associated with a 4-fold higher risk of children being underweight. Peer care of working mother's children was significantly associated with a 7-fold and 4-fold higher risk of children being underweight and stunted, respectively.

In multivariate logistic regression analysis that took into account the sociodemographic characteristics of non-working mothers (Model 1), the unavailability of childcare support was associated with a 4-fold higher risk of children being underweight and 6-fold higher risk of stunting, respectively (Table 4). When disease experiences and feeding practices were accounted for (Model 2), the unavailability of childcare support was still associated with a

TABLE 2. *Childcare practices and child health status*

	Non-working (total = 78)	Working (total = 72)	χ^2 , U^a , or t^b	P value
	n	n		
Availability of childcare support				
Available	37 (47%)	27 (38%)	4.83	0.09
None	28 (36%)	22 (31%)		
Peer childcare	13 (17%)	23 (32%)		
Feeding and healthcare practices				
Feeding frequency ^c Median (IQR) ^d	4 (3–4)	3 (3–4)	1917 ^a	<0.001
Current breastfeeding	71 (91%)	70 (97%)	— ⁱ	0.17
Ever used formula milk	13 (17%)	16 (22%)	0.74	0.39
Age of starting complementary food				
5 months or earlier	16 (21%)	22 (31%)	5.05	0.08
6–7 months	53 (68%)	36 (50%)		
8 months or later	9 (12%)	14 (19%)		
Vaccination completed ^e	71 (91%)	66 (92%)	0.02	0.89
Disease episodes ^f				
Diarrhea	11 (14%)	12 (17%)	0.19	0.66
Fever	27 (35%)	25 (35%)	<0.001	0.99
Nutritional status				
Underweight ^g	25 (32%)	29 (40%)	1.10	0.29
Stunting ^h	33 (42%)	31 (43%)	0.01	0.93
Weight for age Z-score Mean $\pm$ SD	−1.53 $\pm$ 0.9	−1.69 $\pm$ 1.0	1.01 ^b	0.32
Height for age Z-score Mean $\pm$ SD	−1.86 $\pm$ 1.2	−1.85 $\pm$ 1.8	−0.04 ^b	0.97

^aMann–Whitney test.^b t -test.^cSolid food other than milk.^dInterquartile range.^eBCG, DPT, OPV, and measles.^fMother's self-reported episodes during the previous week.^gWeight for age Z score ≤ -2 .^hHeight for age Z score ≤ -2 .ⁱFisher's exact test was used.TABLE 3. *Availability of child care support and nutritional status*

	Underweight ^a				Stunting ^b			
	n	%	OR ^c	95% CI ^d	n	%	OR	95% CI ^d
Non-working (total = 78)								
Available	7	19	1.00		10	27	1.00	
None	12	43	3.21	1.06 9.77	17	61	4.17	1.46 11.9
Peer childcare	6	46	3.67	0.94 14.4	6	46	2.31	0.62 8.57
Working (total = 72)								
Available	5	19	1.00		8	30	1.00	
None	10	45	3.67	1.02 13.2	9	41	1.64	0.50 5.38
Peer childcare	14	61	6.84	1.90 24.7	14	61	3.69	1.14 12.0

^aWeight for age Z score ≤ -2 .^bHeight for age Z score ≤ -2 .^cOdds ratio.^dConfidence interval.

6-fold higher risk of children being underweight and a 9-fold higher risk of stunting, respectively. An increase of one adult family member was associated with a 3-fold higher risk, and the use of milk formula was associated with a 13-fold higher risk of children being underweight. Children who started complementary feeding between 6 and 7 months of age had a 41-fold higher risk of being underweight compared to children who started after 8 months of age.

Taking into account the sociodemographic characteristics of working mothers (Model 1), the unavailability of childcare and peer care were associated with 17- and 11-fold higher risks of children being underweight, respectively (Table 5). Children of informal workers had a 20-fold higher risk of being underweight than children of formal workers. The availability of childcare support was not associated with a risk of stunting; however, the addition

TABLE 4. Effects of availability of child care support on child nutrition among children of non-working mothers (total = 78)*

	Underweight ^a				Stunting ^b			
	Model 1		Model 2		Model 1		Model 2	
	AOR ^c	95% CI ^d	P	AOR ^c	95% CI ^d	P	AOR ^c	95% CI ^d
Availability of childcare support								
Available	Referent			Referent			Referent	
None	3.90	1.04–14.7	0.04	5.83	1.19–28.5	0.03	5.77	1.67–19.9
Peer childcare	4.35	0.70–27.1	0.12	6.05	0.53–69.2	0.15	2.24	0.41–12.2
Household income ^e	0.999	0.998–1.0001	0.08	0.999	0.997–1.0001	0.07	0.999	0.999–1.0003
No. of children	1.26	0.68–2.31	0.46	2.29	0.98–5.38	0.06	1.38	0.76–2.50
No. of adult family member	1.66	0.80–3.43	0.17	2.87	1.13–7.3	0.03	1.32	0.69–2.51
Mother's age	0.94	0.81–1.09	0.44	0.93	0.78–1.12	0.44	1.01	0.88–1.15
Mother's education year	0.92	0.77–1.10	0.36	0.89	0.72–1.10	0.29	1.08	0.92–1.27
Child age (months)	1.11	0.95–1.30	0.19	1.10	0.89–1.35	0.39	1.05	0.91–1.21
Child sex (male)	1.39	0.44–4.39	0.58	1.57	0.37–6.68	0.54	1.66	0.56–4.89
Diarrhea (yes) ^f				0.26	0.03–1.99	0.19		
Fever (yes) ^f				0.78	0.15–3.97	0.76		
Ever used formula milk (yes)				13.4	1.90–94.5	0.01		
Feeding frequency ^g				1.44	0.54–3.81	0.46		
Age of starting complementary feeding								
5 months or earlier				39.3	0.94–1640	0.05		
6–7 months				41.0	1.10–1533	0.04		
8 months or later				Referent				
–2 Log likelihood	84.2			66.1			93.2	

*To examine whether feeding practices and disease episodes are intermediate factors between child nutrition and childcare support availability, we developed two models: Model 1 excludes and Model 2 includes these factors.

^aWeight for age Z score ≤ -2 .

^bHeight for age Z score ≤ -2 .

^cAdjusted odds ratio.

^dConfidence interval.

^eSelf-reported weekly cash income in Nepali rupees.

^fMother's self-reported disease episodes during the previous week.

^gSolid food other than milk.

TABLE 5. Effects of availability of child care support on child nutrition among children of working mothers (total = 72)*

	Underweight ^a				Stunting ^b			
	Model 1		Model 2		Model 1		Model 2	
	AOR ^c	95% CI ^d	P	AOR ^c	95% CI ^d	P	AOR ^c	95% CI ^d
Availability of childcare support								
Available	Referent			Referent			Referent	
None	17.4	2.14–14.1	0.01	17.2	1.47–201	0.02	1.94	0.42–8.93
Peer childcare	11.4	1.70–76.4	0.01	12.7	1.43–112	0.02	3.28	0.71–15.2
Household income ^e	1.00	1.00–1.00	0.93	1.00	1.00–1.00	0.96	1.00	1.00–1.00
% income ^f	0.68	0.03–14.3	0.80	0.46	0.01–17.7	0.68	0.55	0.03–10.9
Mother's work ^g								
Informal	20.1	1.59–25.4	0.02	31.07	1.46–663	0.03	1.71	0.24–12.2
Domestic	1.62	0.09–29.6	0.74	1.90	0.07–49.3	0.70	0.65	0.06–7.30
Formal	Referent			Referent			Referent	
Mother's work hour	1.04	0.9995–1.09	0.053	1.05	0.997–1.10	0.06	1.00	0.96–1.03
No. of children	1.18	0.60–2.31	0.64	1.38	0.64–3.02	0.41	1.95	1.01–3.77
No. of adult family member	1.37	0.58–3.25	0.47	1.44	0.55–3.76	0.46	0.54	0.20–1.44
Mother's age	0.99	0.86–1.15	0.94	0.95	0.79–1.14	0.57	0.89	0.77–1.02
Mother's education year	1.02	0.81–1.29	0.87	1.04	0.77–1.40	0.79	1.04	0.85–1.27
Child age (months)	0.99	0.81–1.22	0.951	1.08	0.84–1.38	0.55	1.15	0.95–1.40
Child sex (male)	1.83	0.52–6.41	0.34	2.74	0.67–11.3	0.16	0.99	0.32–3.04
Diarrhea (yes) ^h				4.09	0.50–33.4	0.19		
Fever (yes) ^h				1.50	0.29–7.81	0.63		
Ever used formula milk (yes)				0.77	0.12–4.7	0.77		
Feeding frequency ⁱ				0.49	0.15–1.63	0.25		
Age of starting complementary feeding								
5 months or earlier				1.82	0.22–15.4	0.58		
6–7 months				0.62	0.07–5.46	0.67		
8 months or later				Referent				
–2 Log likelihood	67.2			61.0			81.3	

*To examine whether feeding practices and disease episodes are intermediate factors between child nutrition and childcare support availability, we developed two models; Model 1 excludes and Model 2 includes these factors.

^aWeight for age Z score ≤ -2 .

^bHeight for age Z score ≤ -2 .

^cAdjusted odds ratio.

^dConfidence interval.

^eSelf-reported weekly cash income in Nepali rupees.

^fProportion of mother's weekly cash income in the total household weekly cash income.

^gInformal work includes manual labours and street vendors; domestic work includes home craft workers; formal work includes office employees and business owners.

^hMother's self-reported disease episodes during the previous week.

ⁱSolid food other than milk.

TABLE 6. Effects of availability of child care support on child nutrition among all participants (total = 150)

	Underweight ^a			Stunting ^b		
	AOR ^c	95% CI ^d	P	AOR ^c	95% CI ^d	P
Availability of childcare support						
Available	Referent			Referent		
None	6.44	2.18–19.0	0.001	3.39	1.33–8.63	0.01
Peer childcare	6.62	1.85–23.7	0.004	3.63	1.21–10.9	0.02
Household income ^e	0.999	0.998–1.000	0.098	1.00	1.00–1.00	0.27
% income ^f	0.23	0.01–3.80	0.31	0.66	0.06–7.32	0.74
Mother's work ^g						
Non-working	11.4	0.47–275.4	0.13	0.80	0.08–7.92	0.85
Informal	13.6	1.19–154.2	0.04	1.86	0.32–10.7	0.49
Domestic	1.07	0.06–19.0	0.96	0.80	0.10–6.76	0.84
Formal	Referent			Referent		
Mother's work hours	1.04	0.996–1.09	0.07	0.99	0.96–1.03	0.68
No. of children	1.15	0.74–1.81	0.54	1.61	1.04–2.48	0.03
No. of adult family members	1.36	0.78–2.37	0.28	0.97	0.61–1.55	0.91
Mother's age	0.98	0.89–1.08	0.64	0.94	0.86–1.03	0.18
Mother's education years	0.99	0.87–1.14	0.92	1.09	0.97–1.24	0.16
Child age (months)	1.07	0.94–1.22	0.31	1.09	0.97–1.23	0.14
Child sex (male)	1.71	0.71–4.12	0.23	1.28	0.59–2.75	0.53
Diarrhea (yes) ^h	1.17	0.35–3.93	0.80	1.06	0.34–3.29	0.91
Fever (yes) ^h	1.14	0.44–2.95	0.79	0.91	0.38–2.17	0.84
Ever used formula milk (yes)	2.24	0.78–6.47	0.13	0.61	0.23–1.63	0.32
Feeding frequency ⁱ	0.91	0.50–1.65	0.75	0.93	0.57–1.51	0.76
Age of starting complementary feeding						
5 months or earlier	3.53	0.83–15.1	0.09	1.40	0.41–4.75	0.59
6–7 months	1.65	0.43–6.33	0.47	1.34	0.44–4.08	0.60
8 months or later	Referent			Referent		
–2 Log likelihood	148.9			180.9		

^aWeight for age Z score ≤ -2 .^bHeight for age Z score ≤ -2 .^cAdjusted odds ratios.^dConfidence interval.^eSelf-reported weekly cash income in Nepali rupees.^fProportion of mother's weekly cash income in the total household weekly cash income.^gInformal work includes manual labours and street vendors; domestic work includes home craft workers; formal work includes office employees and business owners.^hMother's self-reported disease episodes during the previous week.ⁱSolid food other than milk.

of one sibling was associated with a 2-fold higher risk of stunting. An increase in maternal working hours tended to increase the risk of stunting. These associations did not change when disease experiences and feeding practices were accounted for (Model 2). Unavailability of childcare and peer care was still associated with 17- and 13-fold higher risks of children being underweight, respectively. Children of informal workers had a 31-fold higher risk of being underweight than children of formal workers.

When children of both non-working and working mothers were combined (Model 2), the unavailability of childcare support and peer care were associated with a 6-fold and 7-fold higher risk of children being underweight, respectively; the risk of stunting also increased by 3-fold and 4-fold, respectively (Table 6). Children of mothers engaged in

informal work were associated with a 14-fold higher risk of being underweight than children of mothers engaged in formal work. Children of non-working mothers were not significantly associated with being underweight or stunted.

After the inclusion of children of age 25–36 months in Model 2, both the unavailability of childcare support and peer childcare for children of non-working mothers ($n = 114$) were associated with 8- and 5-fold higher risks of stunting, respectively (data not shown). The availability of childcare support for working mothers ($n = 113$), however, was not associated with an increased risk of children being underweight or stunted.

After excluding households with a weekly income of more than 2000 NRs in Model 2, the unavailability of childcare support for non-working mothers was associated with children being underweight and stunted ($n = 72$). Both

the unavailability of childcare support and peer childcare for working mothers were associated with children being underweight ($n = 65$) (data not shown).

DISCUSSION

We found that the unavailability of appropriate childcare support was associated with an increased risk of malnutrition among children of age 10–24 months of both non-working and working mothers. These findings suggest that all mothers, regardless of their working status, require appropriate childcare support. Poor non-working mothers might also suffer from conflict over limited resources, such as time constraints, leading to reduced maternal childcare time or insufficient energy intake, and thus, weakened care practices; childcare support from an appropriate substitute caregiver can compensate for this.

In the present study, the non-working mothers were poorer and younger than the working mothers. This might be attributed to our sampling procedure, which utilized daycare center waiting lists. That is, children of affluent non-working mothers with less need for childcare support might have been excluded by this procedure, and therefore, these findings might not apply in such cases. Reduced resources, limited time, or a lack of childcare support might impact more severely on children of deprived mothers who have more severe time constraints (Ilahi, 2001) and younger mothers who tend to receive less social support (Bégin et al., 1999). Thus, non-working mothers in general, including more affluent mothers, might be a more heterogeneous group than suggested by our participants, and therefore, the impact of availability of substitute caregivers among affluent non-working mothers requires further investigation.

There are several explanations as to how appropriate childcare support can result in better child nutrition; for example, support can improve feeding practices and reduce disease episodes. However, the inclusion of these hypothesized intermediate factors into the multivariate models did not reduce the odds ratios or statistical significance of the association between unavailability of childcare and child malnutrition. This suggests that childcare support independently influences child nutrition irrespective of feeding practices and disease episodes.

Adult substitute caregivers not only improve the food intake and reduce disease epi-

sodes of the children they care for, but they can also alleviate maternal time conflicts by sharing the mothers' responsibility for other domestic tasks (Jain and Choudhry, 1993; Tucker and Sanjur, 1988), such as food preparation or fetching water and fuel, which might improve the quality of food or enable mothers to spend more time on childcare. Bégin et al. (1999) showed that the amount of support was more important for child health than the type of support. In addition, given the poverty of the non-working mothers included in the present study, it is possible that support compensates for weakened maternal childcare practices due to insufficient maternal energy intake, though maternal nutritional status was not measured here.

Peer childcare was not significantly associated with malnutrition among children of non-working mothers. One possible reason for this is that older siblings might care for younger children appropriately under the supervision of their non-working mothers. In highland Ecuador, peer caretaking was not associated with poor growth indices among children aged between 20 months and 5 years; this might be due to the mother or other adult family members working the farm within calling distance of their residence (Stunsbury et al., 2000). Children can also help their mothers perform domestic chores, such as fetching water or fuels. In contrast, children of working mothers had a higher risk of being underweight when receiving peer childcare.

When a substitute caregiver, whether an adult or older sibling is not available, mothers are required to take full responsibility of their child or children, and working mothers might find they have to take their children to their workplace. However, the presence of the mother neither guarantees quantity nor quality of childcare, because even at home mothers have time conflicts between childcare and domestic work (Jokes, 1989; McGuire and Popkin, 1990). When concentration or handling of hazardous substances is necessary, mothers are perhaps unable to pay full attention to their accompanying children. Hence, in such situations, the children are either kept outside or in another room unattended. Moreover, working mothers sometimes leave young children alone at home unattended (Shah et al., 1979). Such poor parenting practices were evident in the present study.

Resources other than childcare support can also be determinants of child nutrition. The children of mothers engaged in informal work

were significantly more at risk of being underweight than children of mothers engaged in formal work. However, no significant difference was found regarding the nutritional status of children of non-working mothers compared to children of working mothers. The better income, working conditions, and access to resources of formal workers compared to informal workers might explain these findings.

Furthermore, a large family was associated with an increased risk of being underweight among children of non-working mothers, even though other family members were able to provide support for childcare and domestic tasks (Bégin et al., 1999; Jain and Choudhry, 1993; Kamau-Thuita et al., 2002). This might be the result of the family members being more dependent, and hence, a less per capita income. In contrast, stunting was associated with an increased number of children among children of working mothers; working mothers already have severe time conflicts that worsen with an increased number of children.

Caste/ethnic differences might also play a role in influencing child nutritional status as a result of differing fertility and childcare practices (Panter-Brick, 1992). Although the models did not include caste/ethnic groups, differences in childcare and fertility practices were considered in the models. Moreover, we assumed that caste/ethnic differences were reflected in the observed differences (Panter-Brick, 1992), becoming less significant with urban life-styles.

Limitations

Several limitations of the present study should be noted. As only a small number of children were not fully immunized, we were unable to investigate the association between immunization status and child nutrition. Although attending a health care clinic for immunization can divert a mothers' time from other essential activities (Coreil, 1991; Devin and Erickson, 1996; McGuire and Popkin, 1990), in urban areas health care services are easily accessed. Furthermore, we were unable to investigate how children were treated when sick, and hence, were not able to identify a relationship between treatment and nutritional status.

Due to the cross-sectional nature of the present study, both directions of causality are possible. For example, poor child health can deter mothers from working away from home; although this would cause an overestimation

of the association between non-working mothers and child malnutrition, no such significant association was seen. Moreover, poor child health might also increase childcare support from other adult family members or neighbors, which would cause an underestimation of the association between the unavailability of childcare support and child malnutrition. However, despite this, the association observed here was statistically significant.

Further, we are unable to ignore the possibility of inaccurate measurements of feeding practices or disease episodes. Here, we only measured the daily feeding frequency of solid food, not the quantity or quality of food consumed. The frequency of feeding does not necessarily reflect food intake, possibly explaining the seemingly paradoxical finding that those children who started complementary feeding after 8 months of age had a lower risk of being underweight. Likewise, registering disease episodes in the previous week only might not accurately reflect disease frequency or severity, though limiting the reporting period to one week reduced recall bias. In addition, Katz et al. (1998) indicated that agreement between parental reports and clinical examinations in rural Nepal is moderate to poor for diarrhea and fever. The possibility of some inaccurate data does not, however, demean the importance of the availability of childcare support among children of non-working mothers. Further investigation is therefore required to elucidate the mechanisms involved in childcare support and increased child nutritional health.

Some potential determinants were not included in the present model, such as the influence of different types or quality of support and their association with child nutrition. However, availability of childcare support might reflect a mothers' social network and social power, which, in turn, determines the quantity and types of support they receive. Although maternal time allocation was not directly measured, it is unlikely to distort the results because mitigation of time constraints of poor women is one of the intermediate factors between availability of support and improved child nutrition.

CONCLUSION

Our findings suggest that childcare support is essential for children of both non-working and working mothers in deprived areas. Therefore, instead of categorizing women based on their participation in income-generating work, we need to focus on the availability of resour-

ces. Childcare support components should be integrated into intervention programs aimed at enhancing child growth, and, especially, these programs should include children of non-working mothers.

LITERATURE CITED

- Acharya M, Bennett L. 1983. Women and the subsistence sector. Economic participation and household decision making in Nepal. World Bank Staff Working Papers No. 526. Washington, DC: The World Bank.
- Apps P. 2004. Gender, time use, and models of the household. Washington, DC: The World Bank.
- Basu AM. 1996. Women's economic roles and child health: an overview. In: Population and Women: Proceedings of the United Nations Expert Group Meeting on Population and Women, Gaborone, Botswana, 22–26 June 1992. New York: United Nations. p 312–321.
- Bégin F, Frongillo EA Jr, Delisle H. 1999. Caregiver behaviors and resources influence child height-for-age in rural Chad. *J Nutr* 129(3):680–686.
- Coreil J. 1991. Maternal time allocation in relation to kind and domain of primary health care. *Med Anthropol Q* 5(3):221–235.
- Costello AM. 1989. Growth velocity and stunting in rural Nepal. *Arch Dis Child* 64(10):1478–1482.
- Devin RB, Erickson PI. 1996. The influence of male caregivers on child health in rural Haiti. *Soc Sci Med* 43(4):479–488.
- Doan RM, Popkin BM. 1993. Women's work and infant care in the Philippines. *Soc Sci Med* 36(3):297–304.
- Dufour DL, Reina JC, Spurr GB. 2003. Physical activity of poor women in Cali, Colombia: a comparison of working and not working women. *Am J Hum Biol* 15(4):490–497.
- Engle PL. 1991. Maternal work and child-care strategies in peri-urban Guatemala: nutritional effects. *Child Dev* 62(5):954–965.
- Engle PL. 1993. Influences of mother's and father's income on children's nutritional status in Guatemala. *Soc Sci Med* 37(11):1303–1312.
- Engle PL, Menon P, Haddad L. 1996. Care and nutrition: concepts and measurement. Washington, DC: International Food Policy Research Institute.
- Engle PL, Pederson ME. 1989. Maternal work for earnings and children's nutritional status in urban Guatemala. *Ecol Food Nutr* 22(3):211–223.
- Goto R, Panter-Brick C, Northrop-Clewes CA, Manahdhar R, Tuladhar NR. 2002. Poor intestinal permeability in mildly stunted Nepali children: associations with weaning practices and *Giardia lamblia* infection. *Br J Nutr* 88(2):141–149.
- Ilahi N. 2000. The intra-household allocation of time and tasks: what have we learnt from the empirical literature? Policy research report on gender and development. Working paper no. 13. Washington, DC: The World Bank.
- Hernandez P, Zetina A, Tapia M, Ortiz C, Soto IC. 1996. Childcare needs of female street vendors in Mexico City. *Health Policy Plan* 11(2):169–178.
- Ilahi N. 2001. Gender and allocation of adult time: evidence from the Peru LSMS panel data. Washington, DC: The World Bank.
- Jain S, Choudhry M. 1993. Mother surrogate and nutritional status of preschool children. *Indian J Pediatr* 60(3):429–433.
- Jokes S. 1989. Women's work and social support for child care in developing countries. In: Leslie J, Paolisso M, editors. Women, work, and child welfare in developing countries. Boulder, CO: Westview Press. p 59–84.
- Kamau-Thuita F, Omwega AM, Muita JW. 2002. Child care practices and nutritional status of children aged 0–2 years in Thika, Kenya. *East Afr Med J* 79(10):524–529.
- Katz J, West KP Jr, LeClerq SC, Thapa MD, Khatry SK, Shrestha SR, Pradhan EK, Pokhrel RP. 1998. Agreement between clinical examination and parental morbidity histories for children in Nepal. *J Trop Pediatr* 44(4):225–229.
- Lamontagne JF, Engle PL, Zeitlin MF. 1998. Maternal employment, child care, and nutritional status of 12–18-month-old children in Managua, Nicaragua. *Soc Sci Med* 46(3):403–414.
- Lawrence F, Lamb WH, Lamb C, Lawrence M. 1985. A quantification of child care and infant-caregiver interaction in a West-African village. *Early Hum Dev* 12(1):71–80.
- Leslie J. 1989. Women's work and child nutrition in developing countries. In: Leslie J, Paolisso M, editors. Women, work, and child welfare in developing countries. Boulder, CO: Westview Press. p 19–58.
- McDade TW. 2001. Parent-offspring conflict and the cultural ecology of breast-feeding. *Hum Nat* 12(1):9–25.
- McGuire JS, Popkin BM. 1990. Helping women improve nutrition in the developing world. World Bank technical paper no. 114. Washington, DC: The World Bank.
- Moffat T. 1998. Urbanization and child growth in Nepal. *Am J Hum Biol* 10(3):307–315.
- Moffat T. 2003. Diarrhea, respiratory infections, protozoan gastrointestinal parasites, and child growth in Kathmandu, Nepal. *Am J Phys Anthropol* 122(1):85–97.
- Panter-Brick C. 1992. Women's work and child nutrition: the food intake of 0–4 year old children in rural Nepal. *Ecol Food Nutr* 29:11–24.
- Panter-Brick C. 1997. Seasonal growth patterns in rural Nepali children. *Ann Hum Biol* 24(1):1–18.
- Popkin BM. 1980. Time allocation of the mother and child nutrition. *Ecol Food Nutr* 9(1):1–13.
- Rabiee F, Geissler C. 1992. The impact of maternal workload on child nutrition in rural Iran. *Food Nutr Bull* 14(1):43–48.
- Shah PM, Walimbe SR, Dhole VS. 1979. Wage-earning mothers, mother-substitutes and care of the young children in rural Maharashtra. *Indian Pediatr* 16(2):167–173.
- Stansbury JP, Leonard WR, DeWalt KM. 2000. Caretakers, child care practices, and growth failure in highland Ecuador. *Med Anthropol Q* 14(2):224–241.
- Tucker K, Sanjur D. 1988. Maternal employment and child nutrition in Panama. *Soc Sci Med* 26(6):605–612.
- United Nations Children's Fund. 1998. The state of the world's children 1998. New York: Oxford University Press.
- Wandel M, Holmboe-Ottesen G. 1992. Women's work in agriculture and child nutrition in Tanzania. *J Trop Pediatr* 38(5):252–255.
- World Bank. 2003. World development indicators 2003. Washington, DC: The World Bank.
- World Health Organization. 1983. Measuring change in nutritional status. Geneva: World Health Organization.