Association between mother’s work status and child stunting in urban slums: a cross-sectional assessment of 346 child-mother dyads in Dhaka, Bangladesh (2020)

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Abstract

**Background:** A growing literature highlights the increased risk of stunting among children growing up in informal or slum settlements. Despite relatively high rates of female labor force participation in slums, there is limited evidence on relationship between mother’s work participation and nutritional outcomes of children in these settings.

**Methods:** We conducted a cross-sectional study in two large slums (Korail and Tongi) of Dhaka and Gazipur, Bangladesh to assess the association between maternal work and childhood stunting in a low-income urban context. Logistic regression models estimated unconditional and conditional associations between maternal work status and 1) child stunting, 2) child morbidity and dietary intake, and 3) health and hygiene behaviors. Subgroup analyses were done by type of child care support available.

**Results:** After adjusting for variations in individual and household level characteristics, we found that children of working mothers had nearly twice the odds of being stunted than children of non-working mothers (OR 1.84, 95%CI 1.05-3.23). Large differences in stunting were found by available care support: compared to children of non-working mothers, children of working mothers with nuclear-type family support had 4.5 times increased odds of stunting (OR 4.49, 95%CI 1.81-11.12), while no odds differential was found for children of working mothers with an extended-type family support (OR 0.69, 95%CI 0.30-1.59).

**Conclusions:** Maternal employment is associated with a substantial increase in the odds of child stunting in the slum areas studied. Given that these effects only appear to arise in the absence of adequate family support, integrating appropriate childcare support measures for low-income urban working mothers might be an effective strategy to help reduce the prevalence of chronic undernutrition among slum children.

**Keywords:** Slum health, Maternal employment, Child stunting, Child undernutrition, Childcare support, Urban poor, Bangladesh

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stunting are continued exposure to recurrent infections as well as suboptimal nutritional intake, especially during the first 1000-days [2, 4]. Stunting is difficult to reverse, and frequently associated with physical and cognitive impairments that undermine child’s educational attainment and potential income in later life [3, 5]. The economic impact of stunting in developing countries is also significant, with an estimated cost of $616.5 billion per birth cohort in loss of wage income, and particularly large costs in South Asia [6].

Considerable progress has been made globally to reduce childhood stunting over the last decade. However, the prevalence of stunting remains high in many low- and middle-income countries (LMICs) [7–9]. A growing literature also highlights stunting differentials within countries, with particularly marked inequalities in childhood stunting by socio-economic status, and stunting being viewed largely as a condition of poverty [8, 10]. With many developing countries now experiencing rapid urbanization, rising urban poverty and concern for health and wellbeing of urban poor and slum dwellers has increasingly featured in the global health and development discourse [11–14]. Against this backdrop, slum children have been pointed out as an important vulnerable group for childhood stunting, which needs more focus in the global equity agenda [15–18].

In Bangladesh, slum children bear a disproportionate burden of stunting [19–23]. A number of cross-country studies and in Bangladesh have empirically explored socio-economic and neighborhood-based factors to explain stunting risks among slum children [20, 21, 24, 25]; yet, there is limited evidence about maternal and household behavioral factors that can contribute to linear growth faltering in slum children. One such factor is the role of maternal employment, which tends to be relatively high in Bangladesh slum areas [26]. Many slum residents migrate from rural areas in search of livelihood opportunities or better-pay, but often leave behind families that are a key source of informal childcare support. In the context of limited care support, mother’s work and regular absence from childcare can undermine appropriate care and feeding practices, leading to poorer nutritional outcomes among slum children [27].

Existing country-level studies on maternal work and child stunting in LMICs show mixed results [28–35], including in Bangladesh [20, 36]. Generally, a negative association between mother’s work and child nutritional status has been found in low-income contexts [34, 37–39], suggesting that the positive effects of improved household income—where low-skill and low-wage work tends to be dominant—failed to offset the potential negative effects of maternal absence from childcare in some settings [34].

In this paper, we examine the association between maternal work and child stunting in an urban poverty context of Bangladesh. We theorized that maternal employment is associated with an increased risk of childhood stunting in these settings, due to mothers—who are almost universally primary caregivers in these contexts—lacking adequate child care support.

Methods

Study design and conceptual framework

We conducted a cross-sectional study to explore the association between maternal employment and childhood stunting in an urban poverty context of Bangladesh. Figure 1 shows the study’s conceptual framework, adapted from the UNICEF framework [40], depicting the presumed relationship between maternal employment and child nutritional status in Bangladesh urban slums. As the figure shows, poverty and maternal employment are closely linked in a bi-directional fashion. Poverty compels the mother to work [37, 41], leading to increased household wealth or income, and resulting in a positive improvement to household food security and general living conditions [42, 43]. This, in turn, enhances the adequacy of child care and feeding (i.e., the ‘positive income effect’ of maternal work). On the other hand, in the context of limited formal or informal child care support, maternal employment negatively affects child care and feeding practices (i.e., the ‘negative care effect’ of maternal work), contributing to child’s poorer dietary intake and increased morbidity (the direct causes of child stunting). This framework illustrates that a variable part of maternal employment’s effect interacts with wealth to determine the adequacy of child feeding and care. Maternal work’s association with child nutritional status is thus the balance of its positive income effect and negative (modifiable) care effect.

Setting: female labor force participation in Bangladesh

Nationally, female labor force participation (FLFP) in Bangladesh is 36% [44], which is considered low among countries with comparable income levels, but higher than in neighboring India [26]. In Bangladesh overall urban areas, about one-third of ever-married reproductive-aged women from slums worked full time, compared to one-sixth of women from non-slum areas [22]. In Dhaka, the FLFP rate was 58% in poor urban areas [26] and 31% for all-urban [44]. Lack of income and livelihood security was noted as a key driver of higher FLFP in poor urban settings [37, 41].

Sampling and data collection

Data was collected during February-March 2020 in two large slum areas (Korail and Tongi) of Dhaka North and
Gazipur City Corporations by International Centre for Diarrheal Disease Research, Bangladesh (icddr,b). Sampling and data collection procedures were designed for evaluating the impact of household- and community-based nutrition interventions under the government’s Urban Primary Health Care Service Delivery Project (UPHCSDP) [45], to which this study was piggy-backed. The UPHCSDP survey was nested in the Urban Health and Demographic Surveillance System (UHDSS) [46], which covered 31,577 households, 11,517 under-five children, and 54 slum clusters in 5 large slum areas of 3 city corporations of Dhaka Division as of January 2020. Two-stage stratified sampling was used to select households from the full UHDSS household census as of January 2020: in the first stage, all 54 slum clusters were selected to maximize statistical power; in the second stage, a random set of 39 under-five children (0-59 months) were selected from each cluster to meet the specified cluster size. The UPHCSDP survey had an original target sample size of 2100 children. The sample size was calculated for the UPHCSDP impact evaluation based on detecting a minimum average height-for-age z-score (HAZ) difference of 0.25 standard deviations (SDs) between intervention and control groups, with a 5% significance level, 80% power, and design effect of 3.05. However, due to the onset of the Coronavirus Disease 2019 (COVID-19) pandemic and ensuing nationwide lockdown (March-May 2020), the fieldwork for the survey was suspended after completing a sample of 346 observations in the two slum areas, and could not be resumed in time to allow for a consistent sample.

The survey used tab-based, pre-coded structured questionnaires to collect information on a range of household and individual (mother and child) level characteristics, including separate modules on child care and feeding practices and maternal work background. Interviews were conducted by field enumerators with mothers or caretakers in their homes in the local language. In instances where mothers were unavailable on the first visit, follow-up appointments or up to three attempts were made to obtain the interview. Anthropometric measurements of mothers and children were taken by field interviewers and supervisors trained by a nutritionist from icddr,b following World Health Organization (WHO) protocols [47]. All length/height and weight measurements were completed using equipment on lent from the local UNICEF office. Maternal and child height/length were measured using portable locally made height boards. Length measurement for children under-two were taken in recumbent position. The weight was

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Fig. 1 Study’s conceptual framework: hypothesized relationship of how maternal employment affects child nutritional status in an urban poverty setting
assessed at 50-g resolution on digital scales (SECA 874, Hamburg, Germany) and measured to the nearest 0.1 kg in light clothing for children; tared weighing (with child in arms of caretaker) with SECA scales was done for children under 2 years.

The study was approved by the Institutional Review Board of icddr,b on technical competency and ethical issues, as well as by the Ethikkommission Nordwest - und Zentralschweiz in Switzerland. Written informed consent was obtained from each survey respondent prior to the interview. Before taking consent, interviewers explained to participants all relevant information on the consent form, including research purpose, assurance of confidentiality, and their right to withdraw at any time without further obligation. In cases where respondents could neither read nor write, interviewers read aloud the consent form in entirety and thumbprints were taken.

**Variables**

**Outcome measure**

Our primary outcome measure was stunting, defined as a length/height-for-age z-score (HAZ) of more than 2 SDs below the 2006 WHO Child Growth Standards median (HAZ < -2). We used Stata software built-in package zscore06 to transform child height and weight measurements into z-scores of the WHO reference population. We excluded from our analysis one observation with a biological implausible value beyond the WHO-recommended acceptable range (HAZ > 6 and < -6).

**Exposure measure**

Our main exposure variable was current maternal employment status. At the time of interview, mothers were asked if they were currently engaged in any kind of income-generating work—including jobs that were paid in cash or kind, owning a small business (including street vendors), or working in a family business. Mothers were coded as ‘currently working’ if they responded ‘yes’ to the interview question. Similar criteria were used to define women’s employment in previous research exploring the role of maternal work on child health outcomes [34]. Mothers that reported having worked in the last year or were searching for work were considered ‘currently not working’ in the regression analyses. Information on type of mother’s occupation was also collected and presented in the descriptive analysis.

**Diet and disease measures**

Figure 1 depicts disease and dietary intake as direct causes of child undernutrition. Disease occurrence was captured by caregiver’s report of the child’s last illness episode (fever and diarrhea). Caregivers were asked how long ago (in days, weeks, or months) the child was last sick with the illness; a binary variable was then created as to whether or not the child presented with the illness within the last 3 months.

To assess child’s diet intake, we used indicators of breastfeeding history and complementary feeding in children older than 6 months. Breastfeeding was captured by WHO-recommended exclusive breastfeeding for first 6 months, and complementary breastfeeding between 7 and 23 months. Children were considered exclusively breastfed if the caregiver reported not having given them anything other than breastmilk (including water) within the first 6 months of birth. Children under-6 months, and have not been given anything other than breastmilk at the time of interview, were also coded as exclusively breastfed. Children were considered complementarily breastfed between 7 and 23 months if they had stopped breastfeeding at the time of the interview but were reported to be breastfed at least until 23 months (mothers were asked for how long they breastfed the child). Children still breastfeeding and were older than 6 months at the time of the interview were also coded as complementarily breastfed between 7 and 23 months. Children 6 months or younger were excluded in analysis of this variable.

Questions related to child’s complementary feeding were based on the caregiver’s 24-hour recall. Measures of dietary diversity and meal frequency for children older than 6 months were adapted from WHO guidance on infant and young child feeding (IYCF) indicators [48, 49]. Children were considered to have met minimum dietary diversity if they received foods from at least four out of the seven IYCF recommended food groups (excluding breastmilk) on the prior day of interview. Children were considered to have met minimum meal frequency if they ate soft, semi-solid, or solid foods at least four times on the day prior to the interview. While disaggregating diet measurements by child’s breastfeeding status and specific age-groups was important, we applied broader indicators in our analysis, as our main intent was to assess differences in feeding patterns rather than diet sufficiency. In addition to the IYCF indicators, we assessed children’s consumption of foods from key nutrient groups of plant and animal sources [50].

**Caregiving measures**

We assessed caregiving behaviors in two areas: health and hygiene. Child’s health-seeking behavior was captured through four binary variables indicating access to preventive, curative, and pre- and post-natal care: whether child was fully vaccinated; whether treatment was sought when child was last sick with fever; whether mother received at least four antenatal care (ANC) visits while pregnant with child; and whether child was born at home or at a NGO/public/private health facility. Child’s household...
hygiene environment was assessed through variables of safe drinking water (treatment and storage of drinking water at home) and hand hygiene (presence of soap and water at handwashing place). In addition, we assessed childcare support available to mother through type of secondary caregivers. Caregivers during interview were asked to identify persons (such as child’s sibling, father, or grandmother) that helped with child’s care and feeding other than the mother. The information on secondary caregivers was also used as a proxy to classify nuclear- or extended-type family structures. Children of mothers with only husband, older children, or no one else for care support were considered to be of nuclear-type families; those with support of grandmother, other relative, or multiple people were considered to be of extended-type families.

Other variables
Covariates considered included socio-demographic characteristics at individual and household levels that were known to potentially influence child nutritional status. Child’s age, sex, and birthweight; maternal age and stature; parental education; household size, migration status, water and sanitation access, and slum area were included as main background controls. Child’s age in months was recoded into three age groups of 0-11 month, 12-23 month, and a broader 24-59 month. Child’s birth weight was a quantitative variable recorded in nearest kilogram from caregiver’s recall or health card (children not weighed at birth, or ‘Don’t Know’ was coded as missing). Maternal height in centimetres (cm) was recoded as categorical variables of ‘very short’ (<145 cm), ‘short’ (145 to <155 cm), or normal-to-tall (155 to 200 cm). We used the reference of ≥155 cm as normal height [51], although the average height of Bangladeshi women were in the ‘short’ category. Maternal and paternal education were quantitative variables indicating the highest class completed. Household water and sanitation access was captured by two binary variables: whether toilet was shared with other households, and if water was unavailable at source for at least one full day in the last 2 weeks of interview. A household was considered ‘migrant’ from another place if it had moved from another area, regardless of length of stay in the slum area. Household size indicate the number of members in the household and was treated as a quantitative variable. We included a slum area fixed effect to control for unobserved community- or area-based factors, such as environmental exposures, common cultures or place of origins, and access to basic urban services.

Additional controls for household wealth and monthly income were included in some models to partial-out potential income effects. Household wealth index scores were derived using principal components analysis procedure from data about household ownership of durable assets and amenities, and separated into quintiles. Caregiver reported mean monthly household income (in Bangladeshi Taka) was separated into quartiles.

Statistical analysis
First, we provide descriptive statistics comparing background characteristics of working and non-working mothers in our sample. We used Pearson chi-square and Adjusted Wald tests to assess statistical significance of group-level differences. Next, we used bi-variable and multi-variable logistic regression models to estimate unconditional and conditional associations between maternal work exposure and 1) child stunting outcome, 2) child morbidity and dietary intake, and 3) caregiving behaviours. We considered statistical significance at the 5% threshold (p ≤ 0.05). For quantitative variables, we examined linearity of their relationship with the outcome by adding square and cubic terms in the model and with graphical analysis of predicted values. We used clustered standard errors in all regression models to adjust for sampling design and within-cluster correlation, as well as to address heteroscedasticity in variance. We imputed missing data on covariates using multiple imputation by chained eqs [52], specifying linear, binary, ordered, and multinominal distributions. Data was assumed missing at random. We created 20 imputations for the analysis (see Additional file 1: Appendix 1 for descriptive statistics comparing selected imputations and observed data). We used statistical software Stata 15.1 (Stata Corps) for data analysis.

Results
Table 1 presents descriptive statistics comparing the backgrounds of currently working and non-working mothers. Overall, 15.7% (54 out of 344) of mothers with non-missing exposure information were working at the time of the survey. A higher proportion of households of working mothers than non-working mothers were in Gazipur. On average, children of working mothers were older and had higher birth order and lower birth weight than children of non-working mothers. A considerably lower percentage of working mothers’ children were fully vaccinated than those of non-working mothers. The majority of children of working mothers had mothers that also worked during their pregnancy. Working mothers were on average older, less educated, and less literate than non-working mothers; they were also more likely to want no more children. Their husbands were also older and less educated than non-working mothers. Virtually all mothers were the primary caregivers regardless of work status; however, working mothers were less likely
### Table 1  Background characteristics of children with working and not-working mothers in study sample

| Background factors                                                                 | N*   | Not-working (n = 290) | Working (n = 54) | P-value** |
|------------------------------------------------------------------------------------|------|-----------------------|------------------|-----------|
| **Household**                                                                      |      |                       |                  |           |
| HH slum location (%)                                                               | 344  | 51.38                 | 33.33            | 0.015     |
|   Korail (Dhaka North)                                                             | 48.62| 66.67                 |                  |           |
|   Tongi (Gazipur)                                                                 |      |                       |                  |           |
| HH migratory status (%)                                                            | 328  | 59.21                 | 70.59            | 0.126     |
|   Migrant                                                                         |      |                       |                  |           |
| HH wealth quintile (1-5), mean ± SD                                               | 317  | 2.94 ± 1.42           | 3.25 ± 1.36      | 0.131     |
| Monthly income (BDT, quartiles) (%)                                                | 328  | 40.36                 | 26.42            | 0.036     |
|   1 (2000-15,000 BDT)                                                              |      |                       |                  |           |
|   2 (16000-20,000 BDT)                                                             | 25.45| 32.08                 |                  |           |
|   3 (21000-25,000 BDT)                                                             | 13.45| 26.42                 |                  |           |
|   4(27000-110,000 BDT)                                                             | 20.73| 15.09                 |                  |           |
| Household size, mean ± SD                                                          | 344  | 4.92 ± 2.04           | 4.74 ± 1.47      | 0.432     |
| Main source of cooking fuel (%)                                                    | 343  | 13.84                 | 22.22            | 0.267     |
|   Solid fuels                                                                      |      |                       |                  |           |
| HH has separate kitchen (%)                                                        | 341  | 40.63                 | 43.40            | 0.706     |
| Handwashing place observed at home (%)                                             | 344  | 80.00                 | 83.33            | 0.570     |
| Main drinking water source (%)                                                     | 344  | 80.00                 | 83.33            | 0.570     |
|   Improved type                                                                    |      |                       |                  |           |
| Water unavailable from source for at least 1 full day (in last 2 weeks) (%)       | 344  | 26.66                 | 14.81            | 0.066     |
| Treat water at home to make safer to drink (%)                                     | 344  | 30.34                 | 20.37            | 0.137     |
| Store drinking water at home (%)                                                  | 343  | 60.21                 | 38.89            | 0.004     |
| Toilet type (%)                                                                   | 343  | 100.00                | 98.15            | 0.021     |
|   Improved type                                                                    |      |                       |                  |           |
| Toilet is shared with other households (%)                                        | 343  | 66.90                 | 64.15            | 0.697     |
| Shared toilet type (base: shared toilet)                                           | 229  | 18.04                 | 37.14            | 0.011     |
|   Public facility                                                                  |      |                       |                  |           |
| Distance to nearest public/ NGO health facility (within 1 km) (%)                  | 335  | 85.87                 | 94.23            | 0.097     |
| HH received nutrition IEC/service before survey (%)                                | 336  | 38.65                 | 55.56            | 0.021     |
| **Child**                                                                         |      |                       |                  |           |
| Sex (%)                                                                           | 344  | 47.93                 | 42.59            | 0.471     |
|   Female                                                                          |      |                       |                  |           |
| Age (months), mean ± SD                                                           | 344  | 27.81 ± 16.33         | 34.37 ± 15.11    | 0.004     |
| Birth order, mean ± SD                                                            | 340  | 1.84 ± 0.92           | 2.19 ± 1.08      | 0.029     |
| Place of birth (%)                                                                | 342  | 41.18                 | 41.51            | 0.619     |
|   Home                                                                            |      |                       |                  |           |
| Mother worked during pregnancy (%)                                                | 342  | 15.63                 | 51.85            | <0.001    |
| Birthweight (in kg, both card and recall), mean ± SD                               | 229  | 3.04 ± 0.74           | 2.83 ± 0.53      | 0.045     |
| Birth registered (%)                                                              | 343  | 39.45                 | 59.26            | 0.007     |
| Fully vaccinateda (%)                                                              | 344  | 54.83                 | 29.63            | 0.001     |
| **Mother**                                                                         |      |                       |                  |           |
| Age (years), mean ± SD                                                            | 341  | 26.01 ± 5.64          | 29.43 ± 5.58     | <0.001    |
| Educational attainment (class completed), mean ± SD                                | 340  | 5.75 ± 3.53           | 4.47 ± 3.17      | 0.009     |
| Literacy (%)                                                                      | 343  | 20.07                 | 27.78            | <0.001    |
|   Cannot read at all                                                               |      |                       |                  |           |
|   Can partly read                                                                  | 17.65| 37.04                 |                  |           |
|   Can fully read                                                                   | 62.28| 35.19                 |                  |           |
| Media exposure (%)                                                                | 343  | 84.43                 | 92.59            | 0.116     |
| At least once weekly (to newspaper/radio/TV)                                       |      |                       |                  |           |
than non-working mothers to have no one else to help care for their children. (See Additional file 1: Appendix 2 for descriptive statistics on background characteristics of the full sample.)

Figure 2 (panel A) shows that about 19% of under-five children’s mothers in our sample were currently working (15.7%), worked in last 12 months (1.5%), or were searching for work (2.0%). Panel B indicate types of occupation currently working mothers were engaged in, which were largely in manual or in lower-skill categories according to the International Labor Office’s standard classifications of occupations [53]. Virtually all currently working mothers (96%) worked throughout the year, and a large majority (63%) of them were working to help meet their household’s basic daily sustenance (see Additional file 1: Appendix 3 on further characteristics of working mothers). The overall prevalence of child stunting among children of currently working mothers was 11.2% points higher than children of non-working mothers (panel C). Virtually all difference in stunting rate between working and non-working mothers’ children was concentrated in the 24-59 month age group (see Additional file 1: Appendix 4). Among currently working mothers, child stunting was higher for children of mothers engaged in manual or unskilled type of work (domestic workers and day laborers) than for those in higher-skilled type of work (factory workers, service workers, self-employed) (Panel D).

Table 2 presents estimated unadjusted and adjusted associations between current maternal work exposure and child stunting outcome. The crude estimate shows that children of currently working mothers had 66% increased odds of stunting compared to children of not currently working mothers (odds ratio (OR) 1.66, 95% CI 0.96-2.89). The association was significant with adjustments for child and parental factors (Model 2) (OR 1.68, 95% CI 1.06-2.67). The subsequent controls for neighborhood and household level variables (Model 3) increased the odds of stunting to 84% (OR 1.84, 95% CI 1.05-3.23) for children of working mothers. In Model 4, we tested the association additionally controlling for, or

| Background factors                                      | N* | Not-working (n = 290) | Working (n = 54) | P-value** |
|---------------------------------------------------------|----|----------------------|-----------------|----------|
| Marital status (%)                                       |    |                      |                 |          |
| Married                                                  | 344| 98.28                | 100.00          | 0.331    |
| Children ever born, mean ± SD                           | 341| 1.95 ± 0.92          | 2.26 ± 1.12     | 0.057    |
| Wants no more children (%)                              | 343| 46.02                | 70.37           | 0.004    |
| Currently using contraceptive (%)                       | 342| 81.94                | 88.89           | 0.212    |
| BM% (%)                                                  |    |                      |                 |          |
| Underweight                                             | 334| 6.79                 | 11.11           | 0.242    |
| Overweight                                              |    |                      |                 |          |
| Statuere (%)                                             |    |                      |                 |          |
| Very short < 145 cm                                      | 344| 14.83                | 22.22           | 0.316    |
| Short: 145 to < 155 cm                                   | 70.69| 61.11               |                 |          |
| Normal: ≥ 155                                           |    |                      |                 |          |
| Primary caregiver of child is mother (%)                 | 343| 99.66                | 98.11           | 0.175    |
| Secondary caregivers other than mother (%)               |    |                      |                 |          |
| Older sibling/father/relative only                       | 325| 34.06                | 40.82           | 0.037    |
| Grandmother only                                         |    |                      |                 |          |
| No one else                                              | 34.78| 14.29               |                 |          |
| Multiple people                                          | 10.51| 16.33               |                 |          |
| Father (mother’s husband)                               |    |                      |                 |          |
| Age (years), mean ± SD                                   | 339| 32.54 ± 6.84         | 35.44 ± 6.51    | 0.003    |
| Educational attainment (class completed), mean ± SD      | 337| 6.28 ± 3.88          | 5.33 ± 4.04     | 0.115    |
| Employment status (%)                                    |    |                      |                 |          |
| Currently working                                       | 341| 98.61                | 100.00          | 0.683    |

**HYY household, BMI body mass index, SD standard deviation, IEC information education communication

* 2 observations with missing maternal work exposure were excluded
** indicates statistical significance level between currently working and non-working mothers

A child is considered ‘fully vaccinated’ in Bangladesh if following vaccines were received: 1 dose of BCG, 3 doses of pentavalent, 3 doses of OPV or at least one dose of IPV, and 1 dose of MCV; children 8 months or younger were coded as ‘fully vaccinated’ as the last vaccine is typically received only after 9 months of age

Excludes pregnant women
to partial-out, the positive effect of maternal work (i.e. improved household monthly income and household wealth); it shows a further increase in odds of stunting for children of working mothers to 122% (OR 2.22, 95% CI 1.16-4.24) compared to those of non-working mothers.

Table 3 shows associations between current maternal work status (as exposure) and incidence of child sickness, patterns of dietary intake, and health and hygiene behaviors (as intermediate outcomes). There were no major differences in frequency of child sickness and feeding patterns between children of working and non-working mothers. However, children of working mothers were less likely to be fully vaccinated when adjusted for covariates (OR 0.41, 95% CI 0.21-0.81). Working mothers’ households also had decreased odds of storing drinking water at home (OR 0.47, 95% CI: 0.27-0.81).

Figure 3 depicts prevalence of stunting among slum children by type of secondary caregivers available to support the mother, disaggregated by mother’s work status. Among children of working mothers (presumably where mothers are regularly absent from child for a good part of the day), stunting prevalence was highest when children were left with only their elder sibling (75.0%) or no one else (57.1%), and lowest when grandmothers (25.0%) or multiple people (25.0%) were around. Notably, when grandmother or more than one support source was available, stunting among children of working mothers (25.0%) was lower than the overall stunting prevalence among children of non-working mothers (28.4%).

Table 4 presents estimated associations between child stunting and maternal work status, disaggregated by type of secondary care support available to mother. Compared to children of not-working mothers, only children of currently working mothers with sibling’s or father’s care support showed a statistically significant association with stunting, with a nearly 400% increased odds of stunting compared to children of non-working mothers (OR 4.96, 95%CI 1.87-13.17). Currently working mothers with nuclear-type family structures also had largely increased odds of child stunting compared to non-working mothers.
Table 2  Estimated unadjusted and adjusted associations between child stunting and maternal work

| Stunted | Bivariate | Model 1 Adjusted for: Child age, sex, birthweight | Model 2 Adjusted for: Model 1 + Maternal age & stature, parental education | Model 3 Adjusted for: Model 2 + HH migration status, HH water and sanitation, HH size, HH health and nutrition access, slum area fixed effect | Model 4 Adjusted for: Model 3 + HH wealth, HH monthly income |
|---------|-----------|--------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------|
| N = 343* | OR (95% CI) | | | | |

**Maternal work**

| Currently working | 1.66 (0.96,2.89)^ | 1.55 (0.93,2.59)^ | 1.68 (1.06,2.67)^ | 1.84 (1.05,3.23)^ | 2.22 (1.16,4.24)^ |
|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Currently not working | Ref | Ref | Ref | Ref | Ref |

**Child's age**

| 0-11 months | Ref | Ref | Ref | Ref | Ref |
|-------------|-----|-----|-----|-----|-----|
| 12-23 months | 3.00 (1.64,5.50)*** | 2.78 (1.49,5.19)*** | 2.86 (1.40,5.55)** | 2.95 (1.47,5.92)** | 3.45 (1.75,6.81)*** |
| 24-59 months | 1.40 (0.78,2.52) | 1.29 (0.74,2.25) | 1.36 (0.73,2.55) | 1.28 (0.66,2.47) | 1.34 (0.72,2.48) |

**Child's sex**

| Female | Ref | Ref | Ref | Ref | Ref |
|--------|-----|-----|-----|-----|-----|
| Male | 1.23 (0.69,2.21) | 1.21 (0.65,2.26) | 1.20 (0.66,2.18) | 1.18 (0.66,2.10) | 1.08 (0.58,2.01) |

**Child birth weight (kg)**

| 0.74 (0.46,1.19) | 0.86 (0.52,1.43) | 0.86 (0.49,1.50) | 0.95 (0.52,1.72) |

**Maternal age (years)**

| 0.97 (0.91,1.03) | – | 0.95 (0.89,1.02) | 0.96 (0.90,1.02) | 0.96 (0.91,1.03) |

**Maternal Stature (cm)**

| Normal (≥ 155) | Ref | Ref | Ref | Ref | Ref |
| Very short (< 145) | 4.84 (2.29,10.23)*** | 3.74 (1.72,8.14)*** | 2.96 (1.13,7.72)^ | 2.76 (0.93,8.24)^ |
| Short (145 to < 155) | 1.73 (0.88,3.39) | 1.53 (0.79,2.97) | 1.20 (0.53,2.72) | 1.21 (0.48,3.05) |
| Maternal Education (Years completed) | 0.94 (0.89,1.00)^ | – | 0.99 (0.91,1.06) | 0.99 (0.90,1.09) | 1.02 (0.92,1.13) |
| Paternal Education (Years completed) | 0.92 (0.87,0.98)^* | – | 0.95 (0.88,1.02) | 0.97 (0.89,1.05) | 0.96 (0.89,1.04) |

**HH Migrant status**

| Not Migrant | Ref | Ref | Ref | Ref | Ref |
| Migrant | 2.17 (1.24,3.79)** | – | – | – | – |

**HH slum area**

| Gazipur | Ref | Ref | Ref | Ref | Ref |
| Dhaka North | 2.07 (1.38,3.11)*** | 1.49 (0.67,3.31) | 0.89 (0.34,2.30) |

**HH water unavailable at source ≥ 1 full day**

| No | Ref | – | – | Ref | Ref |
| Yes | 2.04 (1.48,2.80)*** | – | – | 1.85 (1.00,3.42)^ | 1.80 (1.06,3.00)^ |

**HH toilet shared**

| No | Ref | – | – | Ref | Ref |
| Yes | 2.45 (1.66,3.62)*** | – | – | 1.85 (1.32,2.59)*** | 1.28 (0.78,2.11) |

**HH size**

| ≤ 1 km | 1.06 (0.93,1.20) | – | – | Ref | Ref |
| > 1 km | 1.05 (0.59,1.85) | 0.46 (0.20,1.02) | 0.43 (0.17,1.08)^ |

**HH nearest public health facility**

| ≤ 1 km | Ref | – | – | Ref | Ref |
| > 1 km | 0.73 (0.53,1.01)^ | 1.26 (0.66,2.40) | 1.40 (0.79,2.51) |

**HH received nutrition information/service**

| No | Ref | – | – | Ref | Ref |
| Yes | 0.66 (0.57,0.77)*** | – | – | – | 0.65 (0.47,0.90)^* |

**HH income (quartiles)**

| 1 | Ref | – | – | – | Ref |
| 2 | 1.01 (0.53,1.93) | – | – | – | 1.29 (0.53,3.16) |
| 3 | 0.41 (0.18,0.90)^ | – | – | – | 0.45 (0.18,1.15)^ |
| 4 | 1.08 (0.45,2.60) | – | – | – | 1.81 (0.43,7.61) |

OR = Odds Ratio, CI = Confidence Interval, HH = Household; standard errors clustered; data on missing covariates were imputed

*p ≤ 0.10; **p ≤ 0.05; ***p ≤ 0.01; ****p ≤ 0.001

* observation with missing outcome information and 2 observations with missing maternal work exposure information were excluded
### Table 3 Estimated unadjusted and adjusted associations between maternal work status exposure and intermediate outcomes of child morbidity, dietary intake, health and hygiene behaviors

| Intermediate outcomes | Crude OR (95% CI) | Adjusted OR (95% CI) | N |
|-----------------------|---------------------|-----------------------|---|
| **Child Sickness**    | Maternal work status (currently working) | Controlled for child’s age and sex; maternal education; household wealth, slum location |
| Fever in last 3 months | No | Ref | Ref | 343 |
| Yes | 2.12 (1.00, 4.51)<sup>▲</sup> | 1.91 (0.99, 3.65)<sup>▲</sup> | |
| Diarrhea in last 3 months | No | Ref | Ref | 343 |
| Yes | 0.89 (0.43, 1.86) | 0.80 (0.37, 1.69) | |
| **Child Diet**         |                          |                        |
| Breastfeeding          | Exclusive breastfeeding for first 6 months | |
| No | Ref | Ref | 343 |
| Yes | 0.76 (0.44, 1.30) | 0.73 (0.41, 1.31) | |
| Complementary breastfeeding between 7 and 23 months | |
| No | Ref | Ref | 327 |
| Yes | 0.50 (0.21, 1.21) | 0.69 (0.28, 1.66) | |
| Complementary feeding (children > 6 months)<sup>a</sup> | |
| No. of times child ate soft/semi/solid food yesterday (4 or more) | No | Ref | Ref | 327 |
| Yes | 2.48 (1.11, 5.54)<sup>*</sup> | 1.84 (0.67, 5.04) | |
| No. of IYCF food groups child ate yesterday (4 or more) | No | Ref | Ref | 327 |
| Yes | 2.06 (0.95, 4.45)<sup>▲</sup> | 1.39 (0.58, 3.36) | |
| 1. Vitamins of plant origin (vegetables, fruits, grains) – child ate 2 or more source yesterday | No | Ref | Ref | 327 |
| Yes | 1.43 (0.73, 2.81) | 1.15 (0.52, 2.52) | |
| 2. Vitamins of animal origin (breastmilk, dairy products, flesh foods, eggs) – child ate 2 or more source yesterday | No | Ref | Ref | 327 |
| Yes | 0.96 (0.29, 3.15) | 0.82 (0.25, 2.64) | |
| 3. Proteins (nuts/legumes, dairy products, flesh foods, eggs) - child ate 2 or more source yesterday | No | Ref | Ref | 327 |
| Yes | 1.50 (0.71, 3.17) | 0.75 (0.33, 1.68) | |
| **Health and hygiene behaviors** |                          |                        |
| Sought treatment when child last had fever/cough | No | Ref | Ref | 343 |
| Yes | 1.07 (0.56, 2.04) | 1.37 (0.67, 2.80) | |
| ANC visits | None or less than 4 | Ref | Ref | 343 |
| 4 or more | 1.30 (0.61, 2.79) | 0.85 (0.31, 2.36) | |
| Child’s place of birth | Facility | Ref | Ref | 343 |
| Home | 1.01 (0.53, 1.89) | 1.04 (0.54, 1.99) | |
| Fully Vaccinated<sup>b</sup> | No | Ref | Ref | 343 |
| Yes | 0.35 (0.19, 0.66)<sup>***</sup> | 0.41 (0.21, 0.81)<sup>★</sup> | |
| Water is available at handwashing place<sup>c</sup> | No | Ref | Ref | 343 |
| Yes | 1.00 (0.62, 1.60) | 0.61 (0.30, 1.22) | |
Such differences were not found for working mothers with grandmother or multiple persons’ care support, or those with extended-type family structures.

Discussion

Previous studies in Bangladesh have qualitatively explored the effect of maternal work on child care and feeding practices [27]. Maternal work’s association with child stunting has also been reviewed using facility-based information, or in the broader analysis of undernutrition determinants [20, 36]. To our knowledge, our study is the first to specifically explore the association between maternal work and child stunting in the context of urban slums in Bangladesh. Our study yielded four main results:

First, we found a very low labor force participation rate among mothers of young children, even in slum settings where women’s work participation was higher than national and urban averages. Only 16% of mothers in our sample were currently engaged in income-generating work. (Comparison on proportion of working mothers with other representative surveys is in Additional file 1: Appendix 5). The context is notably different from slums in some African countries, where the majority of mothers work [54], but similar to neighboring India [55]. A previous study for Bangladesh noted mothers with under-five children were less likely to work than those with no children or older children, citing lack of access to childcare as a major constraint [26]. Domestic responsibilities and prevailing social and gender norms are also among key constraints to general women’s work participation [26, 56]. Other supply and demand side factors affecting maternal work for pay have also been noted in urban India [55, 57].

Second, our study suggests an overall negative association between maternal work and child stunting in the low-income urban context. Children of working mothers had nearly twice the odds of being stunted than children of non-working mothers. Although working mothers in our sample had on average older children, shorter stature, and less education than non-working mothers, observable individual and household background characteristics largely did not explain the difference in child stunting. The overall negative effect remained, although we observed some ‘positive income effect’ of maternal work (i.e., Table 2 showed higher OR when adjusted for household wealth and income), with working mothers having on average slightly higher household wealth and monthly income.

Our finding of the overall increased stunting risk for children of working mothers is consistent with earlier results of a Dhaka hospital-based study, which found a positive association—albeit small in magnitude—between mother’s income-generating work and child stunting [36]. It also mostly supports and adds further perspective to a previous finding based on analysis of Bangladesh Urban Health Survey data, which found an association between maternal work outside home and poor child nutritional status in slums, although only in underweight status [20]. While the overall evidence from various LMICs on maternal work association with child linear growth remains mixed, our findings argue for a context-relevant negative effect of maternal work
on child linear growth status, as also found in other urban and low-income settings [32–34].

Third, we explored direct and indirect factors in the etiology of child stunting as described in the UNICEF framework [40] and their association with maternal work status. Our study found some differences in health-seeking behavior, suggesting working mothers’ children were less likely to seek preventive care, such as routine vaccinations. A previous study in this slum setting also found that working mothers were less likely to
receive adequate coverage of maternal and child health services, and suggested a tradeoff between livelihood attainment and mother and child [58]. Furthermore, we found that working mothers’ children may be exposed to a less hygienic environment, such as not having drinking water stored at home. Hygiene may be affected in households of working mothers, as the mothers have less time for household chores, although still bearing the burden of household work [26]. A study in Nicaragua identified incomplete vaccinations and poor hand hygiene among care behaviors associated with poorer nutritional outcomes in children [59].

Lastly, we found that the role of care support available to working mothers was critical to understand maternal work’s effect on child nutritional status. Children of working mothers that only had their husbands or older children to rely on for care support had substantially increased odds of stunting, suggesting the nuclear-family type care support as being inadequate. On the other hand, there was no evidence of association between maternal employment and child stunting when children were helped cared for by grandmothers or multiple people.

The important role of family structures in influencing childcare adequacy has been suggested in previous researches. In Nicaragua, children living in extended-families had better nutritional status than children from nuclear-family households [59]. Extended households were also likely to have a grandmother acting as a regular caretaker, although it remains unclear how grandparents influenced child health and development [59, 60].

In nuclear families, care support received from only the father is presumably marginal, given virtually all fathers worked in our sample; in addition, prevailing cultural factors generally limit the husband’s role in childcare [27]. Care by only a non-adult sibling has also been established as inadequate and linked to lower height-for-age among children [28, 59].

### Limitations

Our study has several limitations: First, the study is based on cross-sectional data; therefore, we cannot determine causality due to temporality and confounding concerns. Second, due to the study’s limited sample size and geographic coverage, generalizability of the results is limited and may serve only an exploratory purpose. Further research on mother’s employment and child nutritional status using longitudinal or slum population representative data could strengthen the validity of our findings. Third, although our outcome measure was objective, behavioural information collected in the survey, including questions related to child’s dietary intake, were based on self-report, and thus subject to reporting and recall biases. Lastly, our exposure measurement is based on ‘current employment,’ and our survey did not collect information on the proportion of time the mother was employed over the course of child’s life (although the majority of currently working mothers reported they also worked while pregnant with the child). This was important, and we may have overestimated the association, as stunting results from cumulative risk exposures over time.

### Conclusion

Our findings highlight the crucial importance of adequate care support to working mothers in understanding the effects of maternal employment on child stunting. In contexts of limited care support at the household or

| Table 4  | Estimated unadjusted and adjusted associations between child stunting outcome and maternal work status exposure (by subgroups of child care support type available to working mothers) |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stunted (outcome) | Crude OR (95% CI) | Adjusted OR (95% CI)§ | N = 343 |
| Not currently working | Ref | Ref | 289 |
| Currently working, with only grandparent/relative support | 0.81 (0.26,2.56) | 0.57 (0.14,2.33) | 18 |
| Currently working, with multiple person support | 0.79 (0.18,3.58) | 1.10 (0.26,4.62) | 8 |
| Currently working, with only father/ sibling support | 3.00 (1.27,7.06)* | 4.96 (1.87,13.17)*** | 21 |
| Currently working, with no one support | 3.04 (0.80,11.54) | 3.75 (0.45,30.67) | 7 |
| Not currently working | Ref | Ref | 289 |
| Currently working, with nuclear family type supporta | 3.00 (1.41,6.38)** | 4.49 (1.81,11.12)*** | 28 |
| Currently working, with extended family type supportb | 0.81 (0.37,1.74) | 0.69 (0.30,1.59) | 26 |

* OR Odds Ratio, CI Confidence Interval; standard errors clustered; data on missing covariates were imputed

§ OR adjusted for child age, sex, birthweight; maternal age, stature and parental education; household migration status, size, water and sanitation access, health and nutrition access, slum location (Table 2-Model 3)

a Defined as having only sibling or father support, or no one else

b Defined as having grandmother/relative or multiple people support to help with child care
community level, maternal work may undermine adequate care of children, which is linked with lower child HAZ [59]. Working mothers in our sample had an average household size of 4.7 persons and 2.3 children ever-born, suggesting the presence of predominantly nuclear family structures and limited options for family support and alternative child care. This suggests the ‘negative care effect’ of maternal work on child nutritional status is largely present in Bangladesh slums, which influenced the overall direction of the association in our result. Although we observed a ‘positive income effect’ of maternal work—which was also identified in other studies—the level of increased earnings from a largely low-paid type of work appeared insufficient to offset the ‘negative care effect’ of maternal employment in this particular context [34, 59].

Evidence from our study is specific to urban slums in Bangladesh and should be considered in the larger context. First, the overall experience in developing countries suggest generally little evidence of a negative effect of maternal employment on child nutrition [61]. However, with increasing urbanization and demographic changes, this relationship has become more nuanced and context-contingent, as urban dwellers often do not have the same community and family child care and support networks that are more prevalent in rural areas [62]. Second, at a population level, the maternal work exposure for under-five children remains relatively low in Bangladesh due to barriers previously discussed. Nonetheless, enhancing women’s work participation and economic empowerment is a key development agenda both in Bangladesh and globally. Thus, to promote FLFP and labor income for urban poor, and mitigate stunting risks among slum children, government policy-making should consider reviewing and integrating appropriate childcare support measures for working mothers, especially in slums.

Acknowledgments
We gratefully acknowledge the support and contributions of Mr. Ryotaro Hayashi from the Asian Development Bank in planning and implementation of the field survey associated with this research.

Authors’ contributions
HW and GF conceived the study. HW performed statistical analysis and drafted the manuscript with substantial inputs from GF. SS supervised data collection. GF, JW, NPH, SS, and SM critically reviewed and substantively revised the manuscript. All authors read and approved the final manuscript.

Funding
No specific funding for received for this study. However, the baseline survey of the Urban Primary Health Service Delivery Project—which data supports this study—was funded by the Asian Development Bank under TA-9402 REG: Developing Impact Evaluation methodologies, Approaches, and Capacities in Selected Developing Member Countries (Subproject 3).

Availability of data and materials
The Asian Development Bank (ADB) maintains ownership of the survey data associated with this research. The data supporting this study can be made available pending approval of the ADB.

Declarations

Ethics approval and consent to participate
The study was approved by Ethical Review Committee of icddr,b, Bangladesh and Ethikkommission Nordwest- und Zentralschweiz in Switzerland.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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Received: 3 February 2022 Accepted: 2 August 2022 Published online: 17 August 2022

References
1. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? Lancet. 2003;361(9376):2226–34.
2. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013;382(9890):427–51.
3. Grantham-McGregor S, Cheung YB, Cueto S, De Onis M, Rivera J, Pfeiffer KA. Growth reference curves for use in assessing nutritional status and trends in growth in developing countries. 2005:510–26.
4. Bryce J, Cuitinno D, Darnton-Hill I, Pelletier D, Pinstrup-Andersen P. Maternal and child undernutrition: consequences for adult health and human capital. Lancet. 2008;371(9609):510–26.
5. Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and child undernutrition: consequences for adult health and human capital. Lancet. 2008;371(9609):340–57.
6. Fink G, Peet E, Danaei G, Andrews K, McCoy DC, Sudfeld CR, et al. Schooling and wage income losses due to early-childhood growth faltering in developing countries: national, regional, and global estimates. Ann J Clin Nutr. 2016;104:104–12.
7. UNICEF. The State of the World’s Children 2019. Children, food and nutrition: growing well in a changing world. New York: UNICEF; 2019.
8. Vaivada T, Akseer N, Akseer S, Somaskandand A, Stofopoulos M, Bhutta ZA. Stunting in childhood: an overview of global burden,

Abbreviations
ANC: Antenatal care; BMI: Body mass index; CI: Confidence interval; FLFP: Female labor force participation; HAZ: Length/ height-for-age z-score; icddr:b: International Centre for Diarrheal Disease Research; Bangladesh; IYCF: Infant and Young Child Feeding; LMIC: Low- and middle-income countries; NGO: Non-government organization; OR: Odds ratio; SD: Standard deviation; UDHSS: Urban Health and Demographic Surveillance System; UNICEF: United Nations Children’s Fund; UPHCSDP: Urban Primary Health Care Service Delivery Project; WHO: World Health Organization.

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s13690-022-00948-6.

Additional file 1: Appendix 1. Descriptive statistics comparing selected imputations and observed data. Appendix 2. Background characteristics (full sample). Appendix 3. Nature of work and caregiving among currently working mothers. Appendix 4. Age-specific stunting by maternal work status. Appendix 5. Comparison on proportion of currently working mothers in study’s sample with population-representative data.
trends, determinants, and drivers of decline. Am J Clin Nutr. 2020;11:2(Suppl 2):775–915.

9. Victoria CG, Christian P, Vidaliti LP, Gatica-Dominguez G, Menon P, Black R. Revisiting maternal and child undernutrition in low-income and middle-income countries: variable progress towards an unfinished agenda. Lancet. 2021;397(10282):1388–99.

10. Perez-Escamilla R, Bermudez O, Buccane GS, Kumanyika S, Lutter CK, Mon-sivais P, et al. Nutrition disparities and the global burden of malnutrition. BMJ. 2018;361:k2252.

11. World Health Organization (WHO) and United Nations Human Set-tlements Programme (UN-HABITAT). Global report on urban health: equitable, healthier cities for sustainable development. Geneva: WHO and UN-HABITAT, 2016.

12. World Health Organization (WHO) and United Nations Human Set-tlements Programme (UN-HABITAT). Hidden cities: unmasking and overcoming health inequities in urban settings. Geneva: WHO and UN-HABITAT, 2010.

13. Ellis P, Roberts M. Leveraging urbanization in South Asia: managing spatial transformation for prosperity and livability. Washington, DC: World Bank; 2016.

14. Bloem S, de Pee S. Developing approaches to achieve adequate nutrition among urban populations requires an understanding of urban develop-ment. Glob Food Sec. 2017;12:80–8.

15. Ezeh A, Oyebode T, Satterthwaite D, Chen Y-F, Ndugwa R, Sartori J, et al. The history, geography, and sociology of slums and the health problems of people who live in slums. Lancet. 2017;389(10068):547–58.

16. Lilford RJ, Oyebode O, Satterthwaite D, Melendez-Torres GJ, Chen Y-F, Mberu B, et al. Improving the health and welfare of people who live in slums. Lancet. 2017;389(10068):559–70.

17. Mberu BU, Hazegu TN, Kyobutungi C, Ezeh AC. Health and health-related indicators in slum, rural, and urban Communities: a comparative analysis. Glob Health Action. 2016;9:33163.

18. UNICEF. The State of the World’s Children 2012: children in an urban world. New York: UNICEF; p. 2012.

19. Angeles G, Ahsan KZ, Streetfeld PK, El Arifeen S, Jamil K. Reducing inequity in urban health: have the intra-urban differences in reproductive health service utilization and child nutritional outcome narrowed in Bangladesh? J Urban Health. 2019;96(2):193–207.

20. Ahsan KZ, Arifeen SE, Al-Mamun MA, Khan SH, Chakraborty N. Effects of individual, household and community characteristics on child nutritional status in the slums of urban Bangladesh. Arch Public Health. 2017;75:9.

21. Raju D, Kim KY, Nguyen QT, Govindaraj R. Cities, slums, and early child-hood: empirical evidence from Bangladesh. World Bank Policy Research Working Paper No. 8094: World Bank; 2017. https://openknowledge.worldbank.org/handle/10986/27294. Accessed 15 Aug 2020.

22. NIPORT, icddrb, and MEASURE Evaluation. Bangladesh Urban Health Survey 2013 Final Report. Chapel Hill: MEASURE Evaluation; 2015.

23. Win H, Wallerstein NJ, Probst-Hensch N, Fink G. Understanding urban inequalities in children's linear growth outcomes: a trend and decompo-sition analysis of 39,049 children in Bangladesh (2000-2018). BMC Public Health. 2021;21(1):2192.

24. Kyu HH, Shannon HS, Georgiadis K, Boyle MH. Association of Urban Slum Residency with infant mortality and child stunting in low and middle income countries. Biomed Res Int. 2013;2013:604974.

25. Fink G, Gunther J, Hill K. Slum residence and child health in developing countries. Demography. 2014;51(4):1175–97.

26. Kotsuka A, Hill R, Raza WA. What works for working women: understand-ing female labor force participation in urban Bangladesh. Washington, DC: World Bank; 2019.

27. Kabir AMM. Factors influencing feeding practices of extreme poor infants and young children in families of working mothers in Dhaka slums: A qualitative study. PLoS One. 2017;12(2):e0171219.

28. Engle PL. Maternal work and child-care strategies in peri-urban Guate-mala: nutritional effects. Child Dev. 1991;62(5):954–65.

29. Eshete H, Abebe Y, Loha E, Gebru T, Tesheme T. Nutritional status and effect of maternal employment among children aged 6–59 months in Wolayta Sodo town, southern Ethiopia: a cross-sectional study. Ethn Health. 2017;22:155–62.

30. Nankinga Q, Kwagala B, Walakra EJ. Maternal employment and child nutritional status in Uganda. PLoS One. 2019;14(12):e0226720.
55. Bag S. Urban female labor force participation and its correlates: a comparative study of slum-dwellers and their urban counterparts of three metro cities in India. Emerald series: Advances in Gender Research, Bingley, UK. 2020.
56. ADB and ILO. Bangladesh: looking beyond garments. Mandaluyong City: Asian Development Bank and International Labour Organization; 2016.
57. Klasen S, Pieters J. What explains the stagnation of female labor force participation in urban India? World Bank Econ Rev. 2015;29(3):449–78.
58. Razzaque A, Clair K, Chin B, Islam MZ, Mia MN, Chowdhury R, et al. Association of Time since Migration from Rural to Urban Slums and Maternal and Child Outcomes: Dhaka (North and South) and Gazipur City Corporations. J Urban Health. 2020;97(1):158–70.
59. Lamontagne JF, Engle PL, Zeitlin MF. Maternal employment, child care, and nutritional status of 12-18 month old children in Managua, Nicaragua. Soc Sci Med. 1998;46(3):403–14.
60. Sadruddina AFA, Pongutaa LA, Zondermanb AL, Wileya KS, Grimshawa A, Panter-Bricka C. How do grandparents influence child health and development? A systematic review. Soc Sci Med. 2019;239:112476.
61. Leslie J. Women’s work and child care in the third world. World Dev. 1988;16(Issue 11):1341–62.
62. Hallman K, Quisumbing AR, Ruel M, Brére B. Mothers’ work and child care: findings from the urban slums of guatemala city. Econ Dev Cult Chang. 2005;53(4):855–85.

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