



Impacts of women's work and childcare on child illness among Bangladeshi Shodagor communities

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ABSTRACT

For decades, women's employment has been seen as crucial for achieving greater autonomy and empowerment for women, and for promoting better health and nutrition outcomes for children, particularly in low- and middle-income countries (LMIC). However, numerous empirical studies of the relationship between women's work and child outcomes have shown mixed results. Our study tests the assumptions of a model that suggests loss of maternal care during working hours may produce negative health outcomes for children. We use longitudinal data collected from traditionally semi-nomadic, boat-dwelling Shodagor families in Matlab, Bangladesh to determine the importance of maternal care as a mechanism influencing the relationship between women's work and child illness. We use Bayesian linear mixed models to assess the influence of occupation and amount of care on average days of child illness per month, and also to examine the role that allomothers play in buffering against potential negative impacts of lost maternal care on child illness. Results show that children who receive more care from mothers experience fewer days of illness, and that availability of high-quality alloparents mediates the relationship between maternal work and child health. These results indicate that both the care and resources provided by mothers influence children's biological outcomes. This has important implications for policy and aid interventions in LMIC, which have been developed to capitalize on an assumed positive relationship between maternal work and child health and nutrition.

1. Introduction

For decades, increasing women's participation in the labor force has been seen as a key step towards achieving greater autonomy and empowerment for women, and for promoting better health and nutritional outcomes for children, particularly in low- and middle-income countries (LMIC) (e.g., Sen, 1999; Diiro et al., 2017; IFC, 2013; World Bank, 2012). For these reasons, improving women's access to employment and income-earning opportunities has been a primary focus for international development and aid organizations, and a policy goal in many countries around the world (e.g., Pratley, 2016; United Nations, 2015; 2018; World Bank, 2014).

Understanding the relationship between women's work and child health is important for two reasons. First, poor health and nutrition during childhood is associated with numerous adverse outcomes

throughout the life course, including increased morbidity and mortality, poor cognition and educational performance in childhood, short stature in adulthood, increased risk of perinatal and neonatal death for women, lower productivity and reduced earnings in adults, and increased risk of chronic diseases in adulthood (Victora et al., 2008; Dewey and Khadija, 2011; Black et al., 2013; Onis and Branca, 2016). Second, in millions of families around the world, women work. In 2022, 46% of women in LMIC and 59% of women in low-income countries were engaged in the formal labor force, although this varied substantially by country and region (e.g., Sub-Saharan Africa: 60%; South Asia: 25%) (World Bank Group, 2024). An even greater proportion of women in these countries are estimated to engage in work that is either unpaid or part of the informal work sector (Ortiz-Ospina et al., 2023). For many families in LMIC contexts, women's work is necessary, providing critical income and resources for children, themselves, and other family members.

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Therefore, determining conditions under which women's work leads to better or poorer child health outcomes can inform development and policy work to more-effectively mitigate adverse child outcomes.

The relationship between maternal work and child health and nutrition is complex. Theoretical frameworks produce contrasting hypotheses about directionality of the relationship as well as causal mechanisms. One prominent framework suggests that maternal employment and control over household resources should yield positive outcomes for children (Chowdhury et al., 2003; Hoddinott and Haddad, 1995), while another hypothesizes that loss of maternal care during working hours – regardless of income that results from maternal work – will produce negative health outcomes for children (Glick and Sahn, 1998). Empirical evidence of links between women's work and child health in LMIC is both limited and mixed (Mugo, 2012).

In this paper, we examine maternal care as a potential mechanism linking women's work to child health outcomes in a low-income, cultural minority community of Shodagor fishers and traders in Bangladesh. Shodagor women either work as fishers or traders to generate resources for their families (Starkweather et al., 2020). These occupations differ in ways that are likely to lead to variation in associations between maternal work, childcare, and child health: women who fish do so year round, accompanied by children of all ages; women who trade work primarily during dry seasons (October–March), are never accompanied by children when they work, and typically stay home and care for children during rainy seasons (April–September). In this study, we use a longitudinal, between- and within-subjects study design to determine how compatibility of work with childcare and amounts of maternal and alloparental care affect frequency of child illness while accounting for effects of household income and size, and child age and gender.

1.1. Background and theory

Across all types of human societies, economic work done by mothers is critical for the health and well-being of themselves, their children, and their families. In many subsistence-based societies, women often provide reliable calories via dietary staples (Bliege Bird and Bird, 2008; Kramer, 2018; Lee, 1979; Marlowe, 2010), and consistency in caloric intake may be better for child growth and health than a higher-variance strategy (Drennen et al., 2019; Hawkes et al., 1997; Schmeer and Piperata, 2016). In low-income contexts, women's formal and informal economic contributions can help families meet basic resource needs and are often crucial for families living in poverty, particularly in times of environmental or economic shock (e.g., Bhalotra, 2010; Francke, 1992; Leslie et al., 1988; Verick, 2014). Additionally, women's work is associated with greater economic empowerment and autonomy for women, which confers benefits to women and their children (IMF, 2018; Klugman and Tyson, 2016).

An early, and prominent, theoretical framework suggests a positive relationship between women's work and child health (Chowdhury et al., 2003; Hoddinott and Haddad, 1995). It posits that when women are responsible for procuring resources (food or income) for the household through their own labor, they have more control over those resources and are empowered to make decisions about their distribution (Levin et al., 2001; Richards et al., 2013; Singh et al., 2013). A great deal of cross-cultural evidence shows that when women (compared to men) are in charge of distributing resources, they overwhelmingly favor their own children and household members over others (Coddling et al., 2011; Folbre, 1986; Guyer, n.d.; Quisumbing, 2003), and that this contributes to positive health and nutritional outcomes for children (Engle, 1991; Hoddinott and Haddad, 1991; Rouf, 2011). Therefore, the framework predicts, when women work, a greater proportion of household resources should be spent on children and their well-being, resulting in better overall growth and health for those children.

This “maternal resources” framework has contributed to such a pervasive idea about the positive effect of women's work on child health

and nutrition that international development and policy campaigns have been designed around it (Pratley, 2016; United Nations, 2018). And while there is evidence that women's work is associated with positive health and nutritional outcomes for children in some contexts (e.g., Lamontagne et al., 1998; Tucker and Sanjur, 1988; Ukwuani and Suchindran, 2003), there are also many cases in which maternal work does not lead to better outcomes for kids (e.g., Abbi et al., 1991; Ukwuani and Suchindran, 2003; Jakaria et al., 2022).

A second “maternal care” framework suggests that maternal work may lead to adverse outcomes for child health and nutrition when work results in mothers providing less childcare (Cawley and Liu, 2012; Desai et al., 1989; Glick and Sahn, 1998; Smith et al., 2003). This framework assumes a trade-off for mothers between time spent working and time spent caring for children, which is evident in many cross-cultural settings (Basu and Basu, 1991; Kramer and Amanda, 2018; Panter-Brick, 1989; Short et al., 2002; Sivakami, 2010; Tucker and Sanjur, 1988). This framework is also motivated by evidence that care provided by mothers is critical for child health and well-being. Therefore, a reduction in time available for important tasks like breastfeeding, food preparation, monitoring child feeding, seeking out medical care for sick children, and preventative care like vaccines, and supervision of children, should lead to worse physical health for children (e.g., Bhalotra, 2010; Cawley and Liu, 2012; Desai and Devaki, 1994; Glick and Sahn, 1998; Morrill, 2011; Smith et al., 2003; Ukwuani and Suchindran, 2003).

Explicit tests of the maternal care framework have also produced mixed results (e.g., Diiro et al., 2017; Glick and Sahn, 1998; Kadiyala et al., 2014). Thus, the relationship between women's work and child health remains unclear, and researchers and policymakers are unable to determine when increases in women's participation in the labor force are likely to lead to better or poorer child health outcomes, making it difficult to design and promote interventions to mitigate against adverse effects.

A likely reason for these mixed results may be that many existing studies measure both women's work and childcare in broad terms, using country- or region-wide datasets, which necessitates use of generalized measures (e.g., *mother works* vs. *mother does not work*), and do not examine more-detailed variabilities in women's work that could lead to differences in outcomes (Abbi et al., 1991; Basu and Basu, 1991; Diiro et al., 2017; Glick, 2002). Several recent studies have made similar arguments for examining ‘work’ with more nuance, and subsequently found that more specific measures, such as *type of work*, can help to better-predict the relationship between maternal work and child outcomes (Brauner-Otto et al., 2019; Burroway, 2017; Nankinga et al., 2019). As *type of work* may vary across cultural contexts, we examine aspects of work that may lead to differences in the ways maternal work and childcare impact child health, such as whether mothers' work requires a trade-off with childcare or not, and seasonality of work.

When women's work is compatible with childcare, it does not require mothers to trade-off time spent in one activity for another (Brown, 1970). The extent to which different types of work are compatible with childcare varies a great deal across cultural and economic contexts (e.g., foraging: Crittenden and Frank, 2008; Hurtado et al., 1985; horticulture: Hames, 1988; agriculture: Levine, 1987; Panter Brick, 1989; and wage labor: Bianchi, 2000; Morrill, 2011), and two recent studies show that this impacts child health and nutritional outcomes in ways that are consistent with the “maternal care” framework, with greater compatibility of maternal work with childcare leading to better outcomes (Nankinga et al., 2019; Ukwuani and Suchindran, 2003). Given the differences in compatibility with childcare for Shodagor women's work such that trading is incompatible with childcare and fishing is compatible, **we predict that children in trading households will have poorer health outcomes (i.e., more days of illness per month) than children in fishing households overall (Prediction 1).**

There are also cross-cultural examples of women's occupations that are not compatible with childcare, but only done seasonally (e.g.,

Kadiyala et al., 2014; Panter Brick, 1989). As opposed to year-round work, seasonal work allows mothers to be engaged in childcare more throughout the year and can result in less severe long-term outcomes (Hussain and Smith, 1999; Jain and Zeller, 2015; Johnston et al., 2018). However, occupations with more flexibility or that are only seasonal in nature may also be lower status, provide lower pay, or are more likely to be a part of the informal economy (Kabeer, 2021), all of which tend to be associated with worse child outcomes. Therefore, we explicitly examine impacts of differences in women's economic and childcare trade-offs while also accounting for the effects of income on child illness frequencies.

As Shodagor women's trading is done seasonally, while fishing is year-round, we predict the following: **In dry seasons when women are trading, children in trading households will have more days of illness than children in fishing households (Prediction 2).** Also, **children in trading households will have more days of illness in dry seasons (when mothers work) than they do in rainy seasons (when mothers are home) (Prediction 3).** Additionally, we expect that undivided maternal care (traders during rainy seasons) should result in better child health than when care is provided while mothers are also working (fishers). Therefore, **in rainy seasons, children in trading households will have fewer days of illness than children in fishing households (Prediction 4).**

Finally, just as maternal work is often treated in dichotomous terms, tests of maternal care often do not examine 'care' in nuanced ways. An exception, Win et al. (2022) find that when mothers' work is incompatible with childcare, but others can substitute for mothers' lost care, children experience better nutritional outcomes. There is also ample evidence for positive effects of care from non-maternal sources (*allo-mothers*) on child health outcomes in LMIC and subsistence-based settings (Sear and Mace, 2008; Sear and Mace, 2008), as well as high-income and industrialized contexts (Casper and Hogan, 1990; Pulgaron et al., 2016). If care provided by allomothers is of equal or better quality than maternal care, children should not experience negative outcomes associated with lost maternal care (Brown et al., 1978; Heinsohn, 2004). Therefore, **we predict that children who receive the majority of care from allomothers (i.e., fathers, grandmothers, and others) will experience illness outcomes that are similar to children who receive the majority of care from mothers (Prediction 4).** However, **children who receive the majority of care from mothers or allomothers will have fewer days of illness than children who do not have any specified caregiver (Prediction 5).**

2. Methods

2.1. Study population

Shodagor communities in Matlab, Bangladesh are traditionally boat-dwelling, semi-nomadic fishers and traders who are culturally distinct from the majority ethnicity in the country. Matlab is located in the Meghna River floodplain, which experiences seasonal climatic change with flooded "rainy" seasons and "dry" seasons, in which flooding recedes. It is home to approximately 500 Shodagor families in addition to approximately 230,000 residents who work as agriculturalists, wage laborers, and housewives, and who do not identify with the Shodagor ethnicity (ICDDR, 2018). In 2017, there were around 150 Shodagor families living in 5 groups in Matlab who either currently lived on boats or had moved onto land within the previous 15 years. These families live primarily in nuclear family households and extended family groups and are the focus of this study.

Shodagor fisher-traders engage in a mixed subsistence and cash economy. People who catch fish sell their catch to middlemen in markets in exchange for cash, and traders sell their goods for cash. However, 89% of Shodagor fishers also report that their households regularly consume some of their catches. Most Shodagor men in Matlab (90%) work as

fishermen for the majority of the year, and some also work as day-laborers (11%) or do other types of work (2%), with 18% of men reporting more than one occupation. More than half (52%) of Shodagor women work as traders and 45% report that fishing is their primary occupation. Only a few women (3%) are housewives who do not earn an income.

Women who fish work year-round with their husbands, accompanied by children of all ages, including infants, toddlers, and older children (who work alongside their parents). Husbands and wives cooperate to care for children and complete fishing tasks. They rarely rely on others for help with childcare (Fig. 1), so children in fishing families receive maternal care and are in close proximity to their mothers most of the time. By contrast, trading is incompatible with simultaneous care for children. Women begin their day very early, travel up to 2 h away from home, and carry very heavy baskets full of trade goods on their heads while walking village-to-village, selling their goods to non-Shodagor women. Women who trade unanimously report *never* bringing their children and rely on their husbands and other caregivers to care for young children so they can work (Fig. 1). Traders primarily work during dry seasons, when water levels are low, and typically stay home as the primary caregivers for children during rainy seasons. Women report choosing their occupation based on multiple factors, including their mother's occupation, and socioecological factors, like proximity to a market and availability of alloparents (Starkweather et al., 2020).

2.2. Data collection

Data for this study were collected over 26 months between 2017 and 2019, across 4 seasons (2 rainy seasons and 2 dry seasons) via structured interviews as part of a larger, longitudinal project on Shodagor economics, childcare, and health. Surveys were conducted weekly when possible with all adults in the study population. Mothers and fathers were interviewed about their children and answered questions about who took care of children while they worked and about any illnesses experienced by all household members, as structured interviews are a reliable and valid method for assessing infectious illness symptoms (e.g., Orts et al., 1995). Economic and demographic data were also collected during these interviews.

2.3. Study variables

The sample available for the following analyses included 97 Shodagor children (45 females, 52 males) between 3 and 18 years of age from 50 nuclear families, who were unmarried, living with their parents, and dependent on parents for food, money, and other resources at the time of data collection and had income, occupational, childcare, and illness data spanning the rainy 2017 through dry 2018/2019 seasons (Table 1). Children 2 years old and younger were excluded from this dataset to isolate the effect of mother's work on child health and to eliminate potential confounding effects of breastfeeding on child illness (Clemens et al., 1999; Cushing et al., 1998). These children had a total of 1187 monthly observations across four seasons indicating the number of days during a given month that parents reported any type of illness symptoms, including gastrointestinal symptoms, respiratory symptoms (including reports of cold/fever), and symptoms of other illness (e.g., rash, ear pain, headache) or injury) (Table 1). We calculated monthly illness prevalence from March 2017 through April 2019 as percentage of total days that all children with data for a given month were sick with any illness and plotted monthly illness prevalence trends over time for children by their mother's occupation (Fig. 2).

Childcare data were collected at the household level, indicating the number of days parents listed mother, father, grandmother, sibling, other, or no caregiver as their children's primary caregiver, and were then aggregated on a seasonal timescale to calculate seasonal care percentages (Table 1). We plotted caregiving percentages from the rainy 2017 through dry 2018/2019 season separately for the subset of

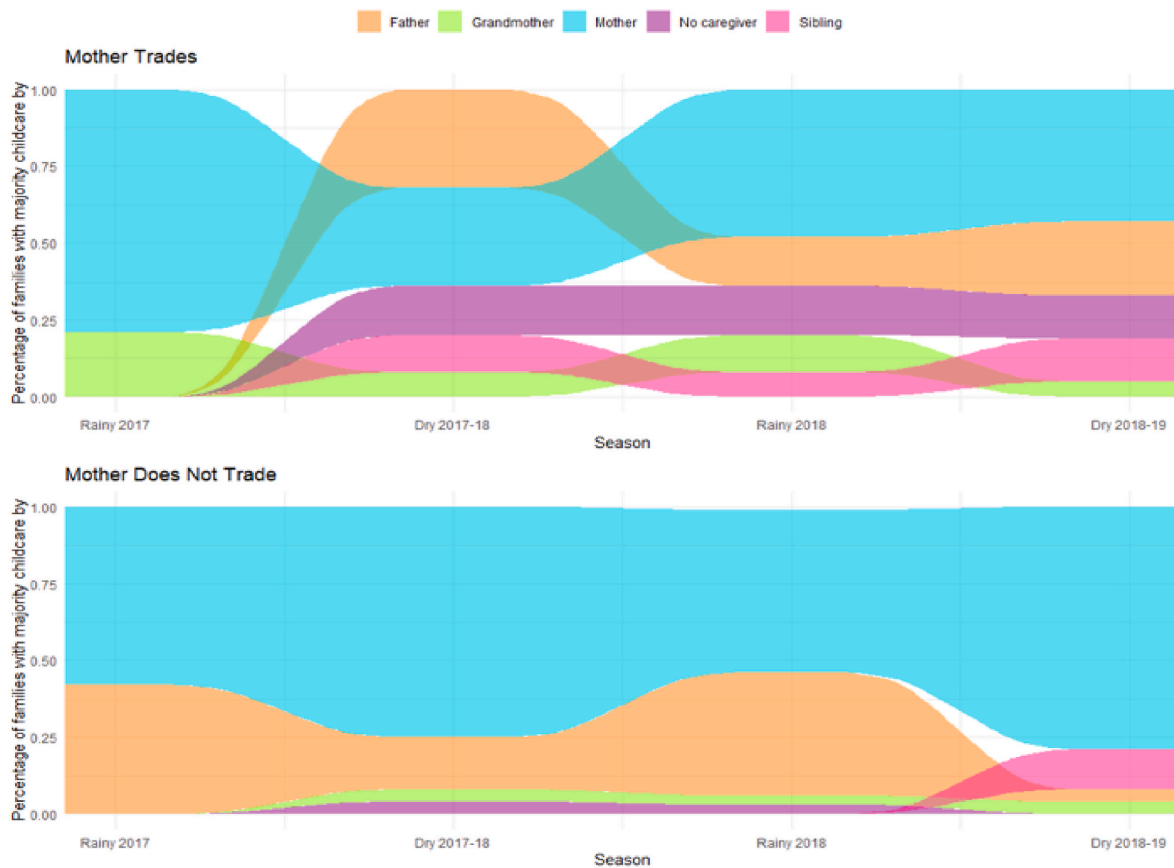


Fig. 1. Seasonal trends in Shodagor childcare among households in which mothers traded ($n = 24$) versus those who did not trade ($n = 26$). Percentages of each caregiver frequency were calculated for each season (rainy 2017, dry 2017/18, rainy 2018, dry 2018/19) and plotted in ascending order (most prevalent on top).

households in which the mother traded ($n = 24$) versus those in which the mother did not trade market goods seasonally ($n = 26$) to visualize how Shodagor childcare patterns varied by women's occupation (Fig. 1).

Other measures in this study included household income and size, mother's occupation, child age, and gender (Table 1). A monthly income average was calculated for each household for one month out of each season by calculating an average daily income for each occupation (fishing and trading), summing across all household members, and multiplying by 20 days (5 days of work per week). Daily incomes were determined by asking Shodagor adults detailed questions about their earnings over the previous 3 days, therefore, income estimates are robust to daily and seasonal fluctuations in economic activity. While we describe raw income statistics in taka in Table 1, this metric was log-transformed in our modeling applications described below. A binary variable indicated household occupational strategy as "trading" or "fishing", based on mother's primary occupation. Child gender was coded as male or female according to parent reports, and age was calculated seasonally for each child in years.

2.4. Statistical analysis

A series of Bayesian generalized linear mixed models (GLMMs) evaluated the impacts of mothers' trading activity and care on monthly child illness frequencies. All models were implemented in R v. 4.2.3 with the 'brms' package (R Core Team, 2023; Bürkner, 2017). Monthly child illness outcomes were represented by the number of days throughout a given month that parents reported illness for each child (i.e. total number of monthly sick days) and modeled as a Poisson count process.

All models included gender, age, a season-specific monthly estimate of household income, and household size as fixed-level covariates described above. Age was modeled as a cubic spline with knot points at 6

and 12 years to allow illness risk to vary nonlinearly and independently across different phases of childhood and adolescence for age ranges 3–6, 7–12, and 13–18 years. We log-transformed seasonal averages of monthly household income given its large variance and right-tailed skew and included this metric to adjust for variation in household resources available to pay for healthcare, transportation, etc. Individual identity was included as a random-level effect in all models to account for within-individual variance in these unbalanced repeated measures, and household identity was included as an additional random-level effect in all models to account for other unmeasured aspects of shared household environments that may impact childcare and illness frequencies in these data.

A series of four GLMMs evaluated the impacts of mothers' seasonal trading and associated childcare patterns on the frequency of child illness. First, the Maternal Occupation model assessed the extent to which child illness frequencies varied between trading and non-trading households overall by modeling mother's occupation (did/did not trade) as a predictor alongside the covariates detailed above (gender, age, household income, household size, individual ID, household ID). Secondly, the Seasonal Trading model included an interaction between mother's occupation and season (dry/rainy) to examine whether children in trading households were more likely to have higher illness frequencies during dry seasons when their mothers were selling. In order to estimate more direct impacts of mothers' childcare on illness frequencies, our third Maternal Care model included a dichotomous variable for whether or not "mother" was listed as the household's primary caregiver for the majority of a given season. Lastly, the Any Care model included seasonal primary household caregiver as a categorical predictor to evaluate the extent to which child illness frequencies varied when their mother, father, alloparent (grandmother or sibling), or no one was responsible for the majority of direct childcare in each household during

Table 1

Descriptive statistics for 97 Shodagor children with illness, childcare, and socio-demographic data across four seasons (rainy 2017-dry 2018/19). Sample sizes (n) indicate the number of observations for each variable, with 1187 monthly observations recorded from 97 individuals in 50 different households across the study period. Percentages are included for categorical variables and summary statistics are reported for numeric variables.

Variable	n (obs)	%	Mean	Median	Std Dev	Min	Max
No. of households	50	-	-	-	-	-	-
No. of trading households	24	48%	-	-	-	-	-
No. of children in household	50	-	4.3	4	1.18	2	8
Monthly household income (taka)	649	-	10627	8600	9580	560	79000
No. of individuals	97	-	-	-	-	-	-
Females	45	46%	-	-	-	-	-
No. of monthly observations	1187	-	-	-	-	-	-
Age (years)	1187	-	9.45	9.00	3.83	3.00	18.00
No. of monthly illness days	1187	-	0.45	0.00	2.46	0.00	30.00
Majority monthly care by mother	757	64%	-	-	-	-	-
Majority monthly care by father	106	9%	-	-	-	-	-
Majority monthly care by gma/sib	230	19%	-	-	-	-	-
Majority monthly care by none	94	8%	-	-	-	-	-

a given season. While the modeled outcome variable represents child illness counts on monthly scales, childcare, income, and occupational metrics vary by season at the household level, household size is represented by a cross-sectional measure at the beginning of the study period

(rainy 2017 season), individual gender remains constant over time, and individual age (in years) varies seasonally.

All of these Bayesian GLMMs used weakly informative priors with a normal distribution centered at 0 and standard deviation of 10 for fixed-level parameters and a Cauchy distribution with scale parameter of 1 for random-level effects allowing model intercepts to vary by each individual and household. All models were sampled with full Bayesian inference and ran for 5000 iterations with 4 chains each and a warmup of 1000 (Bürkner, 2017). Effective sample sizes summarizing the posterior distributions for all model parameters exceeded 1,000, and all estimates showed sufficient chain convergence (Rhat = 1.00).

3. Results

Monthly prevalence trends show low rates of illness (<5%) among Shodagor children overall in these real-world data (Fig. S3), and children in trading households experienced higher rates of illness across most months spanning March 2017–April 2019 (Fig. 2). Illness prevalence also varied by age and gender among this Shodagor sample with rates spiking at ages 7 and 15 among females and around 5 and 17 years among males (Fig. S1). When modeling age, gender, household income, household size, mother’s occupation, and random-level individual and household effects together as predictors of monthly illness days in the Maternal Occupation model, age and mother’s occupation show statistically significant effects with 95% credible intervals that do not span zero (Table S1). Children between 7 and 12 years old have lower illness risks than children between the ages of 3–6 or 13–18, and children in trading households show elevated risk of a partial illness day each month as compared to children in non-trading households overall across these four seasons of data (Fig. S2). The combined fixed-level effects of age, gender, household income, size, and mother’s occupation explain approximately 1% of the variation in monthly illness days observed (R_m^2), and, with the contribution of individual and household random-level effects, the Maternal Occupation model explains a total estimated 14% of observed variation in child illness days (R_c^2) (Table S1).

Modeling seasonal effects of mothers’ trading activity on child illness risk shows statistically significant effects of mother’s occupation, season (dry/rainy), and the interaction between these variables in the Seasonal

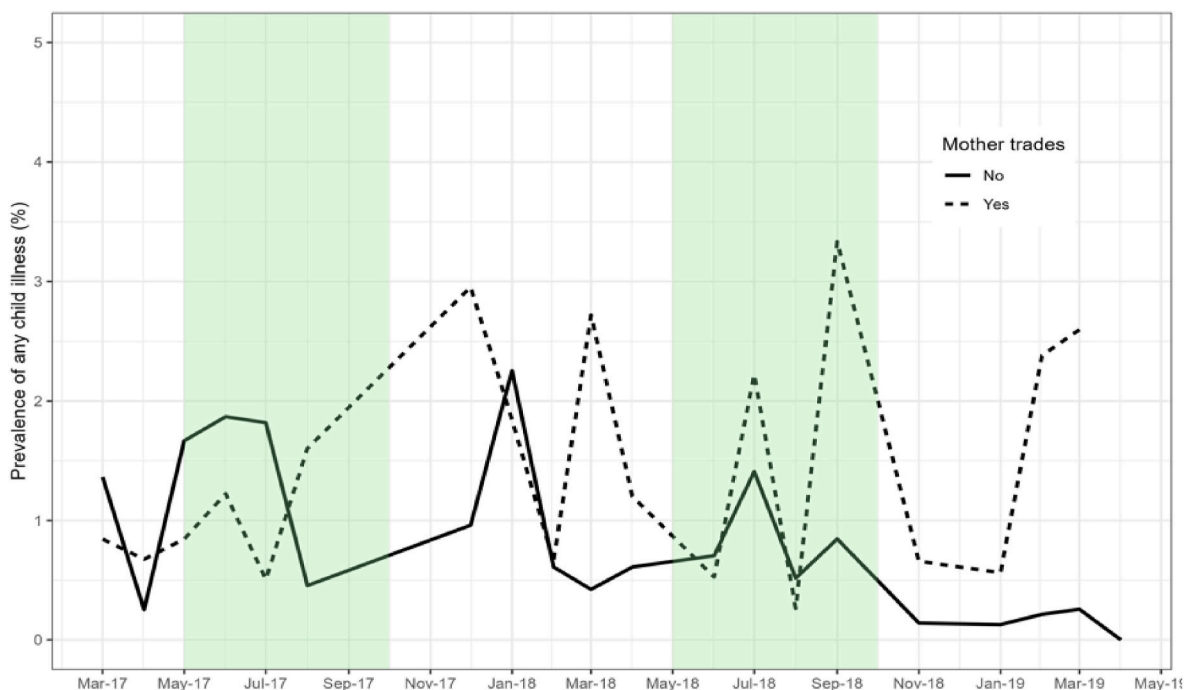


Fig. 2. Monthly illness prevalence from March 2017–April 2019 among Shodagor children whose mothers traded versus those whose mothers did not trade.

Trading model (Fig. 3, Table S1). Fig. 3 shows the conditional effects of each fixed-level predictor in the Seasonal Trading model, and the subgroup effects from the interaction term of primary interest are shown on a magnified scale in the far-right panel. Children in trading households had higher population-level risk of illness overall (bottom middle panel), Shodagor children had higher population-level risk of illness symptoms during rainy seasons than dry seasons (bottom right panel), and children whose mothers traded show higher risk of more illness during dry seasons than during rainy seasons whereas children whose mothers did not trade show higher illness risk during rainy seasons (far right panel, Fig. 3). Combined fixed-level effects explain approximately 2% of the variation observed in monthly child illness counts (R_m^2), and the Seasonal Trading model accounts for a total estimated 16% of illness variation with that explained by random-level effects as well (R_c^2 , Table S1).

Most non-trading households named “mother” as the primary caregiver across all four seasons (rainy 2017-dry 2018/2019), whereas fathers, grandmothers, and siblings provided substantial proportions of primary childcare among trading households throughout the dry 2017/2018, rainy 2018, and dry 2018/2019 seasons (Fig. 1). Trading families also reported having no primary caregiver at higher rates than non-trading families across these last three seasons. Shodagor fathers in non-trading households provided the most primary childcare during rainy seasons, whereas fathers in trading households were responsible for more primary childcare during dry seasons than rainy seasons (Fig. 1).

Coefficient estimates from the Maternal Care model show that

Shodagor children were more likely to have more reported illness days when mothers were not providing the majority of their primary care (Fig. 4A, Table S1). When modeling seasonal primary caregiver as a categorical predictor in the Any Care model, children who received the majority of primary care from an alloparent (grandmother or sibling) show comparably low risk of illness days to those who received majority maternal care (Fig. 4B-Table S1). Risk of monthly illness days is significantly increased for children who received the majority of their primary care from either father or no specified caregiver during a given season, and those who received no majority care show the highest predicted illness risk of any group (averaging ~0.2 days per month). The Any Care GLMM with age, gender, household income, size, and categorical caregiver explains approximately 3% of observed variation in monthly child illness days with these fixed-level effects (R_m^2) and an estimated 17% of illness variation with its combined mixed effects that account for individual repeated measures and shared household effects (R_c^2 , Table S1).

4. Discussion

Worldwide, public policy and aid campaigns have been organized around the idea that women’s employment, through its contribution to economic empowerment, begets positive outcomes for child health and nutrition. However, decades of work have produced mixed results, so the mechanisms that may be driving child outcomes remain unclear. In this paper, we use ethnographic and longitudinal data and a between- and within-individuals study design to test the underlying assumptions

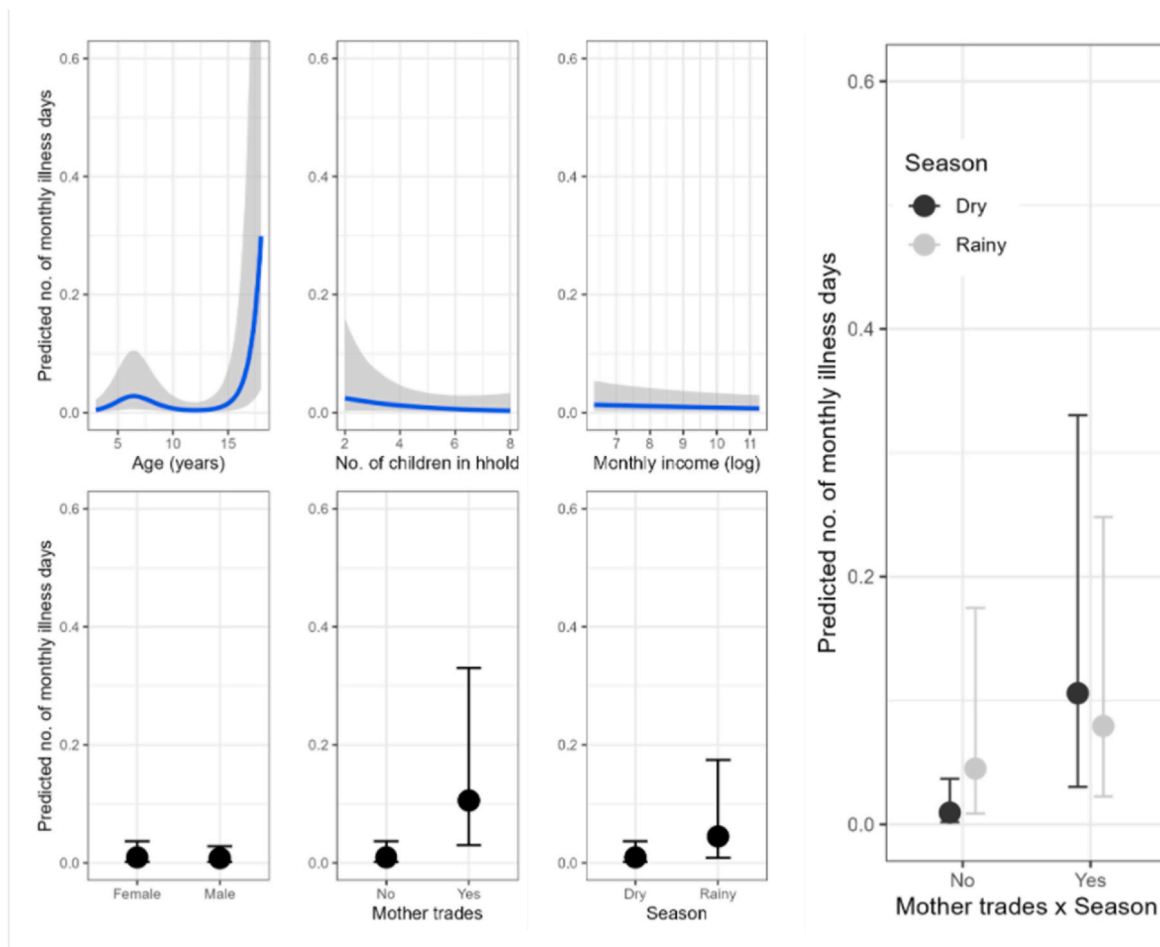


Fig. 3. Conditional effects (posterior means with 95% credible intervals) of child age (top left), household size (top middle), monthly household income (top right), gender (bottom left), mother’s occupation (bottom middle), season (bottom right), and the interaction between mother’s occupation and season (far right) on predicted child illness days in the Seasonal Trading model.

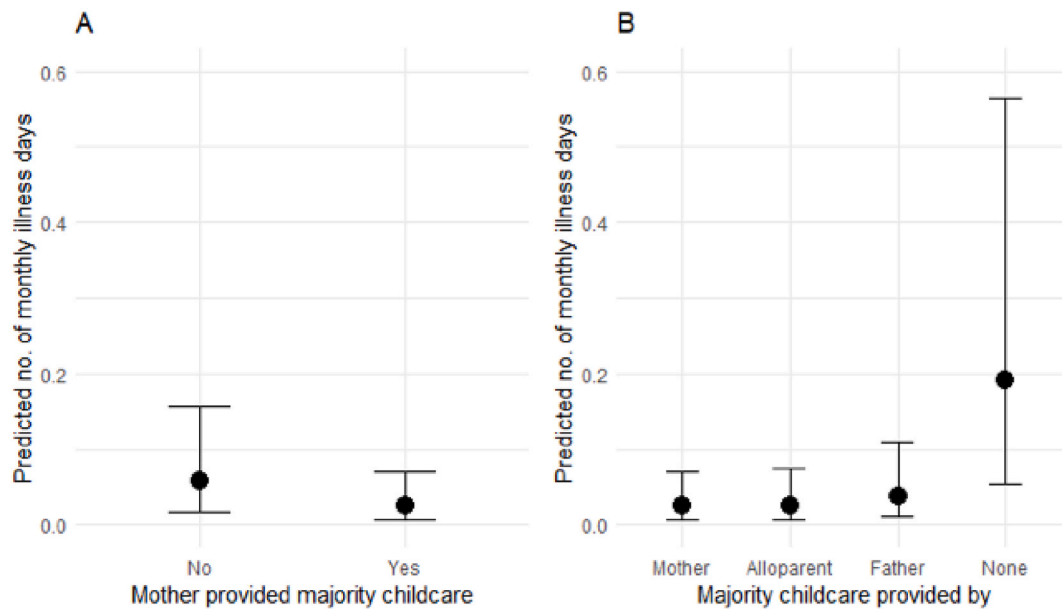


Fig. 4. Conditional illness effects of childcare predictors (posterior means with 95% credible intervals) from the Maternal Care model (A) and the Any Care model (B).

of a competing framework, which suggests negative outcomes are a result of lower levels of maternal care children receive when their mothers are working. Specifically, we examine the role of maternal care among working Shodagor mothers living in rural Bangladesh and its influence on child illness.

In order to gain a clear understanding of the relationship between mothers' work, mothers' care, and child health among Shodagor families, we modeled our data in three different ways to test the hypothesis that maternal care is a significant mechanism driving the relationship between women's work and child illness. Results from all models supported the same conclusion: in Shodagor families, when children receive more care from their mothers, they experience fewer days of illness per month.

As predicted, children who received more maternal care, overall, had fewer days of illness (Fig. 4A) and children in trading households experienced more days of illness than children in fishing households (Fig. 3). Children of women who work as traders also experienced fewer sick days during rainy seasons, when mothers are their primary caregivers, than they do during dry seasons, when mothers are working (Fig. 3). These results provide clear evidence that maternal care is important and more care from mothers supports better health outcomes for children, which is consistent with findings from many other contexts (Bhalotra, 2010; Cawley and Liu, 2012; Desai and Devaki, 1994; Glick and Sahn, 1998; Morrill, 2011; Smith et al., 2003; Ukwuani and Suchindran, 2003). These results are generally supportive of the 'maternal care' framework, but also show there are scenarios in which women's work – and even reduced amounts of maternal care – do not necessarily lead to deleterious child health outcomes.

First, we expected children whose mothers were exclusively caring for them (traders during rainy seasons) would experience fewer days of illness than children whose mothers worked while also providing care (fishers). This prediction was not supported: children in these two scenarios experienced similar illness rates during rainy seasons (Fig. 3). This could be due to the broader disease ecology of Bangladesh, in which many types of illness peak during rainy seasons (Chowdhury et al., 2018). It could also indicate that amount and/or quality of care provided by mothers while working is roughly equivalent to care provided by mothers when they are not working. This makes sense given that women who stay home to care for their children are also responsible for myriad household tasks (Jain and Zeller, 2015), likely resulting in mothers' time

and attention being divided between childcare and other tasks, similar to fishing mothers. These results suggest that when mothers' work does not require a stark trade-off with childcare, such that mothers can be available to meet child needs throughout the day, child health can benefit (e.g., Nankinga et al., 2019; Ukwuani and Suchindran, 2003) and can result in short-term health outcomes that are similar to children whose mothers stay home to care for them.

Second, although trading and the reduction in maternal care that accompanies it are associated with more child illness, these effects are not experienced year-round. When childcare-incompatible work is seasonal and children receive greater amounts of maternal care during portions of the year, they may also experience a sustained reduction in illness burden during that time, which can be important for immune development and catching up on growth that faltered during the previous season (Hauspie and Pagezy, 1989; Stephensen, 1999). A previous study of Shodagor children's growth patterns (Starkweather et al., 2021) similarly found that while child growth slowed during dry seasons in trading households, growth was faster during rainy seasons when mothers were primary caregivers. Also, children in trading households experienced greater cumulative growth, overall, resulting in these children being taller, weighing more, and having higher BMIs than children in fishing households. Considered together, illness results (in this paper) and growth results (from Starkweather et al., 2021) indicate that although lower levels of maternal care associated with mothers' trading during dry seasons are detrimental to child health and growth in the short term, the overall work/care strategy in trading households may ultimately redound to better outcomes for children.

Finally, when allomaternal care substitutes for lost maternal care, mothers can work without negative consequences for child health (Fig. 4). As predicted, Shodagor children who received the majority of care from grandmothers, older siblings, and others experienced illness outcomes that were similar to children who received the majority of care from mothers. Positive effects of grandmaternal care are consistent with evidence from numerous contexts worldwide (Bentley and Mace, 2009; Sadruddin et al., 2019). Evidence for a positive effect of older siblings is mixed cross-culturally (Popkin, 1980; Sear and Mace, 2008), but this may be because their ages and levels of experience caring for children (i. e., quality of care) varies across contexts (Shah, 1978). In Shodagor households, siblings typically are not primary caregivers until they are teenagers, and this appears to benefit their younger siblings.

While fathers' care resulted in significantly more sick days for Shodagor children, and this is consistent with findings from a previous study of child growth (Starkweather et al., 2021), most detrimental to Shodagor children's health is to be without a specified caregiver during the day (Fig. 4). The 'no caregiver' scenario is most common for older children (~7 years and older; Fig. S4) in trading households: mothers and fathers go to work and do not take children along, nor do they arrange childcare. These children are responsible for meeting their own needs during the day, including feeding and bathing themselves. It is also unusual for children who are still dependent on their parents to seek out medical treatment or preventative care (e.g., vaccines) unless accompanied by a parent or other caregiver. These conditions result in significantly more days of illness than does any other care situation. Taken together, these results indicate that, when mothers' work is incompatible with childcare, substitutive care can buffer the effects of lost maternal care and children without a maternal substitute are at the greatest risk of increased illness rates.

In addition to the effects of maternal work, caregiving, and seasonality on child illness, our model results also indicate that age has a significant relationship to child illness, with older teenagers at a statistically higher risk of more illness days, compared to younger children (Fig. 3 and S2). The reason for this is not clear but could be due to differences in patterns of mobility and sociality among older children. Nevertheless, as our model results are conditional on holding age constant, higher rates of illness among older children are not driving the primary results of this study.

The greatest limitation of this study is that it uses a small sample size (97 children) from a relatively small population, which makes generalizability on a larger scale challenging. However, there are advantages to conducting research with smaller communities, including the ability to collect highly detailed, ethnographically-informed data, allowing a more-nuanced interpretation of our results. This also addresses a key critique of many other, country- or region-level studies that examine the impacts of maternal work on child outcomes by treating women's work as a binary variable. The granularity of our data allows us to examine nuances of women's work, including trade-offs between work and childcare, which are necessary to understand the likely mechanisms driving relationships between women's work and child health.

5. Conclusions

In sum, our study supports a key aspect of the "maternal care" framework, providing evidence for the importance of maternal care and indicating that lower amounts can lead to deleterious child health outcomes. However, the Shodagor context also provides examples of ways that women can provide necessary resources for their families without negatively impacting child health, in the short- or long-term. Our major findings are consistent with results from other contexts that similarly – but separately – suggest that flexibility in maternal work and high-quality allocare can lead to better health outcomes for children of working mothers. These findings should motivate further work among larger populations to examine work and care with greater nuance.

These results offer some insight into policy solutions that could allow mothers to work – promoting economic gender equality, which is good for women and their families in numerous ways (Sen, 1999; Smith et al., 2003), and is good for local and national economies – while also preventing negative outcomes for children that are associated with reduced maternal care. First, implementing flexibility in workplaces, allowing women to do work that is compatible with childcare would increase mothers' time spent with their children (Debela et al., 2021; Noonan et al., 2007). This could be done by allowing children to accompany their mothers to work or providing options for childcare nearby, by allowing mothers flexible hours to attend to child needs throughout the day, or by providing flexibility throughout the year so that mothers are able to care for children during critical periods. When such flexibility is not possible or preferred, providing or subsidizing the cost of

high-quality childcare alternatives – including paying family or community members – could provide a pathway to better child outcomes for working mothers (e.g., Diiro et al., 2017; Glick and Sahn, 1998; Win et al., 2022). While we argue that policy and aid should always be targeted at working parents to ensure optimal child health outcomes, this should especially be the case when policies and interventions are specifically designed to increase women's participation in the labor force.

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Ethics approval

All data were collected in accordance with procedures approved by the University of Missouri's Institutional Review Board, the International Centre for Diarrhoeal Disease Research, Bangladesh's (ICDDR,B) Research and Ethical Review Committees, and the Max Planck Institute for Evolutionary Anthropology's Department of Human Behavior, Ecology, and Culture.

CRediT authorship contribution statement

Kathrine Starkweather: Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Monica Keith:** Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Data curation, Conceptualization. **Fatema tuz Zohora:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation. **Nurul Alam:** Writing – review & editing, Writing – original draft, Supervision, Project administration.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2024.117277>.

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