



## Evaluating infant multimorbidity in Ethiopia through the international classification of functioning, disability, and health framework: Results from the performance monitoring for action survey

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### ABSTRACT

**Objective:** Infant multimorbidity—defined as the co-occurrence of multiple symptoms or conditions—can negatively influence early development and population well-being. This study aimed to apply the International Classification of Functioning, Disability, and Health (ICF) framework to classify infant morbidity and examine its association with social and health-related risk factors.

**Study design:** Cross-sectional analysis of population-based survey data.

**Methods:** Data were drawn from the 2019 Performance Monitoring for Action Ethiopia (PMA-ET) community survey. Using multistage stratified cluster sampling, women aged 15–49 were screened, and those pregnant or postpartum within six weeks were eligible. Mothers reported infant illnesses in the preceding two weeks, which were then classified using the ICF framework. Multivariable weighted logistic regression was conducted to assess associations with selected risk factors.

**Results:** Among 2514 infants, 24.7 % experienced morbidity in the cardiovascular, hematological, immunological, or respiratory domains (ICF code b4); 14.0 % in digestive, metabolic, or endocrine systems (b5); 4.5 % in skin and related structures (b8); 2.5 % in sensory functions and pain (b2); and 1.5 % in mental function (b1). Significant risk factors for b4 morbidity included poor sanitation (adjusted OR = 0.68; 95 % CI: 0.47–0.99), lack of cooking facilities (adjusted OR = 0.72; 95 % CI: 0.52–0.99), and a partner's disapproval of family planning (adjusted OR = 1.40; 95 % CI: 1.05–1.87). For b5 morbidity, lower maternal education and partner disapproval or indifference toward family planning were significant predictors.

**Conclusions:** Addressing household-level determinants and empowering women through education and reproductive autonomy may reduce infant morbidity and support early childhood health.

### 1. Introduction

The risk of morbidity during the neonatal period is six times higher in low-income countries than in high-income countries [1,2]. Although the morbidity due to infectious diseases like pneumonia, diarrhea, and malaria declined from 45 % to 20 % between 1990 and 2018 globally [3–5], the burden of disease remains disproportionately high in sub-Saharan Africa. This is primarily due to limited healthcare access, high rates of infectious diseases, and nutritional deficiencies [4,6]. The region accounts for more than 60 % of all newborn morbidity cases

worldwide, underscoring the urgent need for targeted interventions [4,7].

Globally, approximately 75 % of under-five deaths result from pneumonia, diarrheal, malaria, measles, HIV, and perinatal diseases [8]. Nearly half of these deaths occur within the first year of life. In 2020, around 2.4 million newborns (within their first 28 days) died due to complications related to preterm birth, birth asphyxia, and infections like pneumonia. Many of these deaths could be prevented through interventions such as skilled birth attendance, vaccinations, and access to quality healthcare [3,9,10]. Studies have further identified, preterm birth

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complications, congenital abnormalities, injuries, and non-communicable diseases-including pediatric cancer, acquired heart disorders, and metabolic conditions like diabetes and obesity-as leading causes of child mortality [11–14]. Moreover, it is disheartening that 15, 000 children die each day worldwide, many of them suffer from preventable illness such as fever, diarrhea, and malaria [15].

Ethiopia has made significant progress in reducing child mortality rates in line with global initiatives like the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs). Under the MDGs, Ethiopia reduced its under-five mortality rate (U5MR) from 205 deaths per 1000 live births in 1990 to 67 per 1000 by 2015, achieving a 67 % reduction. The infant mortality rate also declined from 123 per 1000 live births in 1990 to 48 per 1000 by 2015 [16]. As part of the SDGs, Ethiopia now aims to reduce neonatal mortality (deaths within the first 28 days of life) to 12 per 1000 live births and under-5 mortality to 25 per 1000 by 2030 [16–18]. However, in 2019, Ethiopia's neonatal mortality rate remained relatively high at 33 per 1000 live births, indicating the need for accelerated efforts to meet the SDG targets [19]. Limited health care access, especially in rural areas, continues to pose challenges in reducing infant morbidity and mortality.

Therefore, in order to design a successful national policy for addressing infant morbidity, it is essential to identify the risk factors and prevalence within the local context. While numerous studies in Ethiopia have focused on infant and under-five child mortality, insufficient attention has been given to morbidity [20–24]. Furthermore, previous studies have identified a wide range of risk factors, including socio-economic, environmental, demographic, and other elements that influence infant morbidity [25–30]. However, most of these studies have focused on a single disease, despite the fact that many infants in Ethiopia suffer from multiple health conditions and it is important to consider them all for prevention. Such an approach limits a comprehensive understanding of morbidity causes and outcomes [31,32].

Furthermore, these existing studies have faced the inability to provide, and investigate based on a unified and standardize language for describing and classifying the newborn morbidity domains to provide a common framework for health outcome measurement [33].

Thus, to providing a more comprehensive, holistic perspective on infant morbidity this study applies the International Classification of Functioning, Disabilities, and Health (ICF) framework. The ICF offers a standardized and multidimensional approach to understanding health and morbidity by considering by considering co-morbidities and their cumulative impact on body function. This approach facilitates the development of more comprehensive treatment and care strategies [33–36]. In this study, we describe infant multimorbidity among participants in the PMA-ET 2019 six-week postpartum community survey, applying the International Classification of Functioning, Disability, and Health (ICF) framework, and we evaluate associated social and health-related risk factors. The findings from our study will improve planning's and intervention to take measure infant morbidity in Ethiopia.

## 2. Methods

The study used the secondary data source based on the Performance Monitoring Action-Ethiopia (PMA-Et, 2019) cohort one (cohort of 2019–2021) longitudinal survey, a national study conducted in collaboration with Addis Ababa University, Ethiopia, and the Johns Hopkins Bloomberg School of Public Health, USA. It collected up-to date data on maternal, neonatal, and reproductive health indicators in six regions of Ethiopia, covering 91 % of the population, to inform national and regional government objectives and initiative [37]. After outlining the goal of our studies and receiving consent via an online request, we obtained the data for our study via PMA website: <https://www.pmadata.org/>

The details of the survey were reported in Ref. [37] briefly, the PMA Ethiopia Cohort One Baseline Longitudinal Survey used a multistage

stratified cluster sampling design. Households were chosen from enumeration areas (EAs) that served as primary sampling units (PSUs). These EAs were chosen with a probability proportionate to size within predefined strata. For four large, predominantly agrarian regions, Amhara, Oromia, and Southern Nations, Nationalities, and Peoples (SNNP), strata were defined by both region and urban/rural residence, whereas in the remaining regions (the pastoralist region Afar and the urban region of Addis Ababa), regions themselves served as strata, with no additional urban/rural stratification. In all, 217 EAs were included in the baseline survey of cohort after regional adjustments and exclusions. The Ethiopian Statistical Service (ESS) provided updated population measures for EA selection and the calculation of design weights. Thus, the stratification variable corresponds to region and residence (urban/rural), and the PSU variable corresponds to the enumeration areas (EA) from which households were sampled. All women who were aged 15–49 and regular members of the household were screened and those who reported being pregnant or having given birth in the past six weeks were eligible for the survey. PMA Ethiopia was able to interview the minimum number of women per EA and achieve a sample that was representative on both national and regional levels. Further details are provided on the protocol of the PMA Ethiopia survey as described by [37].

At baseline interview women's demographic information was collected including socio-economic and demographic variables, including the mother's age, mother's education, partner's family planning feeling, number of household members, availability of electricity, food cooking place, availability of treated bed net, sanitation main classification, and wealth quintiles. At six weeks postpartum, the PMA-Et 2019 Ethiopian panel survey collected information on maternal, newborn, and reproductive health (RMNH) indicators. Women were asked whether their newborns or infant had suffered any illness in the past two weeks, including difficulties/poor feeding, eye infection, skin rash (lesion), convulsion, lethargy, unconsciousness, fever, cold (cough), sore throat, fast or difficulty breathing, diarrhea, and vomiting. Suffering from any illness was defined as having an affirmative response for any illnesses listed.

Infant morbidity after birth was recorded as the presence of cold (cough), fever, diarrhea, vomiting, difficulty feeding (unable to suck), skin rash (skin lesion), red eye (passage of pus from eyes), sore throat (tonsillitis), fast birthing, no stool, unconsciousness, difficulty in birth, reduced alertness (lethargy), convulsion, abdominal(body swelling) in the past two weeks in the PMA-Et survey.

Symptoms were mapped to International Classification of Functioning, Disabilities, and Health (ICF) body functioning codes through direct conceptual correspondence between the observed or reported clinical symptom and the functional domain described in the ICF checklist (see [Supplementary Table 2](#)) [38]. Each from the PMA-Et (2019) was reviewed and linked to the most specific ICF categories: for example, infant symptom types cough, tonsillitis, fast breathing, difficulty in breathing, and swellings belong to the categorizations of functions of the cardiovascular, hematological, immunological, and respiratory systems (b4); unconsciousness and convulsion belong to mental functions (b1); eye infection to sensory functions and pain (b2); vomiting and diarrhea, does not pass stool, poor feeding belongs to under the category of functions of the digestive, metabolic, and endocrine systems (b5); and skin rash/skin lesion belong to functions of the skin and related structures (b8). We also examined the existence of at least one morbidity (any diseases). This mapping ensured that every clinical manifestation was properly classified within the defined ICF framework for functional evaluation [38].

### 2.1. Statistical analysis

The continuous variables (i.e. age and number of Household Members) were described as median and quintiles while categorical ones with frequencies and percentages. Multivariable weighted logistic

regression has been used to evaluate the association between each disease classification according to ICF and covariates with region included as random effect. Design-based standard errors were used [39]. The variables included in the model were chosen a priori based on the literature. Results are reported as odds ratio (ORs) and their 95 % confidence intervals and displayed by the used of forest plots. OR reports the change in the odds of outcome (morbidity) for a unit increase (or from one category to another category) in the predictor, holding other predictors constant. Due to the low number of events we did not modeled the association with b1 and b2. Unless specified, all the analyses were weighted for the female survey weights resulting in a sample that is representative of all pregnant or recently postpartum women aged 15–49 residing in the six regions included in the PMA Ethiopia panel [37]. We used version 4.4.2 of survey package in R.

### 3. Results

The totals of women contacted from panel for baseline interview were 2924. Of these, 47 were ineligible since screening, 2 refused, 18 did not complete the female questionnaire or gave no consent. The remaining 2857 completed the six-week follow-up interview. Among these, 2 women had abortions and 98 experienced miscarriages, leaving a total of 2757 women included with live births. We also excluded 36 women from our study due to the “do not know” or “no response” on either one of the responses for complications experienced, or 207 women have only baseline characteristics (have no data about the morbidity status of their infants). As result, we finally considered 2514 women (see Fig. 1).

The median age was 27 years (I-III quartiles 22–31). The median family size per woman was 5. Among the participants, 45.1 % of women

used treated bed nets, 42 % had no formal education (never attended school), and 39.6 % had primary education, while 7.1 % and 11.2 % had secondary and higher education, respectively. Furthermore, 45.8 % of participants cooked food within their homes, 17 % cooked outdoors, and 37.2 % used a separate building for food preparation. Considering their partner’s views on family planning, only 61.4 % reported that their partner approved of it, 12 % said their partner was indifferent, and 26.7 % stated that their partner disapproved. Sanitation conditions were generally inadequate, with 88.9 % of participants practicing open defecation and only 3 % having access to improved, non-shared facilities. Geographically, the survey covered a wide range of localities with 25 % from Oromia, 23 % from SNNP, 18 % from Amhara, 17 % from Tigray, and lower amounts from other regions (see Table 1).

Table 2 highlights the prevalence of infant symptoms and disease classifications based on the ICF checklists [33]. A total of 38 (1.51 %) women reported symptoms classified under the mental function domain (b1), including 19 cases of unconsciousness and 19 cases of convulsion. Within the digestive, metabolic, and endocrine systems (b5.), 357 (14 %) events were recorded (147 diarrheal, 151 vomit, 83 poor feeding, and 52 does not pass stool).

Furthermore, 621 (24.7 %) women reported symptoms classified under the cardiovascular, hematological, immunological, and respiratory systems (b4.), with the most common one being cough (521 cases). Other symptoms included fast breathing (56 events), sore throat/tonsillitis (70), difficulty in breathing (48), and swellings (18) events. Overall, 987 women (39.26 %) reported at least one disease or symptom, emphasizing the urgent need for targeted health interventions. (see Supplementary Table 2 for detail disease classification based on ICF checklists) [38]. Supplementary Fig. 2 reports the combination of among comorbidity categories or disease domains. While single cases

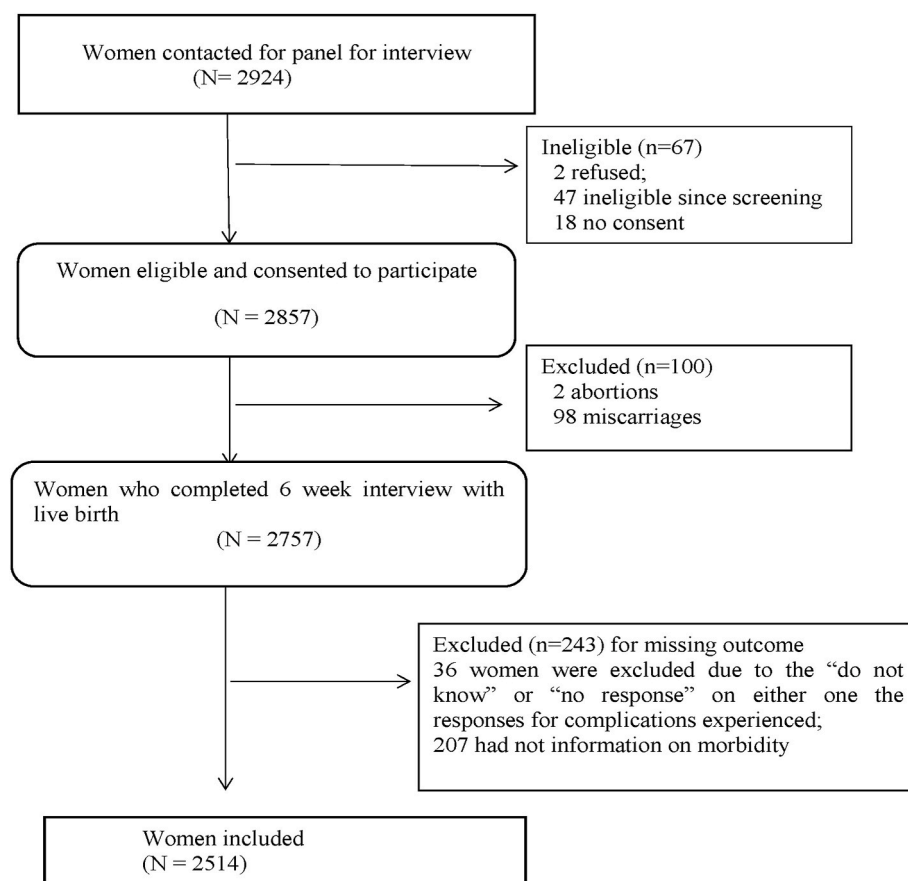


Fig. 1. Data extraction procedure for assessing the infant multimorbidity complications and their predictors among postpartum women in Ethiopia based on Cohort 1 of the PMA Ethiopia Six-Week Longitudinal Survey, October 2019–August 2020.

**Table 1**  
Demographic and Health Characteristics for a sample of 2514 women (weighted analyses).

Characteristic	Median (quartiles) or n (%) - weighted
Age, years	27(22–31)
Household size	5(3–6)
Electricity (yes)	1666 (65.5)
Cooking where	
Within house	1165.8 (45.8)
Outdoors	431.1 (17.0)
In separate building	946.3 (37.2)
Treated bed net (Yes)	1147.7 (45.1)
School	
Never attended	1069.4 (42.0)
Primary	1007.2 (39.6)
Secondary	181.2 (7.1)
Higher	285.5 (11.2)
Partner's feeling on family Planning <sup>a</sup>	
He is ok with it	1527.8 (61.4)
He does not care	297.9 (12.0)
He disapproves of it	664.5 (26.7)
Wealth Quintile	
Lower quintile	1052.2 (41.4)
Middle quintile	508.9 (20.0)
Higher quintile	982.1 (38.6)
Sanitation Main Classification	
Improved, not shared facility	75.1 (3.0)
Shared Facility	206.0 (8.1)
Open defecation	2262.2 (88.9)
Region(geographical locations)	
Tigray	176.0 (6.9)
Afar	47.6 (1.9)
Amhara	534.1 (21.0)
Oromia	1121.7 (44.1)
SNNP	568.9 (22.4)
Addis Ababa	95.0 (3.7)

<sup>a</sup> 63 women had missing value for this variable.

dominate, there are clear co-occurrences, particularly between b4 and b5, suggesting a close relationship between these morbidity groups [40].

Fig. 2 shows the results from the weighted logistic regression on functions of the cardiovascular, hematological, immunological, and respiratory systems (b4). Based on the results, sanitation was significantly associated with the presence of illness of the cardiovascular, hematological, immunological, and respiratory systems (b4), with improved/shared facility showing 32 % lower odds of b4 morbidity (OR = 0.68; 95 % CI: 0.47, 0.99; P = 0.041) compared with open defecation. Similarly, infants whose mothers could cook their food in a separate building were less likely to suffer illness (OR = 0.72; 95 % CI: 0.52, 0.99; P = 0.047) than infants whose mothers cooked their food within the house. The odds of disease in the b4 domain for children whose father disapproved family planning feelings were 1.4 times greater (weighted OR = 1.4; 95 % CI: 1.05, 1.87; P = 0.021) than the odds for children whose fathers accepted family planning (see Fig. 2).

Fig. 3 displays the functions of the digestive, metabolic, and endocrine systems (b5) infant morbidity result. Newborns from mothers with no formal education and primary education were more likely to develop b5 morbidity than those whose mothers had secondary or higher education (OR = 1.78; 95 % CI: 1.11, 2.83; P = 0.016, and OR = 1.71; 95 % CI: 1.08, 2.71; P = 0.023, respectively). Moreover, infants from a partner who disapproved or did not care of the family planning feeling were more likely (OR = 1.38; 95 % CI: 1.02, 1.92; P = 0.042, and OR = 1.84; 95 % CI: 1.24, 2.72; P = 0.002, respectively) to develop b5 morbidity than infants from a partner who accepted family planning.

Cooking food in a separate building was associated with 47 % lower odds of b8 morbidity (Functions of the skin and related structures, OR =

**Table 2**  
Distributions of reported illnesses based on ICF diseases classification checklist.

Illness type	Number of women reporting the illness (n)	Disease classification	Unweighted number of events per disease classification (n) (%)
Unconsciousness	19	Mental function (b1.)	38(1.51 %)
Convulsion	19		
Eye infection	63	Sensory functions and pain (b2.)	63(2.51 %)
Cough	521	Functions of the cardiovascular, hematological, immunological and respiratory systems (b4.)	621 (24.7 %)
Fast breathing	56		
Sore throat/ tonsillitis	70		
Difficulty in breathing	48		
Swellings	18		
Diarrhea	147	Functions of the digestive, metabolic and endocrine systems (b5.)	357(14 %)
Vomit	151		
Poor feeding	83		
Does not pass stool	52		
Skin rash/skin	113	Functions of the skin and related structures (b8)	113(4.49 %)
Other	148		148(5.89)
Fever	72		72(2.86)
All Diseases/any disease	987		987(39.26)

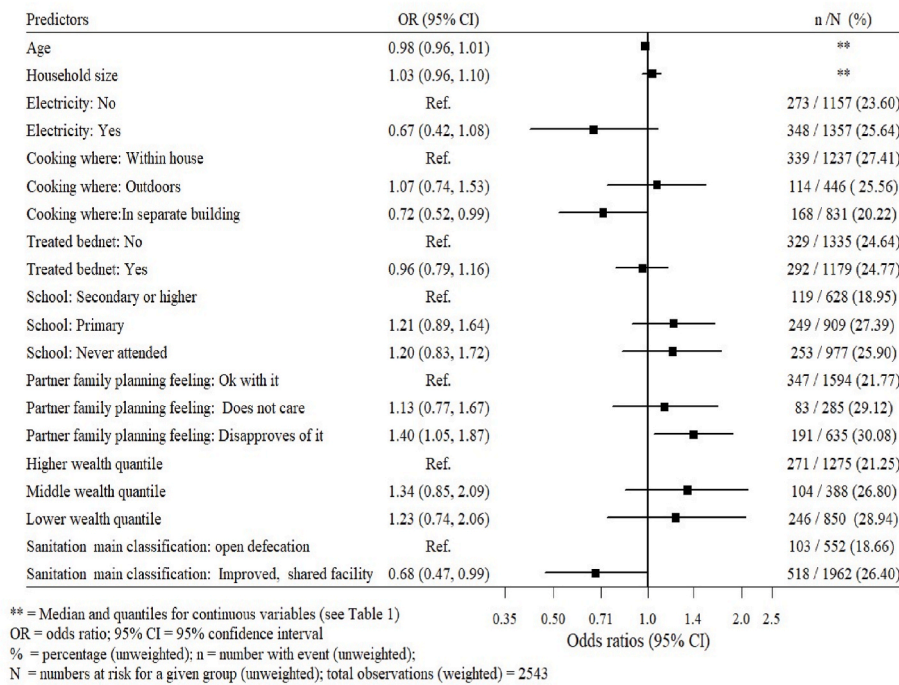
0.53; 95 % CI: 0.31, 0.92; P = 0.026) compared with cooking food within the house, as shown in Supplementary Fig. 1.

When we evaluated all diseases (see Fig. 4), we found that children of men who disapproved of family planning had 1.4 times higher odds of morbidity than those whose father approved family planning. Compared with secondary or higher education levels, primary education of the mother was associated with 32 % higher odds of morbidity (OR = 1.32). The availability of electricity was associated with 39 % lower odds of morbidity compared to those without access to electricity.

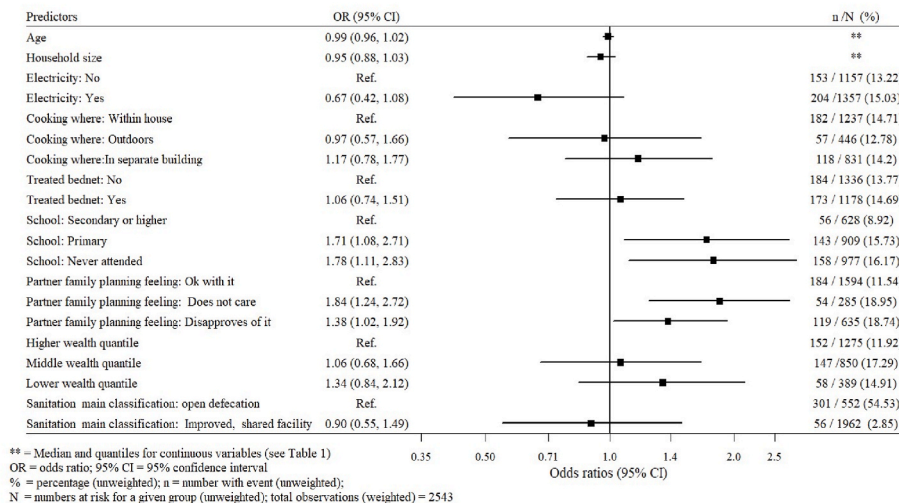
#### 4. Discussion

To our knowledge, this large, population-based study is among the first to examine the association between socioeconomic determinants and infant morbidity using the International Classification of Functioning, Disability, and Health (ICF) framework to systematically categorize disease outcomes. By leveraging a comprehensive classification approach and a large sample size, our findings highlight the significant influence of sanitation, access to electricity, cooking location, and paternal attitudes towards family planning on childhood morbidity, particularly within the cardiovascular, hematological, immunological, respiratory (b4) and digestive, metabolic, and endocrine (b5) domains. One of the key findings of our study is that children from households used open defecation as sanitation main classification had a significantly higher likelihood of developing illnesses, particularly those related to the cardiovascular, hematological, immunological, and respiratory systems (b4 domain). Infants from the open defecation sanitation main classification group were 0.68 times less likely to experience morbidity in this domain compared to those from households who use improved or shared sanitations. These findings align with those reported by [41–43], indicating that an open defecation remains a major public health concern linked to several important health outcomes, particularly in infants.

Cooking foods indoors can have significant adverse effects on infant morbidity, primarily due to the exposure to indoor air pollution. As a low income country, they used traditional cooking practices uses open



**Fig. 2. Variables associated with cardiovascular, hematological, immunological, and respiratory systems (b4) morbidity.** A forest plot reporting resulting of a multivariable weighted logistic regression. The horizontal lines show 95 % confidence intervals on a log-scale x-axis and square mark represent odds ratios (OR). A vertical line at OR = 1 denotes the null hypothesis. **Ref.** indicates the reference category. For each category, we list the OR (95 % CI), the **unweighted** number of events (n), number at risk (N), and percentage (%).

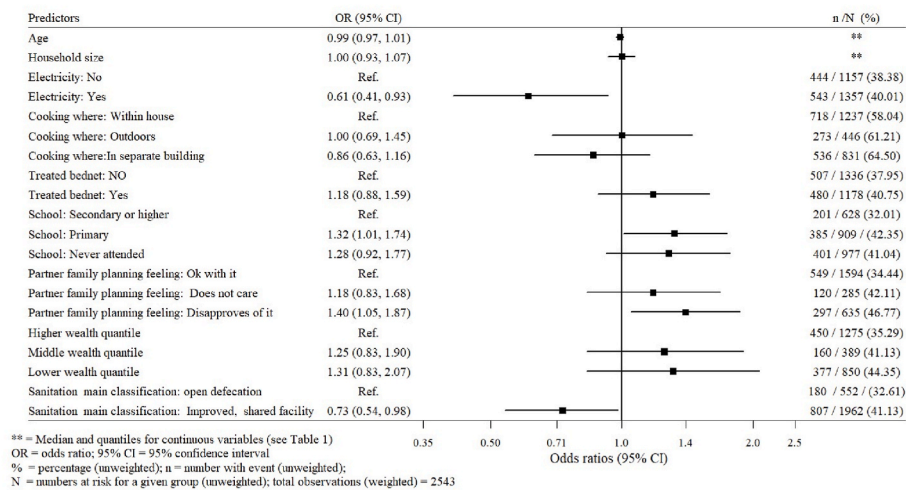


**Fig. 3. Variables associated with digestive, metabolic and endocrine systems (b5) morbidity.** A forest plot reporting resulting of a multivariable weighted logistic regression. The horizontal lines show 95 % confidence intervals on a log-scale x-axis and square mark represent odds ratios (OR). A vertical line at OR = 1 denotes the null hypothesis. **Ref.** indicates the reference category. For each category, we list the OR, 95 % CI, the **unweighted** number of events (n), number at risk (N), and percentage (%).

fires and biomass such as wood, charcoal, and animal dung. These materials release a high level of pollutants, making infants susceptible to respiratory infection. Furthermore, in rural homes, people, animals, and food areas share space, leads close contact with animal feces increases infant exposure to enteric pathogens, contributing to diarrhea and environmental enteric dysfunction. Hence, isolating food-cooking area safeguards the respiratory health of infants whose developing lungs are highly susceptible to air contaminants. Our result is in accordance with the study conducted in Bangladesh by [44], indicating that cooking in separate building improves household air quality and reduces infant morbidity through lower exposure to hazardous environmental factors.

Likewise, an important cause of infant morbidity was reported on the functions of the digestive, metabolic, and endocrine systems (b5). Women’s education level and infants health, as shown by the elevated odds ratio for those with primary education (weighted OR 1.71; 95 % CI: 1.08–2.71) and those who never attended school (weighted OR = 1.78; 95 % CI: 1.11–2.83), corroborate findings by Refs. [45,46] underscoring education as a critical determinant of the functions of the digestive, metabolic, and endocrine systems (b5).

One of the novel contributions of this study is the identification of a significant association between paternal disapproval of family planning and increased child morbidity. Partners who “disapprove” of family



**Fig. 4. Variables associated with all diseases of infant morbidity study.** A forest plot reporting resulting of a multivariable weighted logistic regression. The horizontal lines show 95 % confidence intervals on a **log-scale** x-axis and square mark represent odds ratios (OR). A vertical line at OR = 1 denotes the null hypothesis. **Ref.** indicates the reference category. For each category, we list the OR, 95 % CI, the **unweighted** number of events (*n*), number at risk (*N*), and percentage (%).

planning exhibit a significant negative influence on health outcomes (OR = 1.38; 95 % CI: 1.02–1.92). Moreover, paternal disapproval towards family planning was also associated with a higher risk of digestive, metabolic, and endocrine system illnesses. This suggests that male partners' attitudes towards reproductive health may indirectly impact child health, possibly through larger family sizes, greater financial strain, and reduced maternal well-being. Prior studies have shown that when men actively participate in reproductive health decisions, maternal and child health outcomes tend to improve. These findings underscore the need for targeted interventions that engage men in family planning discussions to improve overall family health [47].

#### 4.1. Strengths, and limitations

A major strength of this study is its large, nationally representative sample, which enhances the generalizability of our findings. Additionally, the use of the ICF disease classification framework provides a standardized approach to categorizing child morbidity, allowing for better comparison with other studies. Our analysis also adjusted for multiple socioeconomic and demographic factors, increasing the robustness of our conclusions.

However, some limitations must be considered. First, the observational nature of the design prevents us from establishing causal relationships; while we observed significant associations between socioeconomic factors and infant morbidity, we cannot determine whether these factors directly cause the observed health outcomes. Second, morbidity data were collected through maternal self-reporting, which may be subject to recall bias or underreporting, particularly for less visible or transient symptoms. Third, while we adjusted for several key confounders, there may still be unmeasured variables—such as maternal health literacy, sex of infants, healthcare accessibility, or nutritional status—that could act as confounders. Exclusion due to not consent or not info on outcome might also induce a sampling bias.

Furthermore, because exposures and outcomes were recorded concurrently, reverse causality is possible (for example, sickness might affect household income). Even after adjustments, unmeasured confounding—particularly from environmental exposures, prior morbidity, and maternal health literacy—is likely still present, potentially biasing effect estimates in either direction. Some symptoms were uncommon; small cell counts might overestimate pairwise relationships and increase uncertainty. Longitudinal designs are needed to better establish temporality, reduce confounding, and include biomedical assessments to

validate reported health conditions.

#### 4.2. Conclusions

Our findings provide important insights into the socioeconomic determinants of child morbidity and highlight the need for targeted interventions to reduce health disparities among children from lower-income households. Specifically, policies should focus on: 1) expanding access to electricity in underserved areas to achieve significant health benefits; 2) promoting clean cooking practices and alternative technologies to reduce the burden of respiratory diseases among children and 3) engaging male partners in family planning discussions to improve child health outcomes through better family resource allocation and enhanced maternal well-being. Given the significant associations observed, policymakers and public health practitioners are encouraged to prioritize integrated strategies that address both economic and behavioral determinants of child health. Future research should investigate longitudinal associations between paternal involvement in reproductive decision-making and child health outcomes, as well as evaluate the effectiveness of community-based programs aimed at improving household health literacy and living conditions.

#### Data availability statement

The results are supported by data from Performance Monitoring for Action (PMA). The PMA report contained the specific details, and the data set was obtained by submitting an online request for approval at <https://www.pmadata.org/data/available-datasets>.

#### Authors' contribution statement

EA, SF, and PR conceptualized and designed the study. MG, V, and AN contributed to data curation. EA, SF, MG, V and PR contributed to data analysis. EA, SF, and PR drafted the original version of the manuscript inputs from MG, V, and AN. All authors helped develop and revise the work and authorized its submission.

#### Ethical statement

PMA Ethiopia received ethical approval from Addis Ababa University, College of Health Sciences (AAU/CHS) (Ref: AAUMF 01–008) and the Johns Hopkins University Bloomberg School of Public Health

(JHSPH) Institutional Review Board (FWA00000287).

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Abbreviations

CI	Confidence interval
DHS	Demographic and health survey
OR	Odds ratio
ICF-CY	International Classifications of Functions Children and Youth
PMA-ET	Performance Monitoring for Action-Ethiopia
SNNP	South Nation and Nationalities People

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhip.2025.100697>.

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