

# Severe acute malnutrition and its associated factors among under-five children in two districts of Nepal

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## Research article

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# Abstract

**Background :** The main objective of this study was to identify the risk factors of severe acute malnutrition in under-five children in the two districts of Nepal.

**Methods:** Using a mid-upper arm circumference measure, nutritional status along with the associated factors underlying determinants of undernutrition of 404 children who visited the Outpatient Therapeutic Centres were assessed using a validated structured questionnaire. Multivariate logistic regression was used to determine the factors associated with severe acute malnutrition (SAM) and associated variables. **Results:** The odds of a child being in the SAM category increased significantly if the family have five or more children and if the household yearly income is below an average. The children in the Madhesi family were 3.6 times more likely to be malnourished. Toilet facility (Adjusted Odds Ratio [AOR]: 4.45; 95% Confidence Interval [CI]: 1.88-10.53) and family with no kitchen garden (AOR: 3.16; 95% CI: 1.28-7.89) were significantly associated with SAM among under five children. Children from moderate food insecure and severe food insecure households were 3.2 and 5.5 times more likely to be malnourished respectively. Compared to the mothers with no job, mother with some sort of paid job had more than six times higher odds of having severely acute malnourished children.

**Conclusions:** These findings suggest that the nutrition interventions as well as awareness on child feeding practices are crucial to improve the nutritional status of children especially among Madhesi community, poorer households and among illiterate mothers.

## Background

Children have the right to adequate nutrition and access to safe and nutritious food, and both are essential for fulfilling their right to the highest attainable standard of health [1]. Age 6–59 months is the critical period for rapid physical growth and development for children. Child may become the victim of undernutrition if the demand of nutritional requirement is not met [2]. Global statistics shows that 7.5% million under five children are wasted and 16.4 million are severely wasted [3].{UNICEF, 2015 #69} Still 3.62% (15.95 million) under five children are both stunted and wasted, while 1.87% of under-fives children globally (8.23 million) experience both stunting and overweight [4].

Acute malnutrition contributes to over one million under-five deaths per annum. One in 12 children of this age is victim of acute malnutrition. Risk of death of children having MAM or SAM compared to normal child is three times or nine times higher, respectively [5]. Survivors of acute malnutrition are at increased risk of stunting, developing diseases, disorders, poor educational performance and low productive life [6].

In Nepal, both stunting and underweight among under five-years children shows downward trend. The 2016 Nepal Demographic and Health Survey (NDHS) reported that 36% of children under the age of five are stunted, 10 percent are wasted, and 27 percent are underweight, with higher prevalence in rural areas for all three indicators [7]. Nepal National Micronutrient Status Survey 2016 showed that 11 percent of children of 6 to 59 months are wasted and 2 percent are severely wasted [8]. However, the decline in

wasting was minimal since 2001. Target 6 of Global Nutrition Target 2025 aims to reduce and maintain childhood wasting to less than 5 percent by 2025 [9]. These figure suggest poor status of acute malnutrition among children which is higher than the global target of reduction.

According to the 2016 NDHS, the prevalence of wasting in province 1 is 11.8 percent, and 14.4 percent in province 2. The prevalence of severe wasting in province 1 and province 2 are less than one percent and three percent respectively which is higher than the national estimates [7]. By eco-region, prevalence of wasting was higher among children in the Terai region (13%) than compared to the Hill and Mountain regions (9 percent each) [8]. A case control study in Bara district in 2017 reported prevalence of SAM of 4% (N = 292) [10].

Of seven provinces of Nepal, province 2 is one of the provinces with poorest health indicators [11]. Districts in this province are also prone to flooding during monsoon season. Heavy monsoon rainfall during 10–13 August 2017 triggered devastating flash flood and landslide in 32 out of 77 districts in Nepal including Bara and Jhapa districts [12]. These districts suffered from food access, emergency medical services and proper nutrition. There are limited evidences regarding severe acute malnutrition and wide range of determinants among the children in these floods affected districts. The evidences generated from this study could be used by the program and policy makers to address the undernutrition situation in the flood prone districts in Nepal.

## Methods

### Study area

This study was conducted among the children from the rural and urban municipalities of Jhapa and Bara districts. Bara districts is in Province 1 is better off than the Bara district of Province 2 in terms of its human development index [13]. Both the districts are Terai (lower land) districts of Nepal and are bordering districts of India.

### Study design and selection of participants

Institution based cross-sectional study was conducted between April to June 2018. Sample size for which was calculated using the formula,  $n = z^2 pq/e^2$  and placing the 14.4% prevalence of acute malnutrition of under-five children [5, 7]. The sample size of 197 plus an addition 10% non-response rate yielded a total sample size of 217 for each district. The final sample size after data cleaning and excluding incomplete data from the two districts was 404.

One district, each from province 1 and province 2 were randomly selected. Outpatient Therapeutic Centres (OTCs) in a district were considered as strata. Total sample size in each district was divided by the number of OTCs in both districts. From the two districts, all OTCs; 16 from Jhapa and 19 from Bara, were

selected. Mothers of under five year children attending in OTCs were selected and interviewed in consecutive sampling manner (selecting all the eligible participants in fixed duration of time). Enumerators were trained thoroughly on the study tools and for the anthropometric and mid-upper arm circumference (MUAC) measurement.

## Questionnaire

A structured questionnaire was developed based on the study objectives. Indicators related to household socio-economic characteristics, education level, toilet and handwashing practices, food diversity [14], nutritional assessment, breastfeeding status, were validated and adopted with the 2016 Nepal Demographic and Health Survey (NDHS) questionnaire [7].

## Data collection and analysis

Face to face interviews was conducted with mother of a selected child by the trained enumerators using a paper-based structured questionnaire. Questionnaires were pre-tested to ensure its validity. Legibility and completeness of data were ensured during the data collection time and any inconsistencies were addressed in the field work. Anthropometric tools; SECA digital weighing scale for weight and height board (Stadiometer) for height/length of 6 to 59 month children were used. Shakir's tape was used to measure the mid-upper arm circumference (MUAC) from the child's left arm to the nearest 0.1 cm (1 mm) margin. Child's weight was measured with no or minimum layer of dress and all the measurement was taken during daytime and data was then compared with the height for weight z-score of WHO 2006 growth standards [15]. Children with known chronic illnesses, and congenital abnormality which affects feeding pattern of the children were excluded from the study. We used multivariate logistic regression analysis to report the association between SAM with its determinants. Odds ratios (OR) and 95% confidence intervals (CI) were derived and p-value of less than 0.05 was taken as significance level. Potential independent variables such as socio-economic variables and mother's education were included in the logistics regression analysis which was based on the robust literature review. Analysis was done in the STATA software version 15 after consistency checks were undertaken [16].

## Outcome variables

SAM refers to the condition that is identified through measurement MUAC of less than 115 mm or weight for height  $< -3SD$  z-score below the median among children aged between 6 to 59 months [17]. MUAC is widely used rapid nutritional assessment measure based on the assumption that it was closely related to muscle mass to identify severe acute malnutrition in children [18]. For this study, MUAC was used to identify the SAM among children 6 to 59 months.

# Independent variables

To study the determinants of SAM, independent variables were categorized in three factors; household factors, child factors, and maternal level factors. Robust review of literature was done to regroup the potential factors that are associated to malnutrition. Household factor included place of residence of mothers, family type, family size, household income, ethnicity, availability of toilet facility at the household, possession of land size, kitchen garden, and household food insecurity. Annual income of the household was asked with the respondent to classify the economic status of the household. The categorization was based on the standard as recommended by the Nepal Rastriya Bank which is classified on the basis of yearly family income [19]. Household Food Insecurity Access Scale (HFIAS) measurement tool was used to collect the information regarding food insecurity developed by Food and Nutrition Technical Assistance Project (FANTA) [14]. Child factors comprised of gender of child, age of child, number of child at the household, birth order and birth interval of between child. Maternal level factors included mother's age, mother's education, mother's occupation, early breastfeeding practice, colostrum feeding and exclusive breastfeeding practice to the child.

## Ethical considerations and informed consent

Ethical approval was granted by the Nepal Health Research Council, Kathmandu, Nepal. Eligible women with under five year children and who were willing to participate in the study were interviewed after obtaining a written consent.

## Results

Out of 404 samples, more than half of the participants in the sample were from urban municipalities (59.16%). Slightly more than half (54.70%) of participants lived in a joint family. More than half (56.19%) of the participant had a family size of less than five members. The majority (75%) of the participants were non-Madhesi and more than one third (81.44%) of the participants have facility of toilet in their home. More than half (50.73%) of the participants possessed small piece of land (less than 0.5 hectare). More than half (57.18%) of the participants reported to have kitchen garden in their household. About one-third (64.60%) of the households were food secured while 13.61% of the households were moderately food insecure followed by severe food insecure (11.63%) and mildly food insecure (10.15%).

More than half (53.47%) of the child taken for anthropometric assessment were female. The mean age of child was 23.9 month with standard deviation of 15.5 months. More than one third (33.91%) of the children were in 12 to 23 months age group followed by 6 to 11 months (24.01%), 24 to 35 months (15.35%), 36 to 47 months (9.41%) and less than 5 months (1.49%). Almost three-fourth (74.75%) of the respondents have at least two children. Nearly half (46.53%) of the mother's had the first birth order followed by second (31.19%) and third or more (22.8%). About three fourth (74.56%) of participants had birth interval of more than 2 years.

More than half (57.92%) of the mothers were between age group of 21–29 years followed by 29.7% in age group of 30 & above years and 12.38% in age group of 15–20 years. More than one third (38.12%) of mother's education was higher level followed by illiterate (18.56%), secondary level education (16.09%), primary level education (15.84%) and able to read or write (11.39%). About three fourth (73.27%) mothers were unemployed while rest of others own their business and had paid job.

Over half (59.9%) of children were breastfeed within one hour of birth. Almost all last-born children under age of two years (86.45%) were colostrum fed and more than half (54.21%) of the children were exclusively breastfeed.

**\*\*Insert Table 1 Here\*\***

Multivariate logistic regression analysis was applied to determine the association between severe acute malnutrition and exposure variables. Family size of five or more children was significantly associated with the SAM with AOR: 3.07; 95% CI: 1.23–7.64. Likewise, socio-economic variables like yearly household income of less than an average (AOR: 3.92; 95% CI: 0.90–17.03), those belonging to Madhesi ethnic group (AOR: 3.56; 95% CI: 1.52–8.34), who had no toilet facility (AOR: 4.45; 95% CI: 1.88–10.53) and family with no kitchen garden (AOR: 3.16; 95% CI: 1.28–7.89) were statistically associated with SAM. A child from a household with moderate food insecurity and severe food insecurity was 3.16 times and 5.53 times more likely to be malnourished than compared to the food secured household. The odds of children falling in SAM category was higher among mothers having three or more children (AOR: 3.43; 95% CI: 1.46–8.08) and also among mother's whose age was in 15 to 20 years (AOR: 4.32; 95% CI: 1.00–18.84). Children 24 to 59 months age group (AOR: 0.21; 95% CI: 0.05–0.80) were significantly less likely to be affected with SAM in compare to children of less than 12 months of age.

Mother's education level also has some effect on children nutrition status. The odds of children being SAM were higher if the mothers were illiterate (AOR: 3.73; 95% CI: 1.06–13.18), and literate (AOR: 5.44; 95% CI: 1.46–20.21). The odds of children being malnourished were higher if the mother has some sort of paid job (AOR: 6.69; 95% CI: 2.281–19.62) (Table 2).

**\*\*Insert Table 2 here\*\***

**\*\*Insert Figure 1 here\*\***

Figure 1 shows the prediction of child being severe acute malnourished with child's age. With the increase in child's age, probability of child being SAM decreased significant. As the child's age increases there was a significant decrease in the probability of child having severe acute malnutrition.

## Discussion

In this study, the households with more than five children were statistically associated with severe acute malnutrition. Higher the number of children in the household, more will be the burden to household to provide optimum nutritious food to all children. Additionally, higher number of children also makes it difficult for every child to get proper care and time putting them at risk of being malnourished. This finding is coherent with a study conducted in Ethiopia [20].

Finding of this study indicated that family income and ethnicity were significantly associated SAM. Children from the below average family income were almost four times more likely to be severely malnourished. Children of low family income have limited access to nutritious food, and access to health service that makes them more likely to be malnourished. This finding is consistent with studies conducted in Bara district of Nepal and in Pakistan [10, 21]. The odds of severe acute malnutrition were higher among children of Madhesi community. A study investigated the inequality in terms of ethnicity in utilization of health services in Nepal reported higher prevalence of childhood malnutrition among Terai castes/ethnicity where primarily Madhesi ethnicity resides [11]. This may be due to the fact that Madhesi ethnicity are underprivileged group and have sociocultural practices that hinders them in health service utilization and the adoption of health practices. In our study toilet facility showed significant association with severe acute malnutrition. Similar results are reported in studies done previously [22, 23]. Toilet facility is directly linked with child's hygiene and nutrition. Hygiene and sanitation behaviours, therefore, are essential factors to improve the nutritional status among children.

Children in the food insecure households was more likely to have SAM. Several studies found the similar association between household food insecurity and malnutrition of child [24, 25]. This finding is plausible as the reduced or compromised quality of diet due lack of food or limited availability of food, could not meet the dietary requirement in terms of quantity and quality of child's diet. This pose child at a greater risk of undernutrition [26].

As indicated by our findings, child age was independently associated with SAM which is similar with finding from Nepal and India [27, 28]. As child age, the immunity of child gets stronger and have less chance of being undernourished.

In this study, the age of mother at child birth was not statistically significant in our study. Although mother's age at child birth is a strong predictor of child's nutrition status as stated in studies from Nepal, and Vietnam [10, 29]. Our study did not show statistically significant result. This could be due to the cultural practices of study area. Early marriage and pregnancy at early age are still in practice in Nepal. According to the 2016 NDHS, the median age at first birth in Nepal was 20.4, and 19.2 and 21.4 years in province 2 and Province 3 respectively [7].

Our study indicated that the odds of severe acute malnutrition were higher among children of illiterate mothers than compared to the literate mothers. This find is consistent with the studies from India, and Pakistan [21, 29]. Mother's level of education is the key factor by which mother have better understanding of child's nutrition and importance of feeding nutritious diet to the children.

Exclusive breastfeeding practice in this study was significantly associated with severe acute malnutrition. This finding was comparable with the studies from Nepal and Pakistan [10, 21, 30]. Children who were exclusive breastfed gets nutrition from mother's milk than those children who were introduced to the complementary feeding before six months. This pose a higher risk of infection to the children leading to undernutrition. However, our finding did not show statistically significant association with early initiation of breastfeeding and colostrum feeding with severe acute malnutrition. This finding is in agreement with findings from Nepal and India [10, 27, 30]. The possible explanation for this would be the exclusive breastfeeding rather than early breastfeeding could provide a protective nutrition to the children for extended period of time. Apart from the finding, some limitation of this study could not be ignored. Being a cross sectional by the nature of the study limits to capture the prevalence of acute malnutrition among children in the study area. Since the study was conducted in two districts of province 1 and province 2 in Nepal, the findings of the study cannot be generalized to the overall population of the country.

## **Conclusion/recommendation**

In conclusion, household characteristics such as ethnicity, households with five or more children, less than average household income, food insecurity, non-availability of toilet facility, family with no kitchen garden children were significantly associated with SAM. The association was remarkably higher in case of mother's age between 15–20 years, illiterate mother and mothers who had paid job and maternal parity. Children less than 24 months and exclusively breastfed children were also associated with childhood SAM. Nutrition health program should be targeted to the Madhesi communities and among illiterate women by raising awareness on childhood nutrition by promoting kitchen garden.

## **Abbreviations**

*AOR; Adjusted Odds Ratio, CI; Confidence Interval, NDHS; Nepal Demographic and Health Survey, MUAC; mid-upper arm circumference, OTC; Outpatient Therapeutic Center, MAM; Moderate Acute Malnutrition, SAM; Severe Acute Malnutrition, SD; Standard deviation, TB; Tuberculoss, WHO; World Health Organization*

## **Declarations**

## **Ethics approval and consent to participate**

Ethical approval for this study was granted by the Nepal Health Research Council. A written consent was taken with the participants before starting the interview.

## **Consent for publication**

Not applicable

# Availability of supporting data

The datasets analysed in this study are not publicly available due to ethical concerns

# Competing interests

**The author(s) declared no competing interest with regard to the research, authorship, and/or publication of this article.**

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# Authors' contributions

UG; Made a substantial contribution to the concept or design of the work; data analysis or interpretation of data, and drafted the article. BKA; critically reviewed the article and provided technical direction in the content. AKG; interpreted the analysis and reviewed the draft version. SS; critically reviewed the article. All authors approved the final version to be published.

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# Authors' information

This article is an original work and has not been submitted for publication elsewhere. All authors have read and approved the content of the submitted manuscript.

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## **Tables**

### **Table 1 General characteristics of participants**

<b>Characteristics</b>	<b>N (%)</b>
<b>Household factors</b>	
<b>Place of residence</b>	
Urban Municipality	239 (59.16)
Rural Municipality	165 (40.84)
<b>Family type</b>	
Nuclear	183 (45.30)
Joint	221 (54.70)
<b>Family size</b>	
1-5	227 (56.19)
5 or more	177 (43.81)
<b>Household income</b>	
< average (Rs 30,121)	300 (74.26)
>average	104 (25.74)
<b>Ethnicity</b>	
Madhesi	101 (25.0)
Non-madhesi	303(75.0)
<b>Toilet facility</b>	
Yes	329 (81.44)
No	75 (18.56)
<b>Land size (n=205)</b>	
Less than 0.5 ha	104 (50.73)
0.5 or more ha	101 (49.27)
<b>Kitchen garden</b>	
Yes	231 (57.18)
No	173 (42.82)
<b>Food Insecurity</b>	
Food secure	261 (64.6)
Mildly food insecure	41 (10.15)
Moderate food insecure	55 (13.61)
Severe food insecure	47 (11.63)
<b>Child factors</b>	
<b>Sex of child</b>	
Male	188 (46.53)
Female	216 (53.47)
<b>Child age</b>	
<b>Mean age</b>	23.9 (SD± 15.5)
Less than 5 months	6 (1.49)
6-11	97 (24.01)
12-23	137 (33.91)
24-35	62 (15.35)
36-47	38 (9.41)
48-59	64 (15.84)
<b>MUAC (n=398)</b>	
>115 cm (Normal)	94.22 (375)
<115 mm (SAM)	5.78 (23)

<b>Number of child (Parity)</b>	
1-2	302 (74.75)
3 or more	102 (25.25)
<b>Birth Order</b>	
1	188 (46.53)
2	126 (31.19)
3 or more	90 (22.28)
<b>Birth interval (n=228)</b>	
Less than 2 yrs	58 (25.44)
More than 2 yrs	170 (74.56)
<b>Maternal level factors</b>	
<b>Mother's age</b>	
15-20	50 (12.38)
21-29	234 (57.92)
30 and above	120 (29.7)
<b>Mother's education</b>	
Illiterate	75 (18.56)
Literate	46 (11.39)
Primary	64 (15.84)
Secondary	65 (16.09)
Higher	154 (38.12)
<b>Mother's occupation</b>	
Unemployed	296 (73.27)
Paid	27 (6.68)
Business	81 (20.05)
<b>Early initiation of breastfeeding</b>	
Delayed	162 (40.1)
Within an hour	242 (59.9)
<b>Colostrum feeding (n=251)</b>	
Yes	217 (86.45)
No	34 (13.55)
<b>Exclusive breastfeeding</b>	
Yes	219 (54.21)
Less than six months	185 (45.79)

**Table 2: Factors associated with severe acute malnutrition among children visiting Outpatient Therapeutic Centres (n=398)**

Characteristics	AOR	95% CI	P value
<b>Household factors</b>			
<b>Place of residence</b>			
Urban Municipality			
Rural Municipality	1.12	0.48-2.64	0.79
<b>Family type</b>			
Nuclear	1.14	0.76-2.65	0.76
Joint	1		
<b>Family size</b>			
1-5	1		
5 or more	3.07	1.23-7.64	0.01
<b>Household income</b>			
>average	1		
< average	3.92	0.90- 17.03	0.07
<b>Ethnicity</b>			
Non-Madhesi	1		
Madhesi	3.56	1.52 - 8.34	0.00
<b>Toilet facility</b>			
Yes (Ref)	1		
No	4.45	1.88- 10.53	0.001
<b>Land size (n=201)</b>			
less than 0.5ha (Ref)	1		
0.5 or more ha	2.11	0.61- 7.24	0.24
<b>Kitchen garden</b>			
Yes (Ref)			
No	3.16	1.28- 7.89	0.01
<b>Food Insecurity</b>			
food secure (Ref)	1		
Mildly food insecure	2.44	0.62- 9.59	0.20
Moderate food insecure	3.16	0.97- 9.83	0.06
Severe food insecure	5.53	1.86- 15.72	0.002
<b>Child factors</b>			
Male (Ref)	1		
Female	1.39	0.59-3.29	0.45
<b>Child age</b>			
Less than 12 months (Ref)	1		
12-23	1.07	0.42-2.72	0.89
24-59	0.21	0.05-0.80	0.02
<b>Number of child (Parity)</b>			
1-2 (Ref)	1		
3 or more	3.43	1.46-8.08	0.005
<b>Birth interval (n= 225)</b>			
Less than 2 yrs (Ref)			
More than 2 yrs	0.50	0.18-1.36	0.18
<b>Maternal factors</b>			
Mother's age			

15-20	4.32	1.00-18.84	0.05
21-29	2.63	0.74-9.26	0.13
30 and above (Ref)	1		
<b>Mother's education</b>			
Illiterate	3.73	1.06 -13.18	0.04
Literate	5.44	1.46-20.21	0.01
Primary	3.13	0.81- 12.05	0.10
Secondary	0.57	0.06-5.17	0.61
Higher (Ref)	1		
<b>Mother occupation</b>			
Unemployed (Ref)	1		
Paid	6.69	2.281-19.62	<0.001
Business	1.60	0.55-4.70	0.42
<b>Early initiation of breastfeeding</b>			
Delayed (Ref)	1		
Within an hour	0.86	0.37-2.00	0.72
<b>Colostrum feeding (n=245)</b>			
Yes (Ref)	1		
No	1.24	0.34-4.51	0.74
<b>Exclusive breastfeeding</b>			
Yes (Ref)	1		
No	0.19	0.43 - 0.82	0.03

Ref. = Reference Category,

AOR= Adjusted Odds Ratio,

Statistically significant at  $p < 0.05$

## Figures

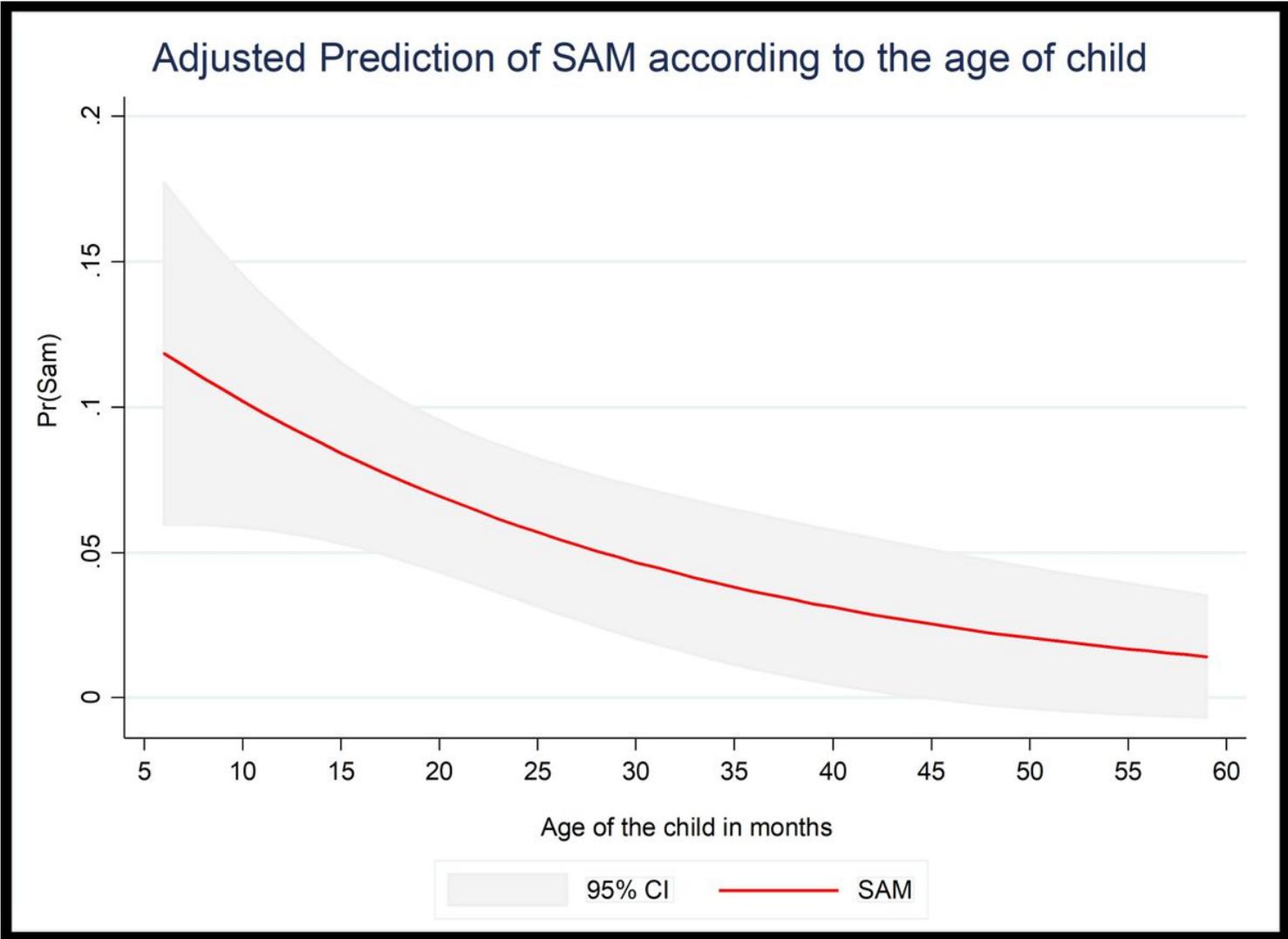


Figure 1

Adjusted prediction of SAM according to the age of child