SEEING AN UNSEEN: NUTRITIONAL STATUS AND ITS DETERMINANTS OF UNDER FIVE-YEAR-OLD CHILDREN IN KARACHI, PAKISTAN

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ABSTRACT:

Background: Optimal nutrition is an important determinant of child health, growth and development especially in the first five years of life. Under-nutrition continues to be a hidden but widespread problem for developing countries, which is now one of the main public health concerns. The main objective of the study was to determine the nutritional status and its determinants.

Methods: A cross-sectional study was conducted in May 2016 among 383 mother/child dyad in Karachi, Pakistan. Weight and height were recorded from under five-year-old children along with their mothers' weight and height. Questionnaire was administrated to mothers. Data was analyzed by using univariate, bivariate (chi-square or fisher exact test) and multivariate analysis (logistic regression).

Results: Almost 4% of children were undernourished; in which 5% were underweight; 3.5% were wasted; and 12.8% were stunted children. Children, who born with the weight of < 2500 gms, [OR 7.64 (CI .932-62.64)] were 7.6 times more likely to be underweight. Children, who had runny nose [OR3.35 (CI 1.31-8.54)] and cough [OR 3.34 (CI 1.26-8.88)] in the past 2 weeks, were 3.35 and 3.34 times more expected to be underweight. Those children, who were > 3rd born, were 4.8 times more predictable to get wasted [OR 4.82 (CI 1.12-20.74)]. Insufficient number and smaller amount of meals increased the chance of wasting to 2.85 times [OR 2.85(CI 1.93-4.20)].

Conclusion: The prevalence of undernourished children in Karachi was low. Some of maternal and child related factors such as low birth weight, history of disease, less birth interval, high birth order and low food security attributed to under nutrition.

Keywords: Nutritional status, Under-five children, Pakistan

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INTRODUCTION

Optimal nutrition and proper dietary patterns are important determinants of child health, growth and development especially in the first five years of life. According to sustainable development goal (SDG) 2, which targets to end all form of malnutrition by 2030.The term malnutrition generally refers both to under nutrition and over nutrition; but in this study I used the term under-nutrition despite of malnutrition to refer only to a deficiency of nutrition in order to avoid confusion [1]. Children become undernourished if diet doesn't provide required calories and protein for growth or development and maintenance; or the child is not able to utilize the food properly they eat due to illness [2]. Under-nutrition includes being underweight for one's age, too short for one's age (stunted), and dangerously thin (wasted) [2]. For the developing countries, now one of the main public health concerns is under-nutrition which causes the increase in a risk of mortality and morbidity. Child under nutrition is the underlying cause of 3.5 million deaths, 35% of the disease burden in children younger than 5 years, and 11% of total globe [3]. Children are the most and the worst affected vulnerable group among all because

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of the high nutritional requirement for growth and development [1]. Central South Asian countries (India, Bangladesh and Pakistan) has shockingly high prevalence of underweight – 46 % of its children, and together account for half the world's under nourished children [2]. Pakistan is in distress of high rates of child under-nutrition. Available evidence for under nutrition signifies that growth faltering in majority of such children begins at around four to six months of age; this is the time when an infant starts receiving complementary foods in addition to breast milk. The process of growth faltering is essentially a series of events throughout childhood. The child suffers from repeated illnesses, inadequate appetite, deficient food and poor standard care [4]. Pakistan shares 2% of global extreme poverty; and extreme poverty defined as the people living on less than US$ 1.25 per day. Under-nutrition continues to be a hidden but widespread problem [5].

Prevalence of under-nutrition for under-five years were reported in Pakistan's National Nutritional Survey in 2011(4); but it cannot give the clear picture for the determinants that are associated with under-nutrition at local level including Karachi, the biggest city in terms of population of Pakistan. There are very few local studies that carried out the prevalence of under nutrition in terms of three categories: stunting, wasting and underweight. Pakistan is lagging behind in the reduction of under-nutrition. Sindh (Karachi is capital of Sindh province) is less well positioned than other provinces. The study aimed to find the nutritional status of under-five children in Karachi and to assess the determinants associated with nutritional status of under-five children in Karachi, Pakistan.

METHODOLOGY

A cross-sectional study was conducted in May 2016 among 383 mother/child dyad in Karachi, Pakistan. Sample size was calculated by Taro Yamane formula [6]. Multi-stage sampling technique was used in three districts by randomly selected in the first stage. For the second stage, only one town was selected randomly from each three selected districts. Four clusters were selected from each town randomly as considering Union Council (sub-division of towns) as a cluster. For the first, second and third stage, computer generating random number sampling method was used to select districts, towns and clusters respectively. At fourth stage, 35 samples of household were collected from each of 12 clusters by random selection through spinning a pen; and the researcher followed the directions the tip of pen points. This method of selection was continued until we reached the samples of 35 in each cluster at fifth stage. All eligible children in one household were selected.

Ethical approval was sought from the Research Ethic Review Committee For Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University on 25 May 2016 (Protocol no. 056-1/J9).

Weight and height were measured for mother/child dyad by researcher. A questionnaire was administrated to mothers by interviewer.

The questionnaire had 3 sections: child related factors (age, gender, birth order, low birth weight, breast feeding, dietary diversity, history of disease, access to health service, immunization history and food security) maternal factors (BMI, education level, no. of ANC visits and birth interval) and socio-demographic factors (socio-demographic status, place of residence and employment status of head of family).

To question was opt from validated questionnaire by reviewing literature. Three experts also validated the contents of questionnaire. Mothers were also asked to give the face validity for each question.

All under-five years old of male and female child were included. Physically disable children, twins or triplets; and those mother/child dyad who were not psychologically prepared or unwilling to participate in the study were excluded from the study.

The population of this study was under-nutrition among under five-year-old children. Their parents might have had experience of pains while sharing their conditions regarding socio-economic status and employment status.

Data was entered and coded into Statistical Package for Social Science (SPSS) for analysis.

Descriptive statistics were calculated in frequency and percentages. Dependent and independent variable were categorical. The prevalence of underweight, wasted and stunted was reported as percentage and frequency. Association between dependent (underweight, wasting, stunting, normal and overweight) and independent variables (age, gender, birth order, low birth weight, breast feeding, dietary diversity, history of disease, access to health service, immunization history and food security, mothers' BMI, education level, no. of ANC

visits and birth interval, socio-demographic status, place of residence and employment status of head of family) were found by using chi square and fisher exact test where applicable, when any cell had observed cell count less than 5 to show the effect of each dependent variable on independent variable. Results were considered statistically significant at a 5% ($P < 0.05$) significance level.

In this study height and weight of children were converted into Z-score based on national center for health statistics reference population recommended by World Health Organization (WHO) [7]. Thus, the height and weight of children below -2SD were considered as undernourished children.

Binary logistic regression was used to analyze the association between each of independent and dependent variables separately. These multivariable model included those independent variables in binary logistic regression which have *p*-value <0.20. It was conducted to examine the relationship between various independent variables and the three dependent variables separately which gave us the unadjusted odds ratio and the statistical significance of the association. Finally, multivariate logistic regression analysis was conducted in one model including all the relevant independent variables together.

RESULTS

Mother, child and socio-demographic factors are displayed in Table 1. Majority of the children (32%) belonged to the age group of 12-23 months. Male children were 56.1% of the total population. The rest were female (43.9%) children and 52.2% of children were first born. Almost, 72% of population were born with normal birth weight followed by 16.2% children who born with low birth weight. Majority of the children 76.2% were exclusively breastfed during the first 6 months of life. About 46.7% of children took 4-5 food groups as per reported by 24-hour dietary recall, which is grouped as medium dietary diversity. Only 31.1% and 22.2% children had high and low dietary diversity respectively. Not getting an appointment was main reason (18.5%) by the mothers for not getting a care for their child. Only twenty-two vaccination cards were available. 14 of those children were identified as fully immunized with valid doses, which had reached the minimum age for vaccine and were administrated. 8 children (36 %) were not fully vaccinated according to their age. Mothers' BMI revealed that 64.8% of were normal; 21.7% of them were overweight; and majority 90.3% of mothers had an above primary (> 5 grade) education. About 82% of the mothers reported that they had made more than 4 visits for antenatal care during pregnancy. 17% said that they visited for 1-3 times; and only 1% didn't pay a visit for a single time. About 52.2% children were first born; and 33.68 had > 24 months' birth interval and 14.1% had < 24-month birth interval compared to their elder sibling.

International wealth index was categorized as below and above average. For each possession of household item, 1 score was given and for every high, medium and low quality of floor material, toilet material and water sources. 3, 2 and 1 scores were given respectively. Total score becomes 20; and below and above average were taken as per Pakistan's international wealth index which in 52.9 [8]. Almost, 94% of the household were above Pakistan's' international wealth index average; and 76.5% of household were in the highest quintile.

Table 1 Frequency and percentage distribution of dependent variables (n = 383)

Independent variables	Frequency	%	Percentage
Town			
Orangi Town	135	35.2	72.1
Liaquatabad Town	141	36.8	36.8
Saddar Town	107	27.9	100.0
Age (months)			
0-11	54	14.1	14.1
12-23	126	32.9	47.0
24-35	88	23.0	70.0
36-47	79	20.6	90.6
48-59	36	9.4	100.0
Sex			
Male	215	56.1	56.1
Female	168	43.9	100.0

Table 1 Frequency and percentage distribution of dependent variables (n = 383) (cont.)

Independent variables		Frequency	%	Percentage
Birth order				
1st		200	52.2	52.2
2nd		110	28.7	80.9
3rd or more		73	19.06	100.0
Low birth weight (gms)				
< 2500		62	16.2	16.2
2500-4000		275	71.8	88.0
> 4000		46	12.0	100.0
Breastfeeding				
Yes		292	76.2	76.2
No		91	23.8	100.0
Dietary diversity				
Low (≤3 food groups)		85	22.2	22.2
Med (4-5 food groups)		179	46.7	68.9
High (≥6 food groups)		119	31.1	100.0
History of disease				
Acute	Diarrhea			
	Yes	61	15.9	15.9
	No	322	84.1	100.0
	Fever			
	Yes	94	24.5	24.5
	No	289	75.5	100.0
	Runny nose			
	Yes	86	22.5	22.5
	No	297	77.5	100.0
	Cough			
	Yes	61	15.9	15.9
	No	322	84.1	100.0
Reasons for not getting health care				
Couldn't afford care		31	8.1	8.1
Didn't know where to find care		23	6.0	14.1
Couldn't get appointment anywhere		71	18.5	32.6
None available		1	.3	32.9
Other (never happened)		131	34.2	67.1
No reason		126	32.9	100.0
Availability of vaccination card				
Yes		22	5.74	5.74
No		361	94.25	100.0
Validity of doses (n=22)				
Valid doses		14	63.63	63.63
Invalid doses		8	36.36	100.0
Food security				
Availability	Variety of food available			
	Yes	369	96.3	96.3
	No	14	3.7	100.0
	Affordability to household			
	Yes	275	71.8	71.8
	No	94	24.5	96.3
	Question N/A	14	3.7	100.0
Access	Child ate limited variety of food			
	Yes	20	5.2	5.2
	No	363	94.8	100.0

Table 1 Frequency and percentage distribution of dependent variables (n = 383) (cont.)

Independent variables		Frequency	%	Percentage
Food security				
Utilization	Insufficient no. of meals per day (< 3)			
	Yes	20	5.2	5.2
	No	5	1.3	6.5
	Question N/A	358	93.5	100.0
	Ate smaller amount of food when meals are insufficient			
	Yes	20	5.2	5.2
	No	5	1.3	6.5
	Question N/A	358	93.5	100.0
BMI				
Underweight		13	3.4	3.4
Normal		248	64.8	68.1
Overweight		83	21.7	89.8
Obese		39	10.2	100.0
Educational level				
Illiterate		12	3.1	3.1
Primary		25	6.5	9.7
Above primary		346	90.3	100.0
Number of ANC visits				
None		4	1.0	1.0
1-3		65	17.0	18.0
≥4		314	82.0	100.0
Birth interval				
≤24 months		54	14.1	14.1
>24 months		129	33.68	47.7
1st born		200	52.2	100.0
Place of residence				
Urban (non-slum)		313	81.7	81.7
Urban (slum)		70	18.3	100.0
Employment status of head of family				
Unemployed		15	3.9	3.9
Domestic worker		15	3.9	7.8
Labor		29	7.6	15.4
Salesman		82	21.4	36.8
Clerk		26	6.8	43.6
Professional		216	56.4	100.0
IWI (International Wealth Index)				
Below average		26	6.8	6.8
Above average		357	93.2	100.0
IWI quintiles(n=383)				
≤ 20.0 (Lowest)		0	0.0	0.0
20.1 - 40.0 (Second)		16	4.2	4.2
40.1 - 60.0 (Middle)		33	8.6	12.8
60.1 - 80.0 (Fourth)		41	10.7	23.5
≥ 80.1 (Highest)		293	76.5	100.0

Table 2 Nutritional status of under-five children in Karachi (n = 383)

Dependent variables	Frequency	%
Undernourished	14	3.7
Normal	350	91.4
Overweight	19	5.0

Table 3 Prevalence of underweight, wasting and stunting among under-five children in Karachi

Dependent variables		Frequency	%
Weight for age	Overweight (>+2SD)	1	.3
	Normal (±2SD)	363	94.8
	Underweight (<-2SD)	15	3.9
	Severely underweight (<-3SD)	4	1.0
Weight for height	Overweight (>+2SD)	18	4.7
	Normal (± 2SD)	351	91.6
	Wasted (<-2SD)	7	1.8
	Severely wasted (<-3SD)	7	1.8
Height for age	Normal (±2SD)	334	87.2
	Stunted (<-2SD)	43	11.2
	Severely stunted (<-3SD)	6	1.6

Table 4 Multivariate analysis for underweight, wasting and stunting (n = 383)

Independent variables	Dependent variables		
	Underweight O.R (95% CI)	Wasted O.R (95% CI)	Stunted O.R (95% CI)
Age (months)			
0-11	.29(.01-6.09)	-	-
12-23	.15(.01-2.33)	-	-
24-35	.13(.00-2.30)	-	-
36-47	1.57(.23-10.46)	-	-
48-59	1	-	-
Sex			
Male	-	1.03(0.24-4.33)	4.89(2.19-10.91)
Female	-	1	1
Birth order			
1st	-	1	-
2nd	-	1.73(0.27-10.95)	-
3rd or more	-	4.37(0.69-27.41)	-
Low birth weight (gms)			
< 2500	23.60(1.24-47.16)	5.95(0.42-84.28)	3.91(1.07-14.28)
2500-4000	3.00(0.21-41.56)	1.17(0.80-15.94)	1.25(0.39-3.99)
> 4000	1	1	1
Breastfeeding			
Yes	-	1	1
No	-	1.46(0.28-7.58)	1.07(0.49-2.34)
Diarrhea			
No	-	-	1
Yes	-	-	1.71(0.78-3.73)
Fever			
No	-	1	-
Yes	-	0.80(0.19-3.30)	-
Runny nose			
No	1	1	-
Yes	1.68(0.39-7.24)	2.32(0.51-10.44)	-
Cough			
No	1	-	-
Yes	4.71(0.90-24.51)	-	-
Birth interval (n=183)			
≤24 months	4.39(0.61-31.51)	-	-
>24 months	1	-	-

Table 2 and 3 describes the nutritional status of under-five children and the prevalence of underweight, easting and stunting.

Table 4, binary logistic regression was used to analyze the association between each of independent and dependent variable separately. These multivariable model includes those independent variables in binary logistic regression, which have *p*-value <0.20. Birth weight >4000 gms, was set as a reference category. Normal birth weight 2500-4000 gms [OR 3.00(CI 0.21-41.56)] had 3 times more chance to get low weight for age; however, children who born with the weight of less than 2500 gms [OR 23.60 (CI 1.24-47.16)] were 23 times more likely to be underweight. Children who had runny nose [OR1.68 (CI 0.39-7.24)] and cough [OR 4.71(CI 0.90-24.51)] in the past 2 weeks were 1.6 and 4.7 times more expected to have a low weight according to their age.

Those children, who were 3rd, 4th or 5th born, were almost 4.4 times more predictable to get wasted [OR 4.37(CI 0.69-27.41). Runny nose contributed [OR 2.32(CI 0.51-10.44)] 2.32 times more to wasting of children.

Males [OR 0.24 (CI 0.11-0.52)] were less likely to be stunted than female. Whereas, when it adjusted in final model; it showed that males [OR 4.89 (CI 2.19-10.91)] were 4.89 times more susceptible to be stunted. Children with birth weight <2500 gms were 3.91 times more prone to get low height for age [OR 3.91(CI 1.07-14.28)].

DISCUSSION

Nutritional status was measured as normal, undernourished and overweight. The undernourished status was calculated by z-score of BMI for age [9]; and it's not the sum of three indices; underweight, wasting and stunting z-score. According to our cross sectional survey, the prevalence of undernourished children in Karachi was 3.7% [10]. In contrast, results from the Sindh provincial department of health (of which Karachi is capital) indicated 6.1% of under-five were undernourished [4]. Perhaps the striking difference between 3.7% and 6.1% prevalence in Karachi, provincial capital and the province as a whole could be the reason that this study has been conducted only in one city, which is the biggest city of Pakistan in terms of population. Therefore, it doesn't give the clear picture of whole province because even though there were a lot of undernourished children; but as being a resident of a big city may provide a lot of factors which alter their health.

In our survey, 5% of children were found to be overweight. Similar to the study conducted in Karachi, it indicated 4.4% of overweight children between the ages of 5-6 years [9]. Whereas, study in Lahore which is the second biggest and capital of Punjab province, found 11.5% overweight children of 5-6 years of age group [11]. Punjab province has better under nutritional indices across Pakistan; so this might be the reason for higher prevalence of overweight [11].

In the study almost 4% of children were underweight; and 1 % of children were severely underweight. It was contrast to national nutritional survey in that the prevalence of underweight is very high in Pakistan; 26% of children were reported underweight [4]. The two prevalence of the study and national are not completely comparable because national study didn't split the underweight and severe underweight in two different measurements. If we sum up percentage of underweight and severely underweight, it becomes 5% against 26%, which is 5 times lower prevalence in this study.

Moreover, in this study, not a single household were included from rural area whereas. Pakistan is low middle income country; approximately 64% of its population [12] lives in the rural areas. Although the study is conducted in an urban area whose low income households are better than the rural areas. Low income households have much more chance for getting undernourished as compare to urban areas. That's why health and nutrition surveys, which were conducted previously, had more proportion of undernourished children. Roughly 25% of the rural children population have more health problems than the urban children [13].

The proportion of underweight children was highest 2% in the age group of 36-47 months. This study is similar to the results of a study in Nepal which 36-47 months old children had the highest prevalence of underweight (8%). In the Nepalese study, the prevalence of underweight in this age group was 4 times higher than our study [14]. On the contrary, the Pakistani national prevalence of underweight was highest, 34%among the age group of 9-11 months and 12-17 months [12]. In Pakistan's national nutritional survey of 2011 indicated that most of the children with mild, moderate and severe underweight belonged to 24-35 months age group; whereas 36-47 months children were second most likely to be underweight [15].

In this study, analysis by age groups showed

that stunting was at 12-23 months with 14 %; and severe stunting was also highest (3%). However, demographic health survey of Pakistan stated the highest rate (52%) of stunting and severe stunting (31%) at 24-35 months. Trend of increment percentage with can be observed in PDHS; and it was also indicated as the most prevalent indices of under nutrition at national, urban and rural level [15].

A notable difference in the prevalence of nutritional indices in our study and demographic health survey and national nutritional survey, probably be due to the different sampling technique. Simple random sampling was done for national survey; and every child got the equal chance to be selected. Whereas this study was multistage convenience, purposive and random sampling. Only one high, middle and low income town for each was selected by random selection. So, every child in the city doesn't get the chance to be selected.

It is a well-known fact that child malnutrition is the outcome of multiple factors. Male children appeared to be more exposed to stunt than female children. Male children were found to be 1.7 times more undernourished [OR1.78 (CI 1.52-2.09)] [16]. There is no obvious explanation for this gender differences. Gender difference could be attributed to boys' preference over girls in South Asia. Contrary to a previous study conducted in Tanzania, [17] among children under four years of age which concluded that males (20 %) had better nutritional status than females (28 %). In our study, 14.5%, 9.6% and 22.5% children, who were born with <2500 gm, were found underweight, wasted and stunted respectively. Being born with the low birth weight appears to carry a higher risk of being undernourished in the first five years of life. Some studies found that children with low birth weight were 2.3 times more vulnerable [OR2.32 (CI 1.61-3.33)]; and 1.04 times more with higher birth order [OR1.04 (CI 1.01-1.08)] were predictor of under nutrition [18].

Study in urban slum of Ludhiana also reports a same pattern that 50 %, 50% and 81% were underweight, wasted and stunted respectively [18]. The mothers who had no antenatal visits were 1.31 times more likely [OR1.31 (CI 1.04-1.66)] to have small size infants than those who had attended four or more antenatal visits [19].

One of the studies indicated that children from lower socioeconomic status was 4.4 times more likely to be wasted as compared to high socioeconomic status family [OR 4.41 (CI: 2.94-8.45)]. Children belonging to the low-income group were at a higher risk of being wasted than children of better income families [20]. In underprivileged socio-economic conditions usually have low birth weight infants which may be stated by the fact that the child's low birth weight could be the reason of mother's poor nutrition and health over a long period of time, including during pregnancy or from pregnancy complications shared by poverty. Smaller the child, it's more important to monitor his/her growth after birth.

Breast milk is a natural resource that has a major impact on child's health, growth and development. It is recommended for at least the first two years of a child's life. It has a lots of protective effects children's nutritional status; and it is found to be an important part because it may reduce the occurrence of under nutrition among children. Deprivation of breastfeeding in first 6 months of birth is significant risk factor for under nutrition in children.

History of acute disease may modify the health status. Children are the most vulnerable and most affected group because of the high requirement for growth and development. Sometimes, acute diseases may alter the weight for height status for temporary period and becomes well-nourished after getting back to normal health status.

International wealth index was used to determine the household socio economic status. Only 7.69 % of the children were wasted; and they belonged to those household below Pakistan's International Wealth Index average and second quintile which was the lowest quintile in this study showed that 14.28 % of those households' children were wasted and severely wasted. Similarly, study in Bangladesh indicated that children of second quintile households have 2.35 more chance to be stunted [21].

CONCLUSION

Under nutrition among under-five Pakistani children is one of the serious public health issues as well as the most prevalent cause of morbidity and mortality among young children in Pakistan. The factors of under nutrition are multiple; and the prevalence is at the individual, community, and nation level.

In conclusion to our study, prevalence of all three indices of under nutrition; underweight, wasting and stunting were found to be much better than provincial and national level because of the

urban and the largest city of Pakistan. Males were found to be more stunted than females. Higher birth order and low weight at birth were also significant. Children with exclusive breastfeeding until 6 months of age were comparatively well-nourished than those who didn't breastfed exclusively. Fever, cough and runny nose in the past two weeks were found to be associated. Mother's low BMI and birth interval less than 24 months also plays a role in poor growth and development of children. Poor or financially weak households were more prone to have undernourished children. It is vital to take an account each of these factors in order to reduce under nutrition in Pakistan.

In conducting research with cluster sampling, cluster design effect for calculating sample size should never be overlooked or ignored. Only one or youngest child should be selected from each household to avoid in recording similar socio-demographic and parental characteristics for every eligible children. In case of the unavailability of vaccination cards, efforts should be made to get access to vaccination cards from Expanded Program on Immunization Centers and to obtain information by caretaker's memory recall and Bacillus Calmette-Guerin (BCG) scar on child's arm. The results can be a baseline for other nutritional researches to follow up changes over three or five years and to gain more informative situation analysis for program decision making. Educational programs should be planned in Expanded Program on Immunization (EPI) centers or health care facilities to educate mothers about the importance of breastfeeding, proper weaning practices and dietary diversity and knowledge to combat with under nutrition.

LIMITATIONS

Due to the large sample size researcher didn't use the formula which can calculate the cluster effect; therefore, with less desirable, researchers used Taro Yamane Formula for sample size estimation. Due to time constraints, researcher chose every under-five child in a household rather than choosing only the youngest one. Since there were large numbers of unavailability of vaccination cards, we didn't have a valid method for assessing vaccination status; and the analysis of 22 children with vaccination card had a very less power to detect association. Even though the recall vaccination method suggested by Expanded Program on Immunization assessment was not successful with mothers, they couldn't recall vaccination status except for Polio. Bacillus Calmette-Guerin (BCG) is the only vaccine which can be verified by its scar without vaccination card; but we didn't verify it because we overlooked it in the preparation of our research methodology. Since researcher studied only one city, therefore the data cannot be generalized for the whole country.

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