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The Effect of Socio-Economic Factors on the Health Indicators in Yemen

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Abstract:

The aim of this study is to determine the effect of socio-economic factors on health indicators of children living in rural areas, poor families and households with no flush toilets. A sample of Yemeni children was determined by size 12542 children aged under 5 years that was taken from the raw data of Household Budget Survey (HBS) 2005/2006 in Yemen. Height-for-age z score (HAZ), Weight-for-height z score (WHZ), and Weight-for-age z score (WAZ) indicators were used to determine the health of children, by applying logistic multiple regression and chi square regression. The study revealed that stunting (HAZ) was found in 31.5% of the children while 11.6% were underweight (WAZ), and 4.9% were wasted (WHZ). In addition, risk of stunting, wasting, and underweighting were significantly at higher risk among males. Also, children at the highest wealth index or middle had a lower risk of stunting or wasting and underweighting, respectively. Children who belong to households with no water systems and to households with no flush toilet at higher risk from stunting and underweighting, respectively.

Key words: HAZ, WHZ, WAZ, Chi square, Logistic regression analysis

Introduction:

The health status of child is always affected by many factors. Examples on these factors are; living and housing conditions, dietary practices and demographic conditions. Also, vaccination is considered as one of the most important factors. Other factors include the family's socio-economic status, post-natal care, number of the family members, and fertility rate.

Recently, researchers have started to study other factors that affect the health of children such as parental care and education of parents. Some of these studies have reported a statistically significant relationship between the health of children and the parents' education and socio-economic factors, while other studies revealed no such relationship. The higher the level of socio-economic factors, the better the health of children. A positive relationship between environmental conditions; including housing with piped water and flush toilet connected to sanitary, and the health of children was apparent (Abdalla, 2003; Mustafa, 1995; Ibrahim, 1995). However, there is a negative association between the source of drinking water or toilet facility and the health of children (Amucu, 1993).

YDMCHS (Yemeni Demographic and Maternal and Child Malnutrition Survey) 1997 showed that about 63% of population are still drinking from primary sources, i.e., spring, rains, streams, uncovered and covered pools, wells with or without pumps. These sources of drinking water are exposed to pollution and random use. Also, YDMCHS 1997 showed that about 24.5% of children were still suffering from severe stunting, 2.6% of children suffered from severe wasting, and 14.5%of children suffered from severe underweighting (Ministry of Planning and development and Central of Statistical Organization, 1998), whereas YHFS (Yemeni Health Family Survey) 2003 revealed that 30.9% of children suffered from severe stunting, 3.0% of children suffered from severe wasting, and 15.2% of children suffered from severe underweighting (Ministry of Public Health and Population and Central of Statistical Organization, 2004).

The last report on Poverty Assessment in Yemen has stated that the poverty rate declined from 41.8% in 1998 to 35% in 2005/2006. It has also stated that about one-third of children from poor families between two and five years old are severely stunted (World Bank and UNDP, 2007). Also, it has been found that the more a child suffers from poverty, the more susceptible the child to illness, disease and malnutrition (Mcleod and Shahnahan, 1993; Samaan, 2002; Wood, 2003; Ahmad, 2007).

Study importance:

It is known that the first five years of life are considered the most important stage of health and growth of a child. So, the present study focuses on children under five years of age because this group is the most vulnerable to adverse health risks within the immediate family and community environment. Therefore, in this study, it is very important to focus on the children who are less than five years old.

Study objectives :

The main objectives of the present research are:

- to determine the health indicators of children.
- to study and analyze the relationship between the following socio-economic factors : parents education, child sex, place of residence, household wealth index, poverty status, flush toilet, drinking water and the health indicators for some Yemeni children,
- to study the effect of socio-economic factors on the health indicators of children,
- using the findings of this study as indicators for policy recommendations for nutrition interventions.

Health Indicators of children:

The malnutrition status of children is usually determined by three indicators which are called the health indicators. These are:

Height-for-Age Z score (HAZ), Weight-for-Height Z score (WHZ) and Weight-for-Age Z score (WAZ) (Waterloo at el, 1977; United Nations, 1990; Abdel-Azeem at el, 1993; Bhargava, 1994).

As recommended by the WMO (World Malnutrition Organization), the evaluation of the children malnutrition status is based on comparison of the population of children in the survey with a reference to population of well-nourished children. Using the standard UN (United Nations) reference population is based on the finding that well-nourished children in all populations follow similar growth patterns and, thus, exhibit similar distributions with respect to height and weight of a given age (Ministry of Planning and development and Central of Statistical Organization, 1998). HAZ and WHZ are the most recommended malnutrition indicators especially for the children under five years old (Waterloo at el, 1977; Abdel-Azeem at el, 1993; Bhargava, 1994).

WHZ indicator is an indicator of thinness/fatness and low score is evidence of acute malnutrition. WHZ is a measure of body mass in relation to body length or height. It is recommended that it is the main indicator of malnutrition by most manuals and guidelines issued by UN agencies, governments, and nongovernmental organizations (Mustafa at el, 2004). WHZ is the most suitable indicator for current and acute malnutrition. Children who are below 2SD from the reference median of WHZ, may be considered as wasted or underfed. However, high WHZ values indicate obesity in children (United Nations, 1990).

HAZ is an indicator of chronic malnutrition or stunting based on the principle that a child has an expected height for his age. It is an indicator of shortness/tallness and low score in this indicator can be considered as an evidence on chronic malnutrition (Sommerfelt, 1991; WHO, 1995). Also, it is a measure of past nutritional status. A child who is less than 2SD below the reference median of HAZ, is classified as chronically malnourished or stunted (United Nations, 1990).

WAZ is a nutritional indicator of malnutrition (either acute or chronic malnutrition) based on the principle that a child has an expected weight for his age (United Nations, 1990). It is a composite of both WHZ and HAZ which reflects long-term chronic undernutrition (stunting or short) and recent acute undernutrition (wasting or thin). It is a primary indicator of nutritional status, commonly used in child malnutrition clinics to monitor the growth of children (Abdel-Azeem, 1993). WAZ score of < -2SD is used for classifying a child as underweight (United Nations, 1990).

WHO and CDC (Center for Disease Control) recommended that the cut-off point of Z-score is 2SD (2 standard deviations) units below the reference median of WHZ, HAZ, or WAZ indicators. So, we will classify the malnutrition status of children into two categories:

Category 1: affected Children, (i.e., their scores are either less than -2SD or greater than 2SD).

Category 2: not affected Children, (i.e., their scores lie between -2SD and 2SD).

In general, by using the Nutrition Procedure of Epi Info Computing Package Version 6.02 (Dean at el, 1994), the anthropometric measures convert information for children with height, weight and age into Z-scores based on the NCHS (National Center for Malnutrition Statistics) recommended reference population.

The aim is to study in details the influence of socio-economic factors on the prevalence of malnutrition

in some Yemeni children.

Data Source:

Several surveys have been conducted in Yemen to reveal the malnutrition of the children. These were Yemen Demographic Maternal and Children Health Survey 1991/1992 (YDMCHS), YDMCHS 1997, YHFS 2003, and Household Budget Survey (HBS) 2005/2006. The final survey was Yemen National Health and Demographic Survey 2013 (YNHDS),unfortunately its data is not available. So, the raw data of Household Budget Survey (HBS) 2005/2006 in Yemen was used for the purpose of this study (Household Budget Survey 2005-2006). SPSS 21 statistical package was used for analysis. The sample data of study was 12542 Yemeni children aged under five years.

Methods:

It should be noted all the variables of the study are categorical. Therefore, chi square test used to study the relationships between the health indicators (HAZ, WHZ, WAZ) and the parents education, child sex, place of residence, household wealth index, poverty status, flush toilet, drinking water. In addition, the health indicators were considered as dependent variables and a binary variables, logistic regression analysis is a suitable model to study the effect of the independent variables (parents education, child sex, place of residence, household wealth index, poverty status, flush toilet, drinking water) on the health indicators (HAZ, WHZ, WAZ).

Research Results:

The children's malnutrition has been classified as affected or not affected. A total of 12542 children (males and females) subjected to this study, were distributed approximately equally.

Table 1 shows that the stunting was found in 31.5% of the children while 11.6% were underweight, and 4.9% were wasted. Children living in poor households were about 22.9% of the total sample. About 53.7% of mothers and 32.3% of fathers of the sample were illiterate. There were about 34% of households living in rural areas, and about 19% of households' wealth index was below middle category.

It should be observed that about 41.1% of households are still drinking water from unhealthy sources (not public network), while 68.9% of households do not have flush toilets connected to public network.

Table 1. Characteristics of the Factors of the study

Factors	Categories	Code	Frequency	Percent
HAZ	not affected	0	8596	68.5
	Affected	1	3946	31.5
WHZ	not affected	0	11931	95.1
	Affected	1	611	4.9
WAZ	not affected	0	11085	88.4
	Affected	1	1457	11.6
Mother Education	None	0	6732	53.7
	Basic	1	3354	26.7
	secondary+	2	2456	19.6
Father Education	none	0	4054	32.3
	basic	1	4648	37.1
	secondary+	2	3840	30.6
Area	Rural	0	4235	33.8
	Urban	1	8307	66.2
Sex of Children	Female	0	6188	49.3
	Male	1	6354	50.7
Wealth Index	Lowest	0	2317	18.5
	Middle	1	2499	19.9
	Highest	2	7726	61.6
Poverty Status	non poor	0	9665	77.1
	Poor	1	2877	22.9
Water Source	not public	0	5153	41.1
	Public network	1	7389	58.9
Toilet Flush	not flush toilet connected	0	8638	68.9
	flush toilet connected	1	3904	31.1

The chi-square test was used for assessing the significance of health indicators (HAZ, WHZ, WAZ) and various independent variables of interest (parents education, child sex, place of residence, household wealth index, poverty status, flush toilet, drinking water). Results are presented in Table 2. The prevalence of stunting among males was 33.1% compared with 29.8% of females. The stunting was significantly ($p<0.01$) more likely in males as compared with females. Similarly, the prevalence of wasting or underweight among males was significant (5.6% males versus 4.1% females, 12.3% males versus 10.9 females%), and was more likely in males than females.

The prevalence of stunting among rural children was 37.1% compared with 26.8% of urban children,

the differences were statistically significant among rural children, and the prevalence of underweight of rural children was also significant, the differences were more significant among rural than they were among urban children (5.3% rural versus 4.7% urban). However, the differences of wasting between rural and urban children were not significant.

The prevalence of stunting and underweight among poor children was significantly ($p < 0.01$) higher when compared to non poor children. The prevalence of stunting and underweight were significantly ($p<0.01$) higher among children who drank from other than network sources as compared to those who drank from network sources. Wasting was only observed to be significantly associated with the literacy status of mothers, the prevalence of wasting was significant ($p<0.05$) among children whose mothers were uneducated, as compared with children whose mothers were educated.

The prevalence of stunting and underweight were significantly ($p<0.01$) higher among children who were classified with lowest wealth index, as compared to middle and high levels of wealth index.

However, the prevalence of stunting, wasting, and underweight were not statistically significance with the literacy status of father or type of flush toilet connected.

Table 2. Distribution of Health Indicators of children by Factors of the Study

Factors	N	Stunting		Wasting		Underweight	
Mother Education		affect (%)	P-value	affect (%)	P-value	affect (%)	P-value
Illiterate	6732	2123 (31.5)	0.936	330 (4.9)	0.694	827 (12.3)	0.042
Primary	3354	1047 (31.2)		169 (5.0)		361 (10.8)	
Secondary+	2456	776 (31.6)		112 (4.6)		269 (11.0)	
Father Education							
Illiterate	4054	1282 (31.6)	0.827	222 (5.5)	0.062	492 (12.1)	0.100
Primary	4648	1447 (31.1)		222 (4.8)		554 (11.9)	
Secondary+	3840	1217 (31.7)		167 (4.3)		411 (10.7)	
Area							
Rural	4235	1572 (37.1)	0.0+00	224 (5.3)	0.121	593 (14.0)	0.000
Urban	8307	2374 (28.6)		387 (4.7)		864 (10.4)	
Sex of Children							
Female	6188	1845 (29.8)	0.000	253 (4.1)	0.000	675 (10.9)	0.015
Male	6354	2101 (33.1)		358 (5.6)		782 (12.3)	
Wealth Index							
Lowest	2317	966 (41.7)	0.000	135 (5.8)	0.052	398 (17.2)	0.000
Middle	2499	962 (38.5)		111 (4.4)		339 (13.6)	
Highest	7726	2018 (26.1)		365 (4.7)		720 (9.3)	
Poverty Status							
Non poor	9665	2926 (30.3)	0.000	482 (5.0)	0.271	1060 (11)	0.000
Poor	2877	1020 (35.5)		129 (4.5)		397 (13.8)	
Water sources							
Public network	7389	2047 (27.7)	0.000	358 (4.8)	0.868	739 (10)	0.000
not Public network	5153	1899 (36.9)		253 (4.9)		718 (13.9)	
Flush toilet connected							
flush toilet connected	3904	1259 (32.2)	0.202	202 (5.2)	0.29	462 (11.8)	0.61
not flush toilet	8638	2687 (31.1)		409 (4.7)		995 (11.5)	

When the health indicators (HAZ, WHZ, WAZ) are binary variables (affect=1, not affect=0), so logistic regression analysis was used to identify various socio-economic factors associated, in separate, with health indicators of children (Table 3).

Table 3. Results of Logistic Regression for Health Indicators of children according to socio-economic factors

Factors	Stunting		Wasting		Underweight	
	OR	C.I.95%	OR	C.I.95%	OR	C.I.95%
Mother Education						
Illiterate=0						
Primary	.993	0.91 - 1.09	1.100	0.90-1.34	.879	0.77-1.01
Secondary+	1.013	0.91-1.13	1.038	0.82-1.32	.938	0.79-1.10
Father Education						
Illiterate=0						
Primary	1.003	0.91-1.10	.852	0.70-1.04	1.030	0.90-1.18
Secondary+	1.036	0.93-1.15	0.778**	0.62-0.97	.928	080-1.08
Area						
Rural=0						
Urban=1	0.971	0.88-1.07	.917	0.74-1.13	1.045	0.91-1.20
Sex of Children						
Female=0						
Male	1.170*	1.08-1.26	1.401*	1.18-1.65	1.143**	1.02-1.28
Wealth Index						
Lowest=0						
Middle	.911	0.80-1.04	0.748**	0.56-.99	0.754*	0.63-.90
Highest	0.547*	.48-.63	.781	0.59-1.04	0.509*	0.42-0.61
Poverty Status						
Non poor=0						
Poor	1.064	0.97-1.17	.839	0.68-1.03	1.096	0.96-1.25
Water Sources						
Public=0						
not Public	1.16*	1.06-1.27	.907	0.74-1.11	1.112	0.97-1.23
Flush Toilet connected						
flush toilet=0						
not flush	1.075	0.99-1.17	.972	0.81-1.17	1.137**	1.01-1.29

* ($p< 0.01$), **($p<0.05$), (category reference=0), OR=Odds Ratio

Risk of wasting was 0.778 (CI=0.62-0.97) times lower among children of father with secondary education and above as compared to children whose fathers were illiterate ($p<0.05$). Risk of prevalence of stunting and wasting were 1.17 and 1.40 times higher among male children as compared to female children ($p< 0.01$), respectively. Also, risk of prevalence of underweight was found 1.14 times higher among males than females ($p< 0.05$).

In general, wealth index is associated with stunting and underweight. Children belonging to middle and high wealth indices had 0.754 (CI=0.63-0.90) and 0.509 (CI=0.42-0.61) times lower risk of underweight as compared to children from the lowest wealth index**.** However, children belonging to the highest wealth index had 0.547 (CI=0.48-0.63) times lower risk of stunting as compared to children from the lowest wealth index**,** and children belonging to the middle wealth index had 0.748 (CI=0.56-0.99) times lower risk of wasting as compared to children from the lowest wealth index.

Children living in households who drank from sources other than public network had 1.16 (1.06-1.26) times higher risk of stunting when compared to those who drank from network sources, while children who lived in household with no flush toilet connected to public network had 1.137 (1.01-1.29) times risk of underweight as

compared to those lived in households with flush toilet connected to public network.

Mothers' education, poverty status, and residence area have no statistically significance associated with stunting, wasting, and underweight.

Discussion:

As shown in Table 1, the study sample consisted of 12542 Yemeni children less than five years old taken from the raw data of Household Budget Survey (HBS) 2005/2006. It was observed that 31.5% of the children were classified as stunting, meanwhile 11.6% were classified as underweight, and 4.9% were classified as wasted. So, health indicators in Yemen are still high among children in comparison with previous surveys' results (Ministry of Planning and development and Central of Statistical Organization, 1998; Ministry of Public Health and Population and Central Statistical Organization, 2004), however, these indicators were lower than those indicators that appeared in Khartoum study (Sudan) (Ibrahim and Alshiek, 2010).

Chi square test was used to distinguish the relationship between socio-economic factors and the health indicators of children. It was observed that stunting and underweight among children were significantly associated with variables including; the place of residence, poverty status, wealth index, and sources of drinking water ($p< 0.01$). Children living in rural areas were significantly suffering from stunting and underweight as compared to those living in urban areas. Children from poor urban areas showed a decline from 32.2% in 1998 to 20.7%, and poor rural children showed a small decline from 42.4% in 1998 to 40.1% in 2005/2006 (World Bank and UNDP, 2007). Stunting and underweight indicators appeared to be higher prevalence in poor children than in non poor children .These results were similar to the results concluded from other studies (Samaan, 2002; Wood, 2003; Ahmad, 2007).

Children with low wealth indices were significantly suffering from stunting and underweight as compared with those with moderate and high wealth indices. This may be referred to the decline of poverty rate in Yemen from 41.8% in 1998 to 35% in 2005/2006 (World Bank and UNDP, 2007).

The prevalence of stunting and underweight among children who drink water from sources other than public network were higher than children who drink water from public network sources, this result was supported by the results of other studies (Masood, 2007).

In addition to that, stunting and wasting prevailed in males more than in females, which is similar to other studies results, too (Felice, 1999; Mittal, 2007).

Logistic regression was also used to study the effect of socio-economic factors on the health indicators. It should be noted that the prevalence of stunting, wasting and underweight were at higher risk among males as compared to females ($p< 0.01$), which is similar to other studies' results (Felice, 1999; Mittal, 2007; Meshram at el, 2012), however, the findings of the study conducted in Laos showed no significant differences between male and female children for any of the health indicators (Kamiya, 2011). Households' wealth indices were significantly associated with all health indicators of children. Children who were characterized by the highest wealth index had lower risk (0.547 times) of stunting and the average wealth index had lower risk (0.748 times) of wasting as compared to children from the lowest wealth index. Also, Children who were characterized by the highest and average wealth index had a lower risk (0.509, 0.754 times, respectively). These findings were supported by other studies (Li at el, 1999; Meshram at el, 2012). Wasting was significantly low among children whose fathers had finished secondary education and above when compared with children whose fathers were illiterate or had primary education, which was supported by other studies (Kamiya, 2011).

Risk of stunting was (OR=1.16) significantly higher among children who drank water from sources other than public network as compared with those who drank water from public network sources, this was also supported by other authors (Mustafa, 1995).

Risk of underweight was higher (OR=1.37) among children who living in households with not flush toilet connected to public network, as compared to those living in houses that have flush toilet connected to public network (Mustafa, 1995).

Therefore, household wealth index, poverty status, sources of drinking water, and sanitation facilities were the indicators for socio-economic development factors and were observed to be associated with all health indicators as it was observed by other authors (Li at el, 1999).

In conclusion, the results of this study indicate that health indicators are still an important public health problem among children under 5 years old and are associated with household's wealth index, poverty status, place of residence, type of water sources and children sex.

Apart from the abovementioned factors that are associated with health indicators, other factors such as breastfeeding and child feeding practices, and maternal knowledge about feeding and care during illness are all important determinants of health indicators that need further study to explore their association.

Action needs to be taken in order to improve socio-economic conditions such as wealth index, food for work program, improved maternal education along with maternal health promotion, improved sanitation and provision on the safety of drinking water to prevent diarrhea and other infections.

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