

Indicators of Under-five mortality in Khartoum state,2018

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Abstract:

This paper aims to construct indicators of under-five mortality in Khartoum state the capital state of Sudan,2018. Primary data on variables of relevance to under-five mortality was collected from a random sample of households in Khartoum state in 2018, and analyzed by using factor analysis technique. the analysis of these data lead to nine indicators of under-five mortality in Khartoum state these indicators are (supervision and place of delivery, socioeconomic and demographic characteristics, mothers health and child feeding, health of pregnancy and under-five children, response of mother to the sickness of under-five children, outcome of pregnancy complication, mother habits, exclusive breastfeeding and delivery in others place, suffering of mother from certain disease).Study concluded that the place of delivery is important indicator of under-five mortality in Khartoum state.

Key words : *under-five mortality , factor analysis , indicators.*

المستخلص:

تدرس هذه الورقة مؤشرات وفيات الأطفال دون سن الخامسة في ولاية الخرطوم للعام 2018 وتهدف إلى بناء مؤشرات وفيات الأطفال دون سن الخامسة في ولاية الخرطوم عاصمة السودان. جمعت البيانات الأولية للمتغيرات ذات الصلة بوفيات الأطفال دون سن الخامسة من عينة عشوائية من أسر ولاية الخرطوم في عام 2018 , ولقد تم تحليلها باستخدام تقنية تحليل العوامل . مؤشرات وفيات الأطفال دون الخامسة في ولاية الخرطوم (الإشراف على الولادة ومكان الولادة ، الخصائص الاجتماعية والاقتصادية و الديموغرافية، صحة الأم وتغذية الطفل، صحة الأم الحامل والأطفال دون الخامسة، ردة فعل الأم عند مرض الأطفال دون سن الخامسة، مولود الحمل الحرج، سلوك الأم ، الرضاعة والولادة في مكان غير البيت أو المستشفى، معاناة الأم من مرض محدد).

1-Background

An indicator is something that provides a summary overview of a specific concept. There is no universal agreement on specific indicator of under-five mortality , indicators of under-five mortality depends on the phenomena of under-five mortality itself in specific area and time. Child mortality is one of important indicators of public health and it reflects the socio-economic and environmental condition as well as the development of countries. Whereas country conditions are known to influence under-five mortality, it is unknown whether these have a different impact on the poor and the rich persons. Also Under-five mortality increase is not only undesirable but also indicative of a decline in general living standard. Data indicate that globally under-five mortality has dropped from nearly 12 million in 1990 to 6.9 million in 2011⁽¹⁾.

Globally, under-five mortality rate has decreased by 58%, from an estimated rate of 93 deaths per 1000 a live births in 1990 to 39 deaths per 1000 a live births in 2017. This is equivalent to 1 in 11 children dying before reaching age 5 in 1990, compared to 1 in 26 in 2017⁽²⁾

Globally, in 2017, half of all deaths under 5 years of age took place in sub-Saharan Africa, and another 30% in Southern Asia. In sub-Saharan Africa, 1 in 13 children died before the fifth day after their birth. In high-income countries, that number was 1 in 185⁽³⁾.

By the end of the Millennium Development Goals (MDGs) era, the international community agreed on a new framework – the Sustainable Development Goals (SDGs) by the target is to end preventable deaths of newborns and children less than 5 years of age. The goal is all countries aiming to reduce under-five mortality to at least as low as 25 per 1000 live births. 117 Member States already met the SDG target on under-five mortality, and 26 countries are expected to meet the target by 2030, if current trends continue⁽³⁾.

The 20th century witnessed dramatic slow decline in under-five mortality in Sudan. Table (1) shows a decrease of under-five mortality rate for selected years 1970, 1990, 2000, 2010, and 2014.

Table (1): Sudan's under-five mortality rate for 1970, 1990, 2000, 2010, and 2014

Year	1970	1990	2000	2010	2014
under-five mortality rate/1000 live births	158	124	114	103	68

Source: UNICEF (2011) and MICS (2014).

Table 2: Under-Five Mortality Rates in State of Sudan in 1993 and 2008.

State	census 2008	census 1993	change %
Khartoum	105	131	-20
Northern	89	143	-38
Nahr el nil	96	131	-27
Red sea	91	175	-48
Kassala	106	147	-28
Algadarif	147	190	-23
Gazira	97	127	-24
White Nile	111	152	-27
Blue Nile	205	192	7
Sinnar	128	168	-24
Northern kordofan	114	168	-32
Southern kordofan	143	189	-24
Northern Darfur	80	153	-48
western Darfur	125	170	-26
Southern Darfur	96	163	-41

Sources: 1993, 2008, CBS, Sudan

2-Research problem:

Globally, under-five mortality rate has decreased regularly that is not found in Sudan. It is observable from table (2) above Khartoum State has achieved the least percentage decline in under-five mortality in the time lapse between the two censuses years 1993 and 2008 .The question is what caused that? That is, what are the determinants of under-five mortality in Khartoum state in general, and are the determinants differ by mode of living (urban and rural).Child health is determined by many factors including parental education, access to health services, and income of families. According to, child mortality is determined by a combination of socio-economic, biological, environmental, and behavioral factors ⁽⁴⁾.

3-Method

3.1 Study Design and Sampling

The study design is a cross-sectional community based one , according to the objectives and the structure of population this paper used the stratified three stage sampling and the sample size was 932. The target population are all the households that living in Khartoum state and the sample units were each household with a live housewife and subjected to a birth experiences . The selection of sample units used systematic random method.

3.2 Data

The study based on the primary data collected from a sample of households in Khartoum State by using a specially designed questionnaire and through interview with mothers by trained field workers. Data were collected from the study area through a sample that was selected randomly from target population of study. The data collected were analyzed by using factor. The data analysis was done using SPSS 16.The dependent variable of this study is the existence of under-five categorized children as being dead (coded as 1) or alive (coded as 0). This paper divided the risk

factors (determinants) of under-five mortality into four groups ,there are socio-economic and demographic characteristics (mode of living, place of origin, duration of living in Khartoum, level of education of father, occupation of father), maternal factors (age, level of education of mother, occupation of mother, age at the first childbearing, number of childbearing. , and mothers suffering from high blood pressure, diabetes, obesity, and other diseased), behavioral factors (medical checkup , number of medical checkups ,delivery under supervision of doctor and midwives , place of delivery (hospital , home , primary health center , other places) , average of breastfeeding , time of child's feeding , and expose of water pipe , cigarette , use snuff (tombak) and alcohol), and personal illness control (reaction of mother when her baby is sick, immunization of mother against tetanus and number of doses she takes , immunizations of child below than 5 years of age against penta diseases (Polio, Tuberculosis, , Pneumococcal, Rota, Measles, and Meningitis).

3.3 Analysis

The analysis used factor analysis to construct the indicators of dying before age 5.

3.4 Result:

1. Descriptive Analysis

Table (3) Association between the socioeconomic and demographic variables and under-five mortality:

Residence.1	Under five mortality		P.value
	Yes	No	
Rural	(11.9%) 29	(13.2%)91	591.
Urban	(88.1%)215	(86.8%)597	
Duration of living in Khartoum state.2			
Less than 6 years	(16.9%) 41	(17.6%)119	008.
20years – 6	(40.5%)98	(37%)250	
years 35 – 21	(19.4%)47	(29.2%)197	
Highest thru 36 years	(23.1%)56	(16.1%)109	
father ' education .3			
Illiterate	(21.2%)51	(6.9%)54	000.
Basic/Primary	(23.7%)57	(18.9%)129	
Secondary	(31.5%)76	(36.1%)246	
University	(21.2%)51	(34.3%)234	
Postgraduate	(2.5%)6	(2.8%)19	
father' Occupation .4			
Labour	(15.7%)38	(9.4%)63	000.
Employee	(22.2%)53	(36.3%)244	
Self employed	(60.7%)145	(53.2%)358	
Other	(1.3%)3	(1.2)8	

It is observable from table (3) above that the mode of living is not significantly associated with under-five mortality. It seems obvious in the same table the significant relation between the duration of living in Khartoum state and under-five mortality. The significant association between father' education and under-five mortality is also clear. Table (3) shows that a significant relation between father' occupation and the under-five mortality too.

Table (4) the association between maternal variables and under-five mortality

Age.1	Under five mortality		P.value
	Yes	No	
Less than 26 years	2 5 (10.2%)	(22.5)154	000.
years 34 – 26	(34.8%)85	(43.5%)297	
years 43 – 35	(24.6%)60	(20.8%)142	
More than 43	(30.3%)74	(13.2%)90	
Age at the first child-.2 bearing			000.
Less than 17 years	7 0 (28.8%)	(13.4%)91	
years 21 – 17	(39.1%)95	(42.2%)286	
years 26 – 22	(21%)51	(30.9%)209	
years 32 27-	(8.6%)21	(10.3%)70	
Highest thru 32	(2.5%)6	(3.1%)21	
Mother' education .3			000.
Illiterate	(25.8%)63	(12%)82	
Basic/Primary	(28.3%)69	(21.6%)148	
Secondary	(23.4%)57	(8%..33)231	
University	(21.7%)53	(29.4%)201	
Postgraduate	(8%.)2	(2.3%)22	

Mother' occupation.4			
Housewife	1 8 5 (75.8%)	(75.8%)517	000
Labour	(5.7%)14	(3.6%)25	
Employee	(13.1%)32	(18.1%)124	
Self employed	(5.3%)13	(2.8%)19	
Number of childbearing.5			
Less than 2	(7.4%) 18	(16.9%)116	000.
3 2-	(45.5)111	(61.2%)421	
5 - 4	(30.3%)74	(16%) 110	
More than 5	(16.8%)41	(6%)41	
Do you have.6			
Blood pressure	(13.5%)33	(6%)41	000.
Diabetes	(19.3%)47	(7.8%)54	000.
Obesities	(9%)22	(7.6%)52	469.
Others	(10.7%)26	(4.4%)30	000.

Table (4) shows that a significant association exists between the age of mother and under-five mortality. Also this study figured out the association between age at the first childbearing and under-five mortality. It is observable in table (4) that a significant association exists between mother' education and the under-five mortality. Table (4) also shows the relation between under-five mortality and mother' occupation mother. It is clear in same table the significant relation between the under-five mortality and number of childbearing. Finally table (4) shows that a significant association between diabetes and other disease in under-five mortality.

Table (5) Association between the behaviour variables and under 5 mortality:

During the pregnancy period did you have medical checkup	Under five mortality		000.
	Yes	No	
Yes	(24.4%)210	(75.6%)650	000.
No	(47.2%)34	(52.8%)38	
Number of medical check up			000.
Less than 3	(45.5%)111	(30.2%) 208	
5 – 3	(27.5%)67	(28.5%)196	
More than 5	(27%)66	41.3)284	
The delivery under the supervision of			000.
Doctor	(62.3%)152	(76.2%)524	
Midwife	(43%)105	(27.6%)190	
Others	(0%)0	(1%.)1	
Place of delivery			000.
Hospital	(61.9%)151	(76.9%)529	
Primary health center	(7.4%)18	(7.8%)54	
Home	(36.9%)90	(19.3%)133	
Other	(0%)0	(3%.)2	399.
Average of breastfeeding			000.
Less than 10	(5.1%)12	(5.3%)36	
14 – 10	(13.6%)32	(9.2%)62	
19 – 15	(37.3%)88	(24.8%)167	
More than 19	(44.1%)104	(60.6%)408	
Time of children's feeding			000.
Before they have reached 6 months	(62.1%)144	(46.7%)309	
After they have completed 6 months	(37.9%)88	(53.3%)352	
Smoking cigarette, and shisha and exposing tombak, alcohol			000.
Cigarette	(8%.)2	(7%.)5	
Water pipe	(0%)0	(3%.)2	
Tombake	(1.2%)3	(1.5%)10	
Alcohol	(1.2%)3	(1.3%)9	
			885.
			399.
			798.
			925.

Table (5) shows the significant association that exists between the medical checkups and under-five mortality. Moreover the number of medical checkups has significant association with under-five mortality. Also it found in the same table the significant association between delivery under the supervision of doctor and midwives and under-five mortality. It is clear in table (5) the significant association between average of breastfeeding and under-five mortality. There is a significant association between time of children's feeding and under-five mortality.. Finally it is revealed in table (5) the insignificant association between the women who are exposed to snuff use, smoking cigarette and water pipe .

Table (6): Association between the personal illness control and under-five mortality:

Action of the mother.1 when her child sick	Under five mortality		P.value
	Yes	No	
Use native treatment	(30.7%)75	(20.5%)141	000.
Go to the pharmacy	(8.2%)20	(77%)53	805.
Go to the doctor	(81.1%)198	(89.5%)616	001.
Go to neighboring	(1.2%)3	(8%.)4	304.
Do immunize yourself.2 (against tetanus (Yes	(23%)183	(77%)613	000.
Number of doses			
Less than 2	(42.7%)96	(40.4%)259	252.
4 – 2	(38.2%)86	(44%)282	
highest thru 4	(19.1%)43	(15.6%)100	
Do you immunize.3 your child less than 5 years			
Yes	(88.9%)209	(96.7%)644	000.
Immediately after.4 childbearing do you im- munize your babies after against			

Action of the mother.1 when her child sick	Under five mortality		P.value
	Yes	No	
Tuberculoses	(78.7%)192	(85.5%)588	003.
Immediately after the first 6 week do immunize your babies against			
Polio	(79.5%)194	(90.8%)625	000.
Penta	(84.4%)206	(93.8%)645	000.
Pneumococcal	(74.2%)181	(88.7%)610	000.
Rota	(70.1%)171	(84.9%)684	000.
Immediately after the first 2 month's do immu- nize your babies against			
Polio	(78.9%)192	(91.1%)627	000.
Penta	(83.2%)203	(93.5%)643	000.
Pneumococcal	(71.3%)174	(88.2%)607	000.
Rota	(67.2%)164	(85%)585	000.
Immediately after the first 3 month's do immu- nize your babies against			
Polio	(78.3%)191	(89.7%)617	000.
Penta	(83.6%)204	(92.7%)638	000.
Pneumococcal	(70.9%)173	(87.9%)605	000.
Rota	(58.2%)142	(69.5%)478	012.
Immediately after the first 9 month's do immu- nize your babies against			
Measles	(82.4%)201	(92.9%)639	000.
Meningitis	(68.9%)168	(75%)516	141.
Immediately after the first 18 month's do immunize your babies against			
Measles	(69.3%)169	(81.5%)561	000.
Polio	(72.1%)176	(79.5%)547	001.

Table (6) shows the significant relation between the under-five

mortality and the use of traditional treatment, and visiting the doctor when her child was sick , and table (6) also shows the insignificant association between going to pharmacy and neighbors with under-five mortality . It is clear also the significant association between immunizing mother against tetanus and under-five mortality. Table (6) shows that there is insignificant association between the number of doses of tetanus and under-five mortality . Also it found in table (6) relation between immunization of under-five children and under-five mortality and this relation is shown clearly in the above table .The immunization protects children against serious diseases (Polio, Penta, Pneumococcal, Rota, Measles, and Meningitis).

Construction of Indictors:

It is clear in the following table (7) the KMO and Bartlett's test that shows the adequacy of sampling (.664) , and the data is suitable for using factor analysis (P.value .000).

Table(7) KMO and Bartlett's Test

.Kaiser-Meyer-Olkin Measure of Sampling Adequacy		664.
Bartlett's Test of Sphericity	Approx. Chi-Square	8.469E3
	Df	666
	.Sig	000.

Table (8) Communalities

	Initial	Extraction
Residence	1.000	669.
Duration of living at khartoum state	1.000	597.
Age of mother	1.000	767.
Level of education of mother	1.000	689.
Occupation of mother	1.000	577.
Level of education of father	1.000	593.
Occupation of father	1.000	464.
Number of childbearing	1.000	682.
Age at the first childbearing	1.000	592.
Medical checkup	1.000	599.
Number of medical checkup	1.000	586.
Delivery under supervision of doctor	1.000	876.
Delivery under supervision of midwives	1.000	879.
Delivery under supervision of other	1.000	503.
Delivery at hospital	1.000	885.
Delivery at primary health centers	1.000	821.
Delivery at home	1.000	856.
Delivery at others	1.000	639.
Duration of Pregnancy less than 32 weeks	1.000	652.
Weight of babies at birth less than 2kg	1.000	704.
Time of feeding children	1.000	481.
Mother expose cigrate	1.000	682.
Mother expose tombak	1.000	639.
Mother expose alcohol	1.000	667.
Mother suffer from obesity	1.000	525.
Mother suffer from blood pressure	1.000	549.
Mother suffer from diabetes	1.000	604.
Mother suffer from other disease	1.000	600.
Immunization of children less than 5 years	1.000	546.
Mother uses native treatment	1.000	600.
Mother goes to pharmacy	1.000	647.
Mother goes to doctor	1.000	655.
Mother goes to neighboring to bring their child medicine	1.000	498.
Mother uses others	1.000	665.
Immunization of mother against tetanus	1.000	679.
Number of tetanus dose	1.000	702.
Average of Breastfeeding	1.000	466.

Extraction Method: Principal Component Analysis.

The above table (8) clarifies that the factors extracted explain a significant proportion of the variance of the derived variables. The

most important variables that have contribution in construction indicators are delivery at hospital (88.5%), the delivery under the supervision of midwives (87.9%), the delivery under the supervision of doctors (87.6%) , the delivery at home(85.6%) , the delivery at the primary health centers (82.1%) , the age of mother (76.7%) , delivery child his weight less than 2kg (70.4%) ,the number of medical checkup(70.2%) , also there were variables have fair contribution like exposing to cigarettes , immunization of the mother against the tetanus ,residence , expose to alcohol , the mother has taken her sick child to the doctor, the age pregnancy less than 32 weeks which respectively (68.2% ,67.9% , 66.9% , 66.7% , 65.5% ,and 65.2 %).

Table (9) shows that the 14 indicators which came to 64.414% from the total variation after rotation which respectively from 1 to 14 came to (10.182%, 6.17%, 5.711% ,5.313%, 4.706% , 4.28% , 4.113% , 4.07% , 3.79% , 3.409% , 3.256% , 3.208%, 3.167%, 3.039% . Later this 14 indicators converted to 9 indicators by merge the variables of relevance to known groups of variables .

Table (9) total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.361	14.490	14.490	5.361	14.490	14.490	3.767	10.182	10.182
2	2.366	6.393	20.884	2.366	6.393	20.884	2.283	6.170	16.352
3	2.052	5.547	26.431	2.052	5.547	26.431	2.113	5.711	22.063
4	1.686	4.558	30.989	1.686	4.558	30.989	1.966	5.313	27.376
5	1.556	4.206	35.194	1.556	4.206	35.194	1.741	4.706	32.082
6	1.450	3.920	39.115	1.450	3.920	39.115	1.584	4.280	36.362
7	1.375	3.716	42.831	1.375	3.716	42.831	1.522	4.113	40.475
8	1.319	3.565	46.395	1.319	3.565	46.395	1.506	4.070	44.545
9	1.231	3.326	49.722	1.231	3.326	49.722	1.402	3.790	48.335
10	1.176	3.177	52.899	1.176	3.177	52.899	1.261	3.409	51.744
11	1.111	3.002	55.902	1.111	3.002	55.902	1.205	3.256	55.000
12	1.065	2.879	58.781	1.065	2.879	58.781	1.187	3.208	58.207
13	1.056	2.854	61.635	1.056	2.854	61.635	1.172	3.167	61.375
14	1.028	2.779	64.414	1.028	2.779	64.414	1.125	3.039	64.414
15	.938	2.536	66.951						
16	.919	2.484	69.435						
17	.881	2.381	71.816						
18	.856	2.315	74.130						
19	.835	2.256	76.386						
20	.790	2.134	78.520						
21	.765	2.067	80.587						
22	.717	1.937	82.523						

23	.699	1.890	84.413					
24	.645	1.743	86.156					
25	.623	1.685	87.841					
26	.607	1.641	89.482					
27	.569	1.539	91.020					
28	.541	1.461	92.482					
29	.533	1.440	93.921					
30	.485	1.311	95.233					
31	.464	1.255	96.488					
32	.342	.925	97.413					
33	.329	.890	98.303					
34	.260	.702	99.004					
35	.206	.557	99.562					
36	.122	.330	99.891					
37	.040	.109	100.000					

Extraction Method: Principal Component Analysis.

The first indicator is place of delivery which came to 13.591% from the total variation, this indicator consists of (delivery under supervision of doctor and delivery under supervision of midwives, delivery at hospital, and delivery at primary health centers, delivery at home, with the saturation respectively (-.909, .903, -.868, -.863 and .847).

Indicator 2 is socioeconomic and demographic characteristics which came 11.881%, this indicator contains the following variables level of education of mother, occupation of mother, level of education of father, age of mother at the first childbearing, residence, the duration of living in Khartoum state, age of the mother and the number of childbearing, with the saturation respectively (.717, .53, .6, .667, -.412, .715, .757 and .516).

Indicator 3 is mothers health and child feeding, which came to 5.313% and it contains time of feeding children, immunization of mother against tetanus and dose tetanus immunization. The saturation of these variables respectively is (-.493, -.661, and .781).

Indicator 4 health of pregnancy mothers and under-five children which came to 4.706% and it contains medical checkup, number of medical checkup immunization of children less than 5 years. The saturation of these variables respectively is (.603, and -.3, and .479).

Indicator 5 reaction of mother on sickness of under-five children, which came to 4.28%, and it contains mother uses native treatment, goes to the pharmacy, and goes to doctor when her child sick, and the saturation respectively are (.479, .747, and .735).

Indicator 6 the outcome of complications pregnancy, which came to 4.113%, and it contains duration of pregnancy less than 32 weeks and the weight of the baby at birth less than 2 kg, and the saturation with respectively are (.791, and .819).

Indicator 7 explained 3.256% and it contains occupation of father, delivery under supervision of others, mother suffer from blood pressure, and the saturated respectively (.33, .67, and .581).

Indicator 8 habit of mothers and delivery at other places, which came to 6.375%, it contains exclusive breastfeeding, mother goes to the neighboring to bring their child medicine when her child has sick, delivery at others, and the saturated respectively (-.737, .630, and .336).

Indicator 9 suffering of mother from cretin disease which came to 3.039% and it contains mother suffer from diabetes and others diseases, and the saturated respectively (.661, and .637).

Discussion

This paper concluded that the place of delivery is most important variables in establishing of indicators of under-five mortality like delivery at hospital, home, and at primary health centers. The previous studies (5)(6) confirmed that the place of birth is effective factor of under-five mortality, also it found the delivery under supervision of doctor and trained midwives have greatest impact on the construction of indicators of under-five mortality . The delivery under the supervision of doctor and trained midwife lead to reduce the direct obstetric mortality cases.

Table (7) shows that the importance of the age in construction of indicators of under-five mortality. age is a central variable influencing pregnancy outcome The mother with high age are more likely to experience preterm birth, delivery of low birth weight infants and neonatal death in their first pregnancy.(7). Many adolescents do not know how to obtain prenatal care, and delivery care. Also, teenage first births has a higher risk than subsequent births(8).

Immunizations is a key determinant of under-five mortality McKeown(9) argued that medical advancement played only a minor role in the mortality reductions. This study found the immunization of the mother against the tetanus has effect on the construction of indicators of the under-five mortality. Bosch and others(10) confirmed that substantial reductions in child mortality associated with further increases in vaccination coverage, particularly additional immunization associated with measles and maternal tetanus in sub-Saharan Africa, where vaccination. Rates lag behind those in other regions.

Mothers education leads to higher use of the modern health care system. Second, mother with higher education levels are more likely to take positive decisions on personal illness control, and can affect child survival by influencing her choices and increasing/limiting her skills in health care practices. The relation between the under-five mortality and number of childbearing is positive, decrease of number of , decrease the under-five mortality and vice versa, the increase of the number of childbearing mean no adequate child spacing that lead to higher complications risk of obstetrics, and the increase of childbearing leads to increase the family size so the parental attention for their children decreases .The number of childbearing has an effect on construction of indicators of under-five mortality.

There is clear relation between the mothers suffering from diabetes and other diseases and under-five mortality. The maternal diabetes and other diseases had a slightly higher

gestational age and low birth weight. The predictive impact of maternal hypertension on preeclampsia that affect the neo-natal mortality.(11).

Several studies shows the greatest relation between mode of living under-five mortality such as (Kalaivani et al. 2012)(12), (Diddy et al.2010) (13) (Sanni, 2019)(14).This paper found there is no relation between the mode of living and under-five mortality this due the equity of providing health services and the similarity of economic conditions.

Consumption of alcohol and use of tobacco are lifestyle measures that may cause direct or indirect health risks. Babies born to women who smoke cigarette and water pipe are more likely to have less weight at birth and increase risk for respiratory diseases. Smoking during pregnancy can cause tissue damage in the unborn baby, particularly in the lung and brain, so some studies suggest a link between maternal smoking and cleft lip (15). This study found the importance of consumption of alcohol and use of cigarette in the construction of indicators of under-five mortality.

Infants born in preterm remain vulnerable to many complications, including respiratory distress syndrome, chronic lung disease, injury to the intestines, a compromised immune system. Infants born preterm are more likely than infants born full term to die during the neonatal period (first 28 days) and infancy (first year), and mortality rates increase proportionally with decreasing gestational age or birth weight. (16);(17)

This study found the usefulness of the duration of the pregnancy period less than 32 weeks in explaining and causing the under-five mortality. About 80 per cent (18) of health care in developing countries occurs at home – and the majority of children who die pass away at home, without being seen by a health worker. Recent estimates suggest that nearly 80 percent of under-five deaths occur in sub-Saharan Africa and South Asia, and about half of the deaths, in one of five countries: India, Nigeria, Democratic Republic of Congo, Pakistan, and China .(19).

The reaction of mother or any other member of family when their babies are sick specially going to doctor is important variable used to explain the under-five mortality and construct its indicators. the reaction of going to doctor most likely reduce the under-five mortality ,also this reaction link good level of education. The association between the duration of living in Khartoum state and under-five mortality, and this for Khartoum state characterized by high levels of health services compared to other states of Sudan. The existence association between fathers education and occupation and under-five

mortality , it is known that education leads to higher use of the modern healthcare system. Second, father with higher education levels are more likely to take positive decisions on personal illness control, and poverty tends to limit the access of household to quality health care services, often leading to non-immunization of the child or treatment when child is sick. The occupation of mother has substantial effects through lack of proper feeding breastfeeding early in life, and however, a working mother can also be associated with high family income which can increase a child's survival. The medical antenatal care services such as checkups and Tetanus Toxoid (TT) injection reduce neonatal mortalities. The regular medical checkups can treat potential pregnancy problem and mother received advices of nutrition and physical and physiological change. Pregnancy problems and complications can range from mild to severe and it appears in different times during the pregnancy period, and it is difficult for a woman to determine them so increase of numbers of medical checkup will treat pregnancy problems and complications. The breastfeeding is important for infants to survive, grow and develop properly. Breast milk is rich in nutrients, anti-bodies and contains the right quantities of fat, sugar, water and protein. The children with exclusive breast feeding are more likely have strong immune system.

Conclusion

Overall this study shows the nine indicators that specified in previous section. This indicators are very important for the discussion of the under-five mortality .

Recommendation

Improving the place of delivery must reduce the under-five mortality, and it is important to send educational messages to the community to help families learn essential skills and basic health knowledge particularly in the care of newborns and pregnancy mother. Expand the program of Immunization, relatively high antenatal care attendance and the integrated child health campaigns. Also the interventions of the government in contributing in the treatment of under-five children or participate with families it are very essential step to reduce the under-five mortality.

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