Examination of Anemia among Young Women in 34 DHS Countries: Prevalence by Age, Residence, Education and Household Wealth[1]

Suzumi Yasutake, The Johns Hopkins University
Huan He, The Johns Hopkins University
Michele R. Decker, The Johns Hopkins University
Freya L. Sonenstein, The Johns Hopkins University
Robert Blum, The Johns Hopkins University
Nan Marie Astone, The Johns Hopkins University

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Direct all correspondence to:
Suzumi Yasutake
suzumi@jhu.edu

ABSTRACT

Anemia is a serious public health problem worldwide. It has health, social and economic impacts. There is not much research on anemia among young women in developing countries. This research describes the prevalence of anemia among all women age 15-24 in 34 developing countries and explores its associations with age, residence, education and household wealth. We analyzed data from the Demographic and Health Surveys (DHS). We found a high prevalence of anemia in all countries ranging from 15 to over 50%. Given that a prevalence over 5% is considered a public health issue, these numbers are very concerning. Overall, our findings suggest that women age 19-24, in rural areas, with less than primary education, in poorest household might have a higher risk of anemia.

INTRODUCTION

Anemia is a serious health concern in both developing and developed countries (WHO, 2001). Anemia influences individuals' health, social and economic well-being (Benoist, McLean, Egll, & Cogswell, 2008). Many women in developing countries are anemic before pregnancy leading to negative consequences for their children's development and maternal health. . Moreover research found anemia has negative influence on people's work productivity (Gardner, Edgerton, Senewiratne, Barnard, & Ohira, 1977).

Research focusing on anemia among young women is scarce. Existing research on anemia has been focused on infants, children or pregnant women (Crawley, 2004) (Stoltzfus, et al., 1997) (Mukuri, Altrena, Aboulafia, & Themme, 2005) (Lutter, 2008)or in some studies all women of reproductive age were lumped together (Asobayire, Adou, Davidsson, & Hurrell, 2001).

Research on pregnant women in Mali found access to food and infections had a significant association with being anemic (Ayoya, Spiekermann-Brouwer, Traoré, Stoltzfus, & Garza, 2006). Research on non pregnant women in India age 18 to 35 found diets with inadequate iron content were more likely to be anemic, although the sample is small (Ayoya, Spiekermann-Brouwer, Traoré, Stoltzfus, & Garza, 2006). Research on women of reproductive age in India found anemia disparities by religion, SES, and urban residence (Bentley & Griffiths, 2002) In Tanzania, prevalence of anemia among women of reproductive age varies by urban and rural areas (2010 Tanzania DHS). Women are dramatically different in biological and their life experiences between 15 and 49 years old which suggests that research on anemia should be mindful of age differences. For example, the risks of anemia increases during adolescent years because of menstruation and pregnancy (Zimmermann & Hurrell, 2007).

As a first step to understand anemia in young women and to fill the gap in the existing literature, we describe the prevalence of anemia among young women from 34 Demographic and Health Surveys (DHS) countries from 2003 to 2011. Then we explore the associations between anemia and women's backgrounds; age, urban residence, education and household wealth. This study is important because we use national representative surveys across nations from four regions, which are Sub-Saharan Africa, North Africa/West Asia/Europe, South and Southeast Asia, and Latin America and Caribbean.

DATA, STUDY SAMPLE AND METHODS

The Demographic and Healthy Surveys (DHS) are "nationally-representative household surveys that provide data for a wide range of indicators in the areas of population, health, and nutrition" usually conducted every five years (ICF International). A stratified two-stage cluster design is the usual sample design. We use 34 DHS surveys which were conducted since 2000 and which had information on anemia. The countries represented include 18 are Sub-Saharan countries, 8 are in North Africa/West Asia/Europe, 4 are in South & Southeast Asia and 4 are in Latin America and Caribbean. DHS also collects biomarker information such as HIV tests. Measure DHS tests women for anemia by using HemoCue blood hemoglobin testing system (ICF International). Testing is voluntarily. We limited the sample to women age 15 to 24 year old young women.

DHS defines anemia with cutoff points of 11.0 grams per deciliter (g/dl) of hemoglobin for pregnant women and 12.0 g/dl for non pregnant women. Women with less than 7.0 g/dl of hemoglobin have severe anemia, women with 7.0 to 9.9 g/dl have moderate anemia, and pregnant women with 10.0 to 10.9 g/dl and non-pregnant women with 10.0 to 11.0 g/dl have mild anemia. We created a dichotomous variable where "0" denotes no anemia and "1" any anemia based on the DHS definition.

Age is a categorical variable of 15-19 and 20-24. *Residence* is a dichotomous variable distinguishing between urban and rural. *Education* has 3 categories: less than primary, completed primary and some secondary plus. DHS provides household wealth quintiles based on the wealth index. The wealth index is calculated "on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities." (ICF International) by principal components analysis .

We first describe the prevalence of anemia among women between 15 and 24 years of age. Second we present associations between anemia and age, urban residence, education and household wealth.

FINDINGS

Figure 1 to Figure 5 presents the prevalence of anemia overall and then by age, urban, education and household wealth among young women. Tables in the Appendix present percentages and Chi-square test of significance.

Figure 1 shows the prevalence of anemia among young women from 34 DHS countries. No country has a prevalence lower than 5%. The results show that anemia is a public health concern for all 34 countries. Moreover, 30 countries out of 34 have a prevalence over 20%. Sixteen countries have a prevalence higher than 40%, which is a severe public health concern. Ghana has the highest prevalence among young women (61.52%). North Africa, West Asia and Europe have the low prevalence of anemia compared to Sub-Saharan Africa, South and Southeast Asia, Latin America and Caribbean. Yet, the prevalence is still high enough to be a public health concern.

Figure 2 shows the prevalence by age group. The associations between age and anemia are significant all countries except Burkina Faso, Congo Democratic Republic, Senegal and India. We observed the difference by age by regions. For most Sub-Saharan African countries and North Africa/West Asia/Europe, the prevalence is higher in women age 15-19 than women age 20-24 whereas Asian, Latin and Caribbean countries show the opposite trend. The highest prevalence among younger women is 62.91% for Ghana, and the one among older women is 63.07% for Benin.

Figure 3 shows the prevalence by urban and rural residence. Twenty-one countries have a higher prevalence rate in rural areas than urban areas. Among 34 countries, the rural areas of 17 countries have a prevalence over 40% as opposed to 14 urban areas. The highest prevalence in rural area is 64.07 % in Mali whereas the highest urban prevalence is 61.11% of Benin. The lowest of the rural areas is 15.37% whereas the lowest is 9.06 % both in Ethiopia. The largest differences between urban and rural are Haiti: 53.76% (urban) and 41.92% (rural). The prevalence in Asia and Southeast Asian countries are consistently high in rural areas. The associations between urbanicity and anemia are significant for all countries except Burkina Faso and Congo Democratic Republic.

Figure 4 presents the prevalence by education by 12 selected countries. Anemia and educational attainment are significantly related among these countries in Figure 5. In general, the prevalence of anemia among women with less than primary education is higher than women with some secondary education. The trend is obvious among these 12 countries.

Figure 5 presents the prevalence by household wealth by 17 selected countries. Anemia and household wealth are negatively association for these countries. Overall, the prevalence of anemia decreases as household wealth goes up in many countries such as Bolivia and Ethiopia whereas the opposite is observed in countries such as Haiti and Lesotho. As is the case of education, the trend is obvious among these countries except Haiti.

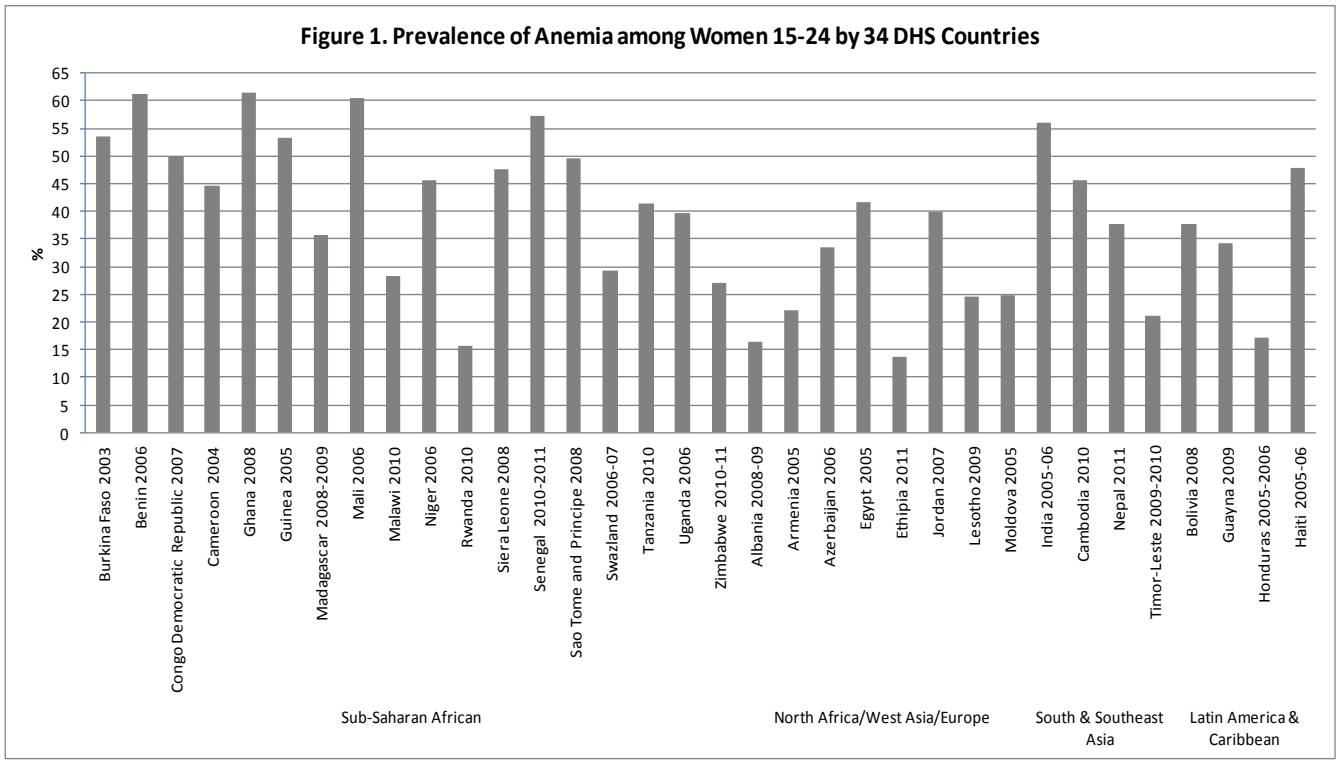


Figure 1. Prevalence of Anemia among Women 15-24 by 34 DHS Countries
%
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Burkina Faso 2003
Benin 2006
Congo Democratic Republic 2007
Cameroon 2004
Ghana 2008
Guinea 2005
Madagascar 2008-2009
Mali 2006
Malawi 2010
Niger 2006
Rwanda 2010
Siera Leone 2008
Senegal 2010-2011
Sao Tome and Principe 2008
Swazland 2006-07
Tanzania 2010
Uganda 2006
Zimbabwe 2010-11
Albania 2008-09
Armenia 2005
Azerbaijan 2006
Egypt 2005
Ethipia 2011
Jordan 2007
Lesotho 2009
Moldova 2005
India 2005-06
Cambodia 2010
Nepal 2011
Timor-Leste 2009-2010
Bolivia 2008
Guayna 2009
Honduras 2005-2006
Haiti 2005-06
Sub-Saharan African
North Africa/West Asia/Europe
South & Southeast Asia
Latin America & Caribbean

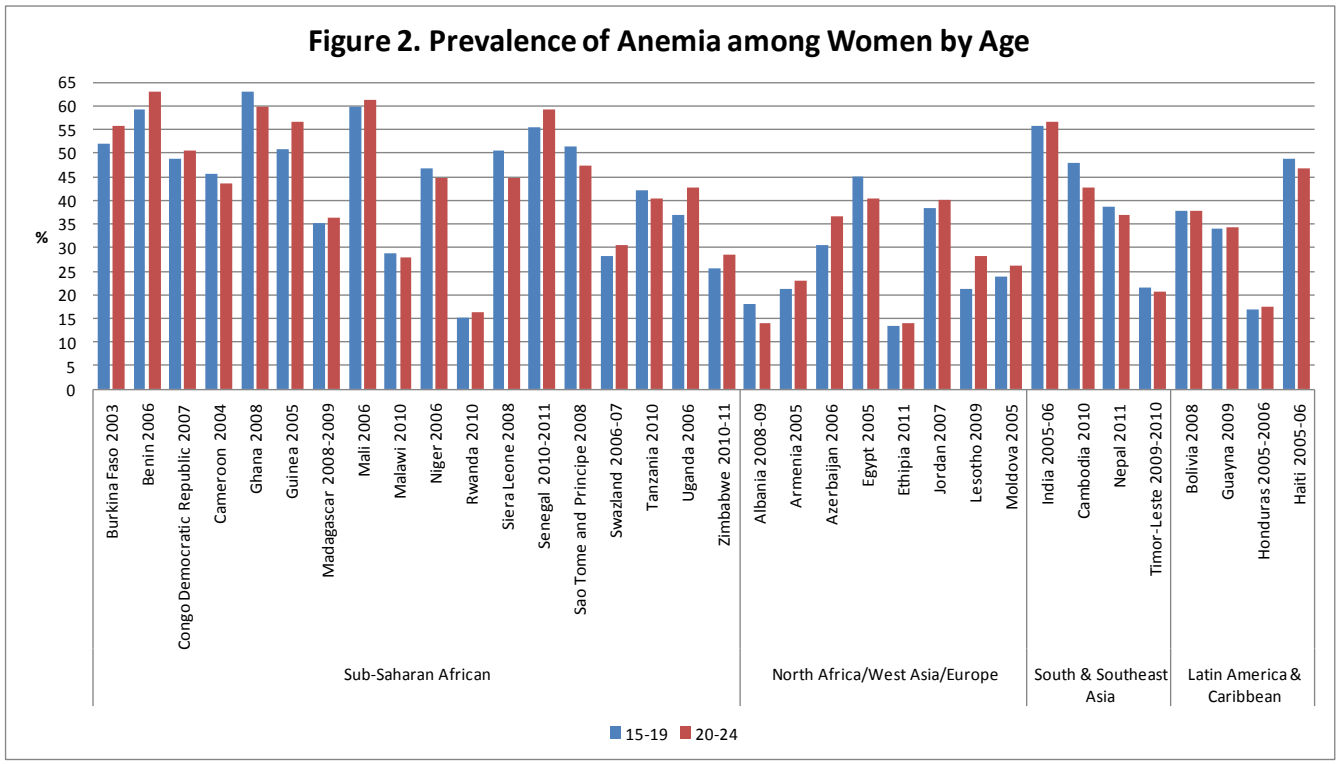


Figure 2. Prevalence of Anemia among Women by Age
%
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Burkina Faso 2003
Benin 2006
Congo Democratic Republic 2007
Cameroon 2004
Ghana 2008
Guinea 2005
Madagascar 2008-2009
Mali 2006
Malawi 2010
Niger 2006
Rwanda 2010
Siera Leone 2008
Senegal 2010-2011
Sao Tome and Principe 2008
Swazland 2006-07
Tanzania 2010
Uganda 2006
Zimbabwe 2010-11
Albania 2008-09
Armenia 2005
Azerbaijan 2006
Egypt 2005
Ethipia 2011
Jordan 2007
Lesotho 2009
Moldova 2005
India 2005-06
Cambodia 2010
Nepal 2011
Timor-Leste 2009-2010
Bolivia 2008
Guayna 2009
Honduras 2005-2006
Haiti 2005-06
Sub-Saharan African
North Africa/West Asia/Europe
South & Southeast Asia
Latin America & Caribbean
15-19
20-24

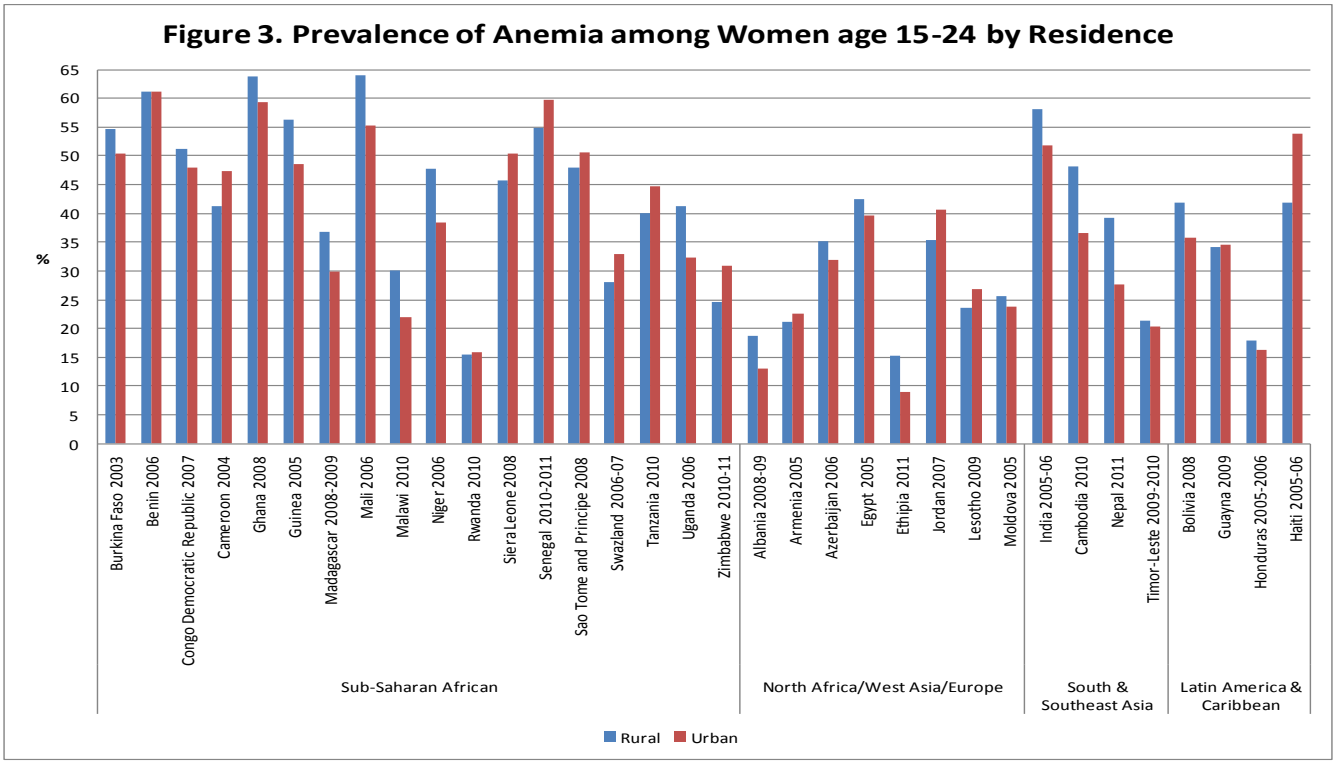


Figure 3. Prevalence of Anemia among Women age 15-24 by Residence
%
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Burkina Faso 2003
Benin 2006
Congo Democratic Republic 2007
Cameroon 2004
Ghana 2008
Guinea 2005
Madagascar 2008-2009
Mali 2006
Malawi 2010
Niger 2006
Rwanda 2010
Sierra Leone 2008
Senegal 2010-2011
Sao Tome and Principe 2008
Swazland 2006-07
Tanzania 2010
Uganda 2006
Zimbabwe 2010-11
Albania 2008-09
Armenia 2005
Azerbaijan 2006
Egypt 2005
Ethipia 2011
Jordan 2007
Lesotho 2009
Moldova 2005
India 2005-06
Cambodia 2010
Nepal 2011
Timor-Leste 2009-2010
Bolivia 2008
Guayna 2009
Honduras 2005-2006
Haiti 2005-06
Sub-Saharan African
North Africa/West Asia/Europe
South & Southeast Asia
Latin America & Caribbean
Rural
Urban

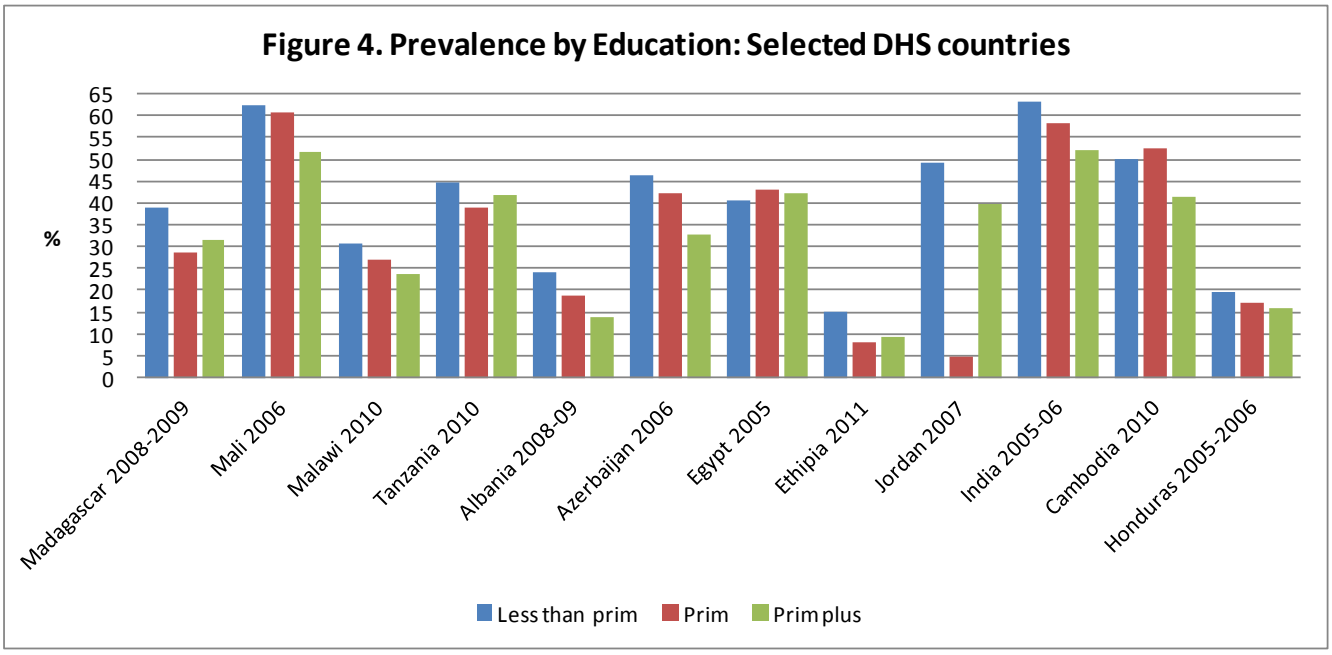
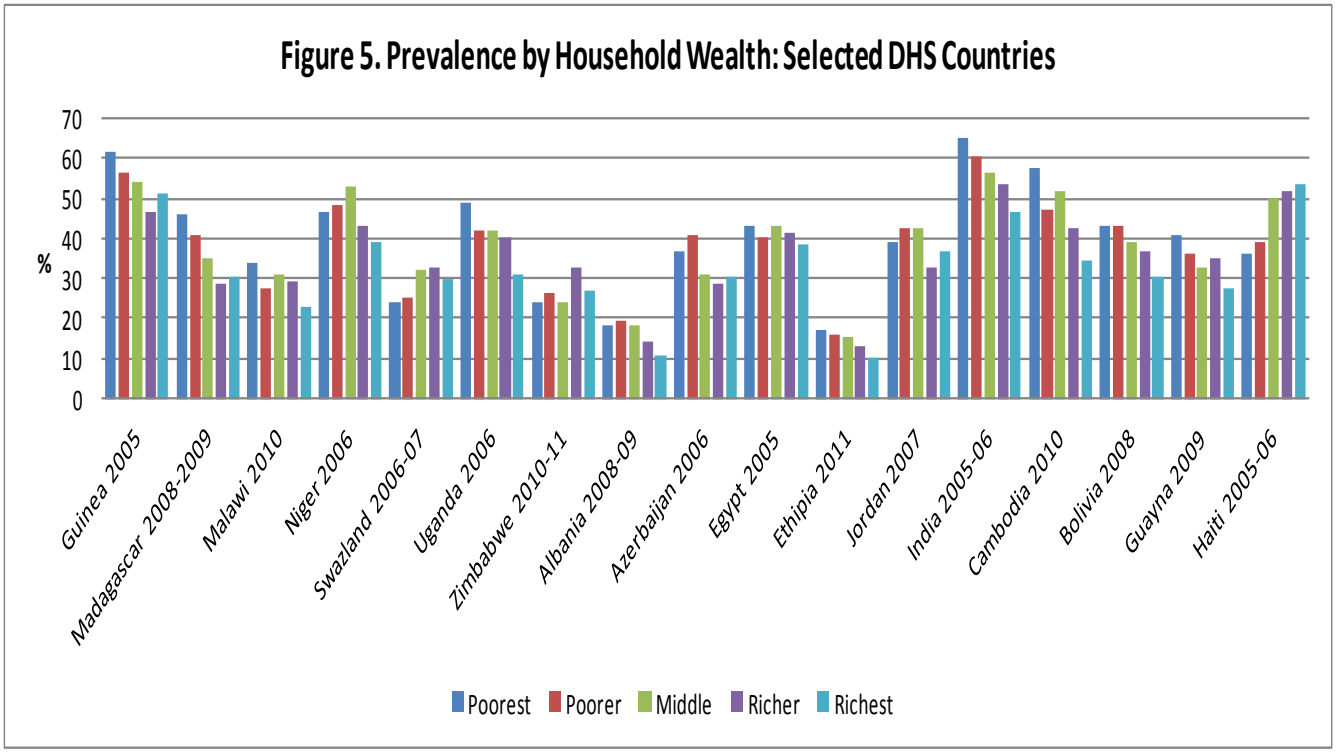


Figure 4. Prevalence by Education: Selected DHS countries
%
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Madagascar 2008-2009
Mali 2006
Malawi 2010
Tanzania 2010
Albania 2008-09
Azerbaijan 2006
Egypt 2005
Ethipia 2011
Jordan 2007
India 2005-06
Cambodia 2010
Honduras 2005-2006
Less than prim
Prim
Prim plus



DISCUSSION

Anemia is a global concern, but research on anemia on young women is scarce. Our study described the prevalence of anemia of young women from 34 DHS countries by age, urban rural residence, education and household wealth. Our research found the high prevalence of anemia among young women between 15 and 25. Sixteen countries have the prevalence rate higher than 40%, which is a sever public health concern (WHO, 2001). No country has the prevalence lower than 5%, that is, anemia is a public health concern for all these countries. Age and urban residence are significantly associated almost all countries. Moreover, age patterns show interesting regional differences. The prevalence is lower for women age 19-25 for South and Southeast Asian countries and Latin and Caribbean countries, but not for the rest. Women in rural area are more likely to have anemia than urban women. Higher education and richer household might have a positive impact on anemia.

If iron deficiency anemia exceeds 5.0 % of the population, it is considered to be a public health problem (WHO, 2001). Our findings show the prevalence of anemia is so high to be a public health concern among all 34 countries. Moreover, anemia is a sever public health concern for almost half of the countries: the highest prevalence rate is 61.52% of young women in Ghana. The research calls for further examination of factors influence anemia among young women for effective interventions.

APPENDIX TABLES

Table A1. Percent of Women Age 15-24 with Some Anemia by 34 DHS countries

Regioons	Country	Ages 15-19	Ages 20-24	Ages 15-24	Chi-Square Test	Total Number of Women between 15-24
Sub-Saharan African	Burkina Faso 2003	51.94	55.66	53.53	P = 0.20	1765
	Benin 2006	59.15	63.07	61.17	P = 0.00	1818
	Congo Democratic Republic 2007	48.7	50.62	49.71	P = 0.56	1977
	Cameroon 2004	45.61	43.65	44.71	P = 0	2338
	Ghana 2008	62.91	59.89	61.52	P = 0	1850
	Guinea 2005	50.95	56.48	53.23	P = 0	1384
	Madagascar 2008-2009	35.12	36.33	35.63	P = 0	3274
	Mali 2006	59.94	61.25	60.54	P = 0	1933
	Malawi 2010	28.75	27.98	28.39	P = 0	2990
	Niger 2006	46.72	44.65	45.68	P = 0	1587
	Rwanda 2010	15.01	16.17	15.56	P = 0	2917
	Siera Leone 2008	50.55	44.81	47.61	P = 0	1061
	Senegal 2010-2011	55.51	59.34	57.32	P = 0.15	2396
	Sao Tome and Principe 2008	51.39	47.23	49.48	P = 0	972
	Swazland 2006-07	28.25	30.37	29.19	P = 0	2161
	Tanzania 2010	42.22	40.49	41.41	P = 0	3986
	Uganda 2006	36.9	42.59	39.6	P = 0	1193
	Zimbabwe 2010-11	25.69	28.52	27.08	P = 0	3370
North Africa/West Asia/Europe	Albania 2008-09	17.91	13.92	16.31	P = 0	2387
	Armenia 2005	21.36	22.85	22.11	P = 0	2047
	Azerbaijan 2006	30.48	36.57	33.37	P = 0	2749
	Egypt 2005	44.93	40.52	41.53	P = 0	1229
	Ethipia 2011	13.41	14.08	13.69	P = 0	6640
	Jordan 2007	38.34	40.16	39.87	P = 0	703
	Lesotho 2009	21.34	28.09	24.54	P = 0	1710
	Moldova 2005	23.86	26.02	24.81	P = 0	2450
South & Southeast Asia	India 2005-06	55.68	56.57	56.1	P = 0.17	44538
	Cambodia 2010	47.83	42.77	45.49	P = 0	3374
	Nepal 2011	38.55	36.76	37.73	P = 0	2476

	Timor-Leste 2009-2010	21.46	20.7	21.13	P = 0	1710
Latin America & Caribbean	Bolivia 2008	37.71	37.67	37.7	P = 0	2106
	Guayna 2009	34.13	34.4	34.24	P = 0	1636
	Honduras 2005-2006	16.81	17.48	17.11	P = 0	7635
	Haiti 2005-06	48.69	46.87	47.91	P = 0	2322

Table A2. Prevalence of Anemia by Rural and Urban Residence among Young Women

Regions	Countries	Residence			Chi-Square Test	Total Number of Women between 15-24
		Rural	Urban	Total		
Sub-Saharan African	Burkina Faso 2003	54.61	50.41	53.53	P = 0.00	1765
	Benin 2006	61.22	61.11	61.17	P = 0.00	1818
	Congo Democratic Republic 2007	51.23	48	49.71	P = 0.00	1977
	Cameroon 2004	41.31	47.29	44.71	P = 0.00	2338
	Ghana 2008	63.78	59.25	61.52	P = 0.0999	1850
	Guinea 2005	56.21	48.61	53.23	P = 0.00	1384
	Madagascar 2008-2009	36.87	29.85	35.63	P = 0.0515	3274
	Mali 2006	64.07	55.3	60.54	P = 0.00	1933
	Malawi 2010	30	21.88	28.39	P = 0.4277	2990
	Niger 2006	47.77	38.46	45.68	P = 0.00	1587
	Rwanda 2010	15.49	15.89	15.56	P = 0.0713	2917
	Siera Leone 2008	45.64	50.37	47.61	P = 0.00	1061
	Senegal 2010-2011	54.81	59.81	57.32	P = 0.4110	2396
	Sao Tome and Principe 2008	48.04	50.66	49.48	P = 0.00	972
	Swazland 2006-07	28.12	32.99	29.19	P = 0.00	2161
	Tanzania 2010	39.97	44.66	41.41	P = 0.4908	3986
	Uganda 2006	41.22	32.37	39.6	P = 0.00	1193
	Zimbabwe 2010-11	24.68	30.91	27.08	P = 0.1316	3370
North Africa/West Asia/Europe	Albania 2008-09	18.7	12.97	16.31	P = 0.00	2387
	Armenia 2005	21.17	22.66	22.11	P = 0.00	2047
	Azerbaijan 2006	35.18	31.87	33.37	P = 0.00	2749
	Egypt 2005	42.38	39.72	41.53	P = 0.0607	1229
	Ethipia 2011	15.37	9.056	13.69	P = 0.00	6640
	Jordan 2007	35.37	40.7	39.87	P = 0.5183	703
	Lesotho 2009	23.65	26.81	24.54	P = 0.00	1710

	Moldova 2005	25.54	23.78	24.81	P = 0.00	2450
South & Southeast Asia	India 2005-06	58.05	51.89	56.1	P = 0.00	44538
	Cambodia 2010	48.22	36.62	45.49	P = 0.00	3374
	Nepal 2011	39.27	27.67	37.73	P = 0.3465	2476
	Timor-Leste 2009-2010	21.38	20.38	21.13	P = 0.00	1710
Latin America & Caribbean	Bolivia 2008	41.79	35.75	37.7	P = 0.00	2106
	Guayna 2009	34.12	34.55	34.24	P = 0.00	1636
	Honduras 2005-2006	17.96	16.37	17.11	P = 0.00	7635
	Haiti 2005-06	41.92	53.76	47.91	P = 0.7973	2322

Table A3. Percent of Women Age 15-24 with Some Anemia and Education by 34 DHS countries

Regions	Countries	Educational Attainment: Less than Primary	Primary	Some Secondary or More	Total %	Chi Square Test	Total Number of Women between 15-24
Sub-Saharan African	Burkina Faso 2003	54.19	45.15	53.66	53.53	P = 0.24	1765
	Benin 2006	62.73	52.46	58.16	61.17	P = 0.17	1818
	Congo Democratic Republic 2007	49.58	53.84	49.25	49.71	P = 0.80	1977
	Cameroon 2004	42.61	48.2	45.22	44.71	P = 0.30	2338
	Ghana 2008	62.94	70.52	60.12	61.52	P = 0.08	1850
	Guinea 2005	54.84	54.6	46.26	53.23	P = 0.0781	1384
	Madagascar 2008-2009	38.9	28.5	31.59	35.63	P = 0.0036	3274
	Mali 2006	62.36	60.62	51.77	60.54	P = 0.0361	1933
	Malawi 2010	30.59	26.87	23.86	28.39	P = 0.0158	2990
	Niger 2006	46.63	49.29	36.38	45.68	P = 0.0620	1587
	Rwanda 2010	16.39	13.18	14.6	15.56	P = 0.2283	2917
	Siera Leone 2008	45.15	44.36	52.84	47.61	P = 0.0710	1061
	Senegal 2010-2011	56.37	46.15	59.98	57.32	P = 0.0950	2396
	Sao Tome and Principe 2008	51.46	54.47	46.92	49.48	P=0.3168	972
	Swazland 2006-07	27.74	26.89	30.24	29.19	P = 0.4315	2161

	Tanzania 2010	44.72	38.75	41.76	41.41	P = 0.0244	3986
	Uganda 2006	41.83	32.89	37.01	39.6	P = 0.1735	1193
	Zimbabwe 2010-11	28.94	23.92	27.42	27.08	P = 0.3151	3370
North Africa/West Asia/Europe	Albania 2008-09	24.12	18.92	13.83	16.31	P = 0.0009	2387
	Armenia 2005		25.63	22.1	22.11	P = 0.8615	2047
	Azerbaijan 2006	46.36	42.16	32.89	33.37	P = 0.0320	2749
	Egypt 2005	40.55	42.95	41.99	41.53	P = 0.0020	1229
	Ethipia 2011	15.13	8.017	9.355	13.69	P = 0.0002	6640
	Jordan 2007	49.39	4.874	39.92	39.8	P = 0.0000	703
	Lesotho 2009	21.64	23.55	25.91	24.54	P = 0.3473	1710
	Moldova 2005		27.04	24.8	24.81	P = 0.8690	2450
South & Southeast Asia	India 2005-06	63.16	58.23	52.03	56.18	P = 0.0000	44538
	Cambodia 2010	50.04	52.41	41.42	45.49	P = 0.0001	3374
	Nepal 2011	41.77	30.02	36.84	37.73	P = 0.0669	2476
	Timor-Leste 2009-2010	19.64	24.69	21.35	21.13	P = 0.4839	1710
Latin America & Caribbean	Bolivia 2008	36.98	36.3	38.08	37.7	P = 0.8931	2106
	Guayna 2009	36.28	35.08	34.04	34.24	P = 0.9227	1636
	Honduras 2005-2006	19.51	17.28	15.72	17.11	P = 0.0156	7635
	Haiti 2005-06	45.82	49.93	49.62	47.91	P = 0.3863	2322

Table A4. Prevalence of Anemia by Household Wealth among Young Women

Regions	Countries	Household Wealth						Chi-Square Test	Total Number of Women between 15-24
		Poorest	Poorer	Middle	Richer	Richest	Total		
Sub-Saharan African	Burkina Faso 2003	57.63	51.95	53.43	58.55	49.71	53.53	P = 0.2451	1765
	Benin 2006	64.11	61	61.09	61.09	59.85	61.17	P = 0.8917	1818
	Congo Democratic Republic 2007	47.33	57.79	48.78	42.78	52.16	49.71	P = 0.1301	1977
	Cameroon 2004	42.63	42.03	43.96	45.63	47.42	44.71	P = 0.5436	2338
	Ghana 2008	62.34	63.7	61.91	63.33	56.86	61.52	P = 0.4414	1850
	Guinea 2005	61.72	56.25	53.87	46.57	51.25	53.23	P = 0.0169	1384
	Madagascar 2008-2009	45.86	40.75	35.16	28.42	30.49	35.63	P = 0.0000	3274
	Mali 2006	63.63	63.6	64.84	61.06	54.3	60.54	P = 0.2147	1933
	Malawi 2010	34.08	27.42	30.72	29.18	23.01	28.39	P = 0.0162	2990
	Niger 2006	46.74	48.5	52.82	43.32	38.95	45.68	P = 0.0244	1587
	Rwanda 2010	16.26	16.45	15.17	15.14	15.03	15.56	P = 0.9495	2917
	Siera Leone 2008	47.04	42.65	45.85	49.35	50.69	47.61	P = 0.6468	1061
	Senegal 2010-2011	57.37	56.5	57.04	57.1	58.3	57.32	P = 0.9878	2396
	Sao Tome and Principe 2008	54.8	54.23	49.38	48.39	42.99	49.48	P = 0.3052	972
	Swazland 2006-07	24.32	25.21	31.89	33	29.66	29.19	P = 0.0546	2161
	Tanzania 2010	42.84	40.37	38.63	40.56	44.13	41.41	P = 0.4460	3986
	Uganda 2006	48.72	42.22	41.75	40.41	30.93	39.6	P = 0.0151	1193

	Zimbabwe 2010-11	24.12	26.31	24.28	32.53	26.93	27.08		3370
North Africa/West Asia/Europe	Albania 2008-09	18.13	19.49	18.5	14.05	10.88	16.31	0.0165	2387
	Armenia 2005	23.4	22.16	17.14	25.16	22.91	22.11	P = 0.2620	2047
	Azerbaijan 2006	36.63	40.89	31.06	28.46	30.19	33.37	P = 0.0120	2749
	Egypt 2005	43.15	40.17	43.24	41.51	38.52	41.53	P = 0.0001	1229
	Ethipia 2011	17.1	15.81	15.41	12.99	9.927	13.69	P = 0.0026	6640
	Jordan 2007	38.9	42.35	42.75	32.63	36.59	39.87	P = 0.0000	703
	Lesotho 2009	18.89	20.19	23.88	26.53	30.08	24.54	P = 0.0496	1710
	Moldova 2005	27.67	25.37	23.99	25.67	22.06	24.81	P = 0.3935	2450
South & Southeast Asia	India 2005-06	65.19	60.35	56.43	53.58	46.87	56.18	P = 0.0000	44538
	Cambodia 2010	57.81	47.15	51.73	42.75	34.67	45.49	P = 0.0000	3374
	Nepal 2011	35.46	36.44	41.18	38.52	36.26	37.73	P = 0.6942	2476
	Timor-Leste 2009-2010	20.01	21.67	20.76	19.32	23.83	21.13	P = 0.7003	1710
Latin America & Caribbean	Bolivia 2008	42.85	42.89	39.32	36.9	30.2	37.7	P = 0.0067	2106
	Guayna 2009	40.86	36.02	32.47	35.05	27.66	34.24	P = 0.0591	1636
	Honduras 2005-2006	18.78	17.07	16.89	16.92	16.46	17.11	P = 0.7380	7635
	Haiti 2005-06	35.99	38.81	50.05	51.86	53.66	47.91	P = 0.0001	2322

Works Cited

Asobayire, F., Adou, P., Davidsson, L. ,., & Hurrell, R. (2001). Prevalence of iron deficiency with and without concurrent anemia in population groups with high prevalences of malaria and other infections: a study in Côte d'Ivoire. *The American Journal of Clinical Nutrition, 74*(6), 776-82.

Ayoya, M., Spiekermann-Brouwer, G., Traoré, A., Stoltzfus, R., & Garza, C. (2006). Determinants of anemia among pregnant women in Mali. *Food and Nutrition Bulliten, 27*(1), 3-11.

Benoist, B. d., McLean, E., Egll, I., & Cogswell, M. (2008). *Worldwide prevalence of anaemia 1993-2005: WHO global database on anaemia.* WHO.

Bentley, M., & Griffiths, P. (2002). The burden of anemia among women in India. *The American Journal of Clinical Nutrition, 57*(1), 52-60.

Crawley, J. (2004). Reducing the Burden of Anemia in Infants and Young Children in Malaria-Endemic Countries of Africa: from Evidence to Action. *71*(Suppl 2), 25-34.

Gardner, G., Edgerton, V., Senewiratne, B., Barnard, R., & Ohira, Y. (1977). Physical work capacity and metabolic stress in subjects with iron deficiency anemia. *The American Journal of Clinical Nutrition, 30*(6), 910-7.

ICF International. *Anemia*. Retrieved 9 21, 2012, from Measure DHS Demographic and Health Survey: http://www.measuredhs.com/topics/Anemia.cfm

ICF International . *DHS Overview*. Retrieved 9 21, 2012, from Measure DHS Demographic and Health Survey: http://www.measuredhs.com/What-We-Do/Survey-Types/DHS.cfm

ICF International. *Wealth Index*. Retrieved 9 21, 2012, from Measure DHS Demographic and Health Surveys: http://www.measuredhs.com/topics/Wealth-Index.cfm

Lutter, C. (2008). Iron deficiency in young children in low-income countries and new approaches for its prevention. *The Journal of Nutrition, 138*(12), 2523-8.

Mukuri, Altrena, Aboulafia, C., & Themme, A. (2005). *The Context of Women's Health:Results from the Demographic and Health Surveys, 1994-2001.Comparative Reports No. 11.* Calverton, Maryland: ORC Macro.

Stoltzfus, R., Chwaya, H., Tielsch, J., Schulze, K., Albonico, M., & Savioli, L. (1997). Epidemiology of iron deficiency anemia in Zanzibari schoolchildren: the importance of hookworms. *The American Journal of Clinical Nutrition, 65*(1), 153-9.

WHO. (2001). Iron Deficiency Anaemia Assessment, Prevention, and Control:A guide for programme managers.

Zimmermann, M., & Hurrell, R. (2007). Nutritional iron deficiency. *Lancet, 370*(9576), 511-20.