

Supplemental materials for the manuscript “A multivariate decomposition analysis of the determinants of infant and under-five mortality rates in Ghana: Evidence from 2003, 2008 and 2014 Demographic and Health Surveys”

Table S1: Summary of Ghana Demographic and Health Survey data sets included in the analysis.

Survey year	The reference period for five-year mortality estimates	Women response rate	Number of women age 15-49 years interviewed	The population of women aged 15-49 years at the time of the survey	Number of live births, five years preceding the interview
2003	1999-2003	95.7	5691	4170068	3844
2008	2004-2008	96.5	4916	4891557	2992
2014	2010-2014	97.3	9396	5655156	5884

Table S2: The trend in select characteristics of the household that could have influenced Infant mortality, among children born in the five years preceding the survey, Ghana 2003, 2008, and 2014.

Characteristics of the households	2003 GDHS	2008 GDHS	2014 GDHS	Overall
	%	%	%	%
<b>Sex of household head</b>				
Male	73.3	72.4	74.3	73.4
Female	26.7	27.6	25.7	26.6
<b>Age of household head [Mean ± SD]</b>	41.5 ± 13.8	39.7 ± 12.7	39.6 ± 12.0	40.2 ± 12.8
<b>Place</b>				
Urban	33.1	37.9	45.0	39.2
Rural	66.9	62.1	55.0	60.8
<b>Region</b>				
Western	10.1	9.3	10.1	9.8
Central	8.4	10.1	10.9	9.9
Greater Accra Central	10.7	11.9	15.5	12.9
Volta	8.2	8.4	7.7	8.1
Eastern	10.0	8.8	9.4	9.3
Ashanti	18.8	18.7	18.7	18.7
Brong Ahafo	11.0	9.3	8.7	9.6
Northern	13.7	15.7	12.5	13.9
Upper East	5.9	5.1	4.0	4.9
Upper West	3.2	2.8	2.7	2.9
<b>Wealth</b>				
Poorest	25.9	25.6	22.2	24.4
Poorer	22.2	22.0	21.0	21.7
Middle	19.8	18.9	19.6	19.4
Richer	16.9	19.3	18.9	18.4
Richest	15.1	14.3	18.4	16.1
<b>Household</b>				
<5 residents	34.1	37.1	37.2	36.2
5-7 residents	43.6	43.4	46.2	44.5
8+ residents	22.3	19.6	16.6	19.2
<b>Household access to an improved water source</b>				
Improved	75.9	86.0	89.5	84.3
Not improved	24.1	14.0	10.5	15.7
<b>Household access to improved toilet</b>				
Improved not shared	9.6	7.5	11.5	9.6
Improved shared	59.2	53.1	55.2	55.7
Not improved	29.6	38.2	33.0	33.7
Missing	1.6	1.2	0.3	1.0

% represents column percentages, SD: Standard deviation.

Table S3: The trend in select characteristics of the mother that could have influenced Infant mortality, among children born in the five years preceding the survey, Ghana 2003, 2008, and 2014

Characteristics of the mother	2003 GDHS	2008 GDHS	2014 GDHS	Overall
	%	%	%	%
<b>Mother's age at child's birth</b>				
Mean ± SD	30.4 ± 7.1	30.0 ± 7.0	30.5 ± 6.8	30.3 ± 6.9
<18	26.2	26.1	24.3	25.5
18 - 34	73.5	73.6	75.1	74.1
35 +	0.3	0.3	0.6	0.4
<b>Marital status</b>				
Never married	3.0	4.9	7.7	5.4
Currently married	90.2	89.5	85.7	88.2
Formerly married	6.8	5.6	6.7	6.4
<b>Educational attainment</b>				
None	40.3	32.7	27.4	32.9
Primary	23.2	24.8	20.0	22.5
Secondary	35.4	40.1	48.1	41.8
Tertiary	1.1	2.4	4.5	2.8
<b>Body mass index</b>				
Underweight	8.2	7.1	2.3	5.6
Normal	64.5	63.2	28.2	50.2
Overweight	15.8	21.0	13.1	16.5
Obese	6.9	7.4	7.6	7.4
Missing	4.6	1.3	48.7	20.3

% represents column percentages, SD: Standard deviation

Table S4: The trend in select characteristics of the child that could have influenced infant mortality, among children born in the five years preceding the survey, Ghana 2003, 2008, and 2014

Characteristics of the child	2003 GDHS	2008 GDHS	2014 GDHS	Overall
	%	%	%	%
<b>Age in years [Mean ± SD]</b>	2.2 ± 1.5	2.3 ± 1.5	2.3 ± 1.5	2.3 ± 2.3
<b>Sex of child</b>				
Male	50.6	51.9	52.2	51.6
Female	49.4	48.1	47.8	48.4
<b>Birth type</b>				
Single birth	96.0	95.7	94.9	95.5
Multiple births	4.0	4.3	5.1	4.5
<b>Birth order</b>				
First	22.5	23.7	24.0	23.5
Second	19.4	21.1	21.0	20.5
Third	15.5	17.0	17.3	16.7
Fourth or higher	42.6	38.3	37.7	39.3
<b>Preceding birth interval</b>				
< 2 years	10.5	10.7	9.9	10.3
2 years	23.5	20.9	22.9	22.4
3+ years	43.1	44.7	42.9	43.5
Missing	22.9	23.8	24.4	23.7

% represents column percentages, SD: Standard deviation

Table S5: The trend in coverage of recommended maternal and delivery care, and other interventions that could have influenced Infant mortality, among children born in the five years preceding the survey, Ghana 2003, 2008, and 2014

	2003 GDHS	2008 GDHS	2014 GDHS	Overall
	%	%	%	%
<b>RECOMMENDED MATERNAL AND DELIVERY CARE</b>				
<b>Number of ANC visits attended<sup>1</sup></b>				
None	4.6	2.5	1.9	2.9
1 – 3 times	15.0	11.6	7.0	10.9
4 + times	50.4	56.4	63.5	57.3
Missing	30.0	29.5	27.7	28.9
<b>Mother received tetanus injections</b>				
None	10.4	8.0	7.8	8.7
One	24.0	22.7	22.9	23.2
Two or more	36.6	40.5	41.5	39.7
Missing	29.0	28.7	27.8	28.4
<b>Delivered in health facility<sup>2</sup></b>				
No	53.4	42.0	26.6	39.5
Yes	45.6	57.1	73.0	59.8
Missing	1.0	0.9	0.4	0.7
<b>OTHER INTERVENTIONS RELEVANT TO UNDER-FIVE SURVIVAL</b>				
<b>Mother has health insurance<sup>3</sup></b>				
No	n/a	3.3	8.5	4.3
Yes, card seen	n/a	24.4	38.9	22.7
Yes, card not seen	n/a	10.0	20.0	10.9
Missing	n/a	62.3	32.6	62.2
<b>Household owns a mosquito net<sup>3</sup></b>				
No	75.5	28.5	19.1	38.9
Yes	24.5	71.5	80.9	61.1
<b>Mother slept under a net previous night<sup>3</sup></b>				
No	84.8	56.0	49.4	62.0
Yes	15.2	44.0	50.6	38.0
<b>Number of children slept under mosquito net previous net</b>				
None	83.8	53.8	49.3	61.0
One or more	16.2	46.2	50.7	39.0

% represents column percentages, SD: Standard deviation, n/a: not applicable

Table S6\_1: Infant mortality rate [IMR] in the five years preceding the survey and the difference in IMR between surveys, by selected characteristics of the household, Ghana 2003, 2008, and 2014

Characteristics of the households	2003 GDHS Ref. period:		2008 GDHS Ref. period:		2014 GDHS Ref. period:		The difference in IMR between surveys		
	IMR [95% CI]	P-value	IMR [95% CI]	P-value	IMR [95% CI]	P-value	2003 - 2008	2003 - 2014	2008 - 2014
<b>Sex of household head</b>		0.069		0.995		0.143			
Male	61.5[53.2-71.1]		55.9[46.7-66.7]		41.9[36.3-48.4]		-5.6	-19.6***	-14.0*
Female	76.4[60.3-96.5]		59.0[43.9-79.0]		52.4[41.6-66.1]		-17.4**	-24.0**	-6.6
<b>Place</b>		0.124		0.840		0.906			
Urban	54.6[42.1-70.7]		60.1[46.5-77.6]		45.3[37.4-54.9]		5.5	-9.3**	-14.8
Rural	68.9[59.8-79.2]		55.0[45.5-66.4]		43.8[37.4-51.4]		-13.9**	-25.1***	-11.2
<b>Region</b>		0.109		<0.001***		0.001**			
Western	73.4[49.8-107.6]		36.2[19.0-68.5]		31.0[19.4-49.4]		-37.2*	-42.4**	-5.2
Central	78.4[50.1-121.7]		63.8[37.5-107.4]		44.0[29.9-64.5]		-14.6	-34.4	-19.8
Greater Accra	43.3[25.9-72.0]		54.6[32.7-90.5]		23.2[12.6-42.7]		11.3	-20.1	-31.4
Volta	76.8[50.2-116.6]		26.2[11.9-57.4]		41.7[26.8-64.5]		-50.6***	-35.1**	15.5
Eastern	63.5[40.9-97.8]		53.9[31.6-91.1]		57.1[40.0-81.1]		-9.6	-6.4	3.2
Ashanti	76.6[57.2-102.3]		55.9[37.5-83.0]		61.5[44.6-84.7]		-20.7	-15.1	5.6
Brong Ahafo	62.4[43.2-89.7]		31.8[16.0-62.7]		33.6[22.0-51.1]		-30.6	-28.8*	1.8
Northern	63.5[46.4-86.6]		79.3[57.5-108.7]		53.9[40.4-71.9]		15.8	-9.6	-25.4
Upper East	36.6[19.8-66.9]		33.2[1.06-68.6]		29.8[18.0-49.0]		-3.4	-6.8	-3.4
Upper West	70.1[47.5-102.8]		103.6[73.1-145.7]		61.7[43.3-87.6]		33.5	-8.4**	-41.9*
<b>Wealth</b>		0.672		0.457		0.853			
Poorest	60.3[48.2-75.3]		59.1[45.6-76.5]		45.6[36.8-56.5]		-1.2	-14.7*	-13.5
Poorer	62.4[47.7-81.6]		43.2[29.6-62.8]		44.9[34.6-58.1]		-19.2**	-17.5**	1.7
Middle	83.9[64.7-108.4]		69.1[49.4-96.4]		40.8[30.2-55.1]		-14.8	-43.1**	-28.3*
Richer	58.5[41.2-82.6]		61.2[42.6-87.5]		45.0[32.8-61.6]		2.7	-13.5	-16.2
Richest	62.9[44.1-89.3]		50.9[31.9-80.6]		45.2[32.0-63.6]		-12	-17.7*	-5.7
<b>Household</b>		0.108		0.097		<0.001***			
<5 residents	77.5[63.4-94.5]		62.9[49.2-80.3]		56.2[46.8-67.5]		-14.6	-21.3**	-6.7
5-7 residents	62.4[51.5-75.5]		53.2[41.9-67.3]		32.5[26.2-40.1]		-9.2**	-29.9***	-20.7*
8+ residents	53.6[40.6-70.5]		53.9[38.4-75.4]		51.8[39.9-67.1]		0.3	-1.8	-2.1
<b>Household access to improved water source</b>		0.609		0.770		0.929			
Improved	62.6[54.1-72.4]		58.2[49.4-68.4]		44.5[39.1-50.7]		-4.4*	-18.1***	-13.7*
Not improved	72.2[56.9-91.3]		48.2[31.4-73.8]		43.7[30.6-62.3]		-24.0	-28.5**	-4.5
<b>Household access to improved toilet</b>		0.020*		0.866		0.579			
Improved not shared	85.0[58.6-122.4]		68.3[41.0-112.6]		43.0[29.0-63.5]		-16.7	-42.0**	-25.3
Improved shared	59.3[49.5-71.1]		58.9[47.3-73.2]		46.2[38.9-54.9]		-0.4	-13.1**	-12.7*
Not improved	64.1[52.5-78.3]		53.1[41.9-67.1]		42.3[34.7-51.6]		-11.0*	-21.8***	-10.8
<b>Overall</b>	65.0[57.4-73.5]		56.7[48.7-66.0]		44.4[39.3-50.2]		-8.3 *	-20.6***	-12.3***

p-value notation: \*\*\*p<0.001, \*\*p<0.01, \*p<0.05. CI: Confidence interval

Table S6\_2: Infant mortality rate [IMR] in the five years preceding the survey and the difference in IMR between surveys, by selected characteristics of the mother, Ghana 2003, 2008, and 2014

Characteristics of mother	2003 GDHS		2008 GDHS		2014 GDHS		The difference in IMR between surveys		
	IMR [95% CI]	P-value	IMR [95% CI]	P-value	IMR [95% CI]	P-value	2003 - 2008	2003 - 2014	2008 - 2014
<b>Mother's age at child's birth</b>		0.014*		0.867		0.748			
< 18	78.4[63.2 - 97.1]		51.3[37.6 - 69.9]		42.4[32.9 - 54.5]		-27.1**	-36***	-8.9
18 - 34	59.8[51.3 - 69.5]		58.4[49.0 - 69.6]		44.9[38.9 - 51.7]		-1.4	-14.9***	-13.5
35+	105.3[15.5 - 546.3]		111.1[16.4 - 567.0]		90.8[23.3 - 318.7]		5.8	-14.5	-20.3
<b>Marital status</b>		0.537		0.148		0.118			
Never married	75.6[36.7 - 152.2]		24.9[8.1 - 75.2]		63.4[42.6 - 94.0]		-50.7*	-12.2	38.5
Currently married	63.9[56.1 - 72.8]		57.5[49.0 - 67.4]		42.7[37.3 - 48.8]		-6.4*	-21.2***	-14.8**
Formerly married	75.4[47.5 - 118.6]		69.0[37.7 - 124.4]		47.3[29.7 - 75.1]		-6.4	-28.1	-21.7
<b>Educational attainment</b>		0.034*		0.071		0.123			
None	62.8[52.3 - 75.5]		60.4[47.6 - 76.5]		48.2[39.4 - 58.8]		-2.4	-14.6**	-12.2
Primary	83.3[65.9 - 105.0]		57.0[41.7 - 77.5]		38.1[28.4 - 51.1]		-26.3	-45.2**	-18.9
Secondary	55.7[43.6 - 71.1]		55.0[42.4 - 71.3]		43.0[35.4 - 52.3]		-0.7	-12.7**	-12.0
Tertiary	51.3[13.1 - 189.8]		16.0[2.3 - 108.2]		59.6[34.2 - 102.7]				
<b>Body mass index</b>		0.857		0.326		0.135			
Underweight	68.7[45.4 - 103.5]		67.6[40.6 - 111.6]		55.0[27.8 - 107.0]		-1.1	-13.7	-12.6
Normal	65.0[55.9 - 75.6]		56.0[46.3 - 67.6]		35.0[27.1 - 45.0]		-9.0**	-30.0***	-21.0*
Overweight	61.9[44.1 - 86.4]		47.3[32.2 - 69.3]		60.8[45.0 - 82.0]		-14.6	-1.1	13.5
Obese	63.6[37.4 - 107.0]		74.0[44.4 - 121.9]		45.7[28.3 - 73.5]		10.4	-17.9	-28.3
<b>Overall</b>	65.0[57.4-73.5]		56.7[48.7-66.0]		44.4[39.3-50.2]		-8.3 *	-20.6***	-12.3***

p-value notation: \*\*\*p<0.001, \*\*p<0.01, \*p<0.05. CI: Confidence interval

Table S6\_3: Infant mortality rate [IMR] in the five years preceding the survey and the difference in IMR between surveys, by selected characteristics of the child, Ghana DHS 2003, 2008, and 2014

Characteristics of the child	2003 GDHS		2008 GDHS		2014 GDHS		The difference in IMR between surveys		
	IMR [95% CI]	P-value	IMR [95% CI]	P-value	IMR [95% CI]	P-value	2003 - 2008	2003 - 2014	2008 - 2014
<b>Sex of Child</b>		0.630		0.458		0.204			
Male	72.2[61.2 - 85.1]		60.4[49.1 - 74.2]		47.0[39.8 - 55.4]		-11.8	-25.2***	-13.4
Female	57.5[47.6 - 69.3]		52.8[42.1 - 66.1]		41.6[34.6 - 50.0]		-4.7*	-15.9***	-11.2
<b>Birth type</b>		<0.001***		<0.001***		<0.001***			
Single birth	58.5[51.2 - 66.8]		52.2[44.3 - 61.4]		37.8[33.0 - 43.4]		-6.3**	-20.7***	-14.4**
Multiple Births	222.5[162.8 - 299.9]		153.8[101 - 230.6]		169.3[130.0 - 218.9]		-68.7	-53.2*	15.5
<b>Birth order</b>		0.410		0.062		0.132			
First	69.2[53.6 - 89.2]		58.1[42.4 - 79.3]		45.2[35.0 - 58.2]		-11.1	-24.0**	-12.9
Second	49.0[35.1 - 68.3]		35.3[22.9 - 54.2]		37.4[27.6 - 50.4]		-13.7	-11.6	2.1
Third	67.4[49.3 - 91.9]		54.0[36.8 - 78.9]		37.5[27.1 - 51.9]		-13.4	-29.9*	-16.5
Fourth or higher	68.7[57.3 - 82.3]		68.2[54.8 - 84.8]		50.4[42.1 - 60.5]		-0.5	-18.3***	-17.8
<b>Birth interval</b>		<0.001***		0.041*		0.047*			
< 2 years	132.4[102.2 - 170.5]		87.0[60.1 - 125.3]		62.1[44.3 - 86.7]		-45.4	-70.3**	-24.9
2 years	54.7[41.4 - 72.2]		53.5[38.1 - 74.9]		44.1[34.0 - 57.1]		-1.2	-10.6	-9.4
3+ years	52.3[42.3 - 64.5]		50.5[39.5 - 64.3]		39.7[32.6 - 48.2]		-1.8	-12.6***	-10.8*
<b>Overall</b>	65.0[57.4 - 73.5]		56.7[48.7 - 66.0]		44.4[39.3 - 50.2]		-8.3 *	-20.6***	-12.3***

p-value notation: \*\*\*p<0.001, \*\*p<0.01, \*p<0.05. CI: Confidence interval

Table S6\_4: Infant mortality rate [IMR] in the five years preceding the survey and the difference in IMR between surveys, by use of selected recommended mother's and delivery care services and other relevant interventions, Ghana 2003, 2008, and 2014.

RECOMMENDED MATERNAL AND DELIVERY CARE	2003 GDHS		2008 GDHS		2014 GDHS		The difference in IMR between surveys		
	IMR [95% CI]	P-value	IMR [95% CI]	P-value	IMR [95% CI]	P-value	2003 - 2008	2003 - 2014	2008 - 2014
<b>Number of ANC visits attended<sup>1</sup></b>		0.623		0.271		0.049*			
None	41.1[20.8 - 80.6]		39.2[12.8 - 116.7]		61.7[29.8 - 125.5]		-1.9	20.6	22.5
1 - 3 times	34.4[21.5 - 54.8]		45.4[27.0 - 75.7]		21.0[10.5 - 41.7]		11.0	-13.4**	-24.4*
4 + times	45.7[36.9 - 56.6]		32.7[24.7 - 43.1]		25.3[20.5 - 31.2]		-13.0**	-20.4***	-7.4
<b>Mother received tetanus injections<sup>1</sup></b>		0.921		0.952		0.310			
None	42.6[26.7 - 67.8]		25.3[11.5 - 55.5]		37.3[23.0 - 60.2]		-17.3	-5.3	12.0
One	46.4[34.0 - 63.3]		33.5[21.7 - 51.6]		26.1[18.5 - 36.7]		-12.9	-20.3**	-7.4
Two or more	41.6[31.9 - 54.1]		39.6[29.4 - 53.3]		22.8[17.4 - 30.0]		-2.0*	-18.8***	-16.8
<b>Delivered in health facility<sup>2</sup></b>		0.791		0.387		0.165			
No	61.7[52.1 - 73.0]		56.1[44.7 - 70.3]		45.6[36.5 - 56.7]		-5.6	-16.1**	-10.5
Yes	61.9[50.9 - 75.3]		54.7[44.2 - 67.6]		43.1[37.1 - 50.1]		-7.2*	-18.8***	-11.6
<b>Household owns a mosquito net<sup>3</sup></b>		0.302		0.039*		0.530			
No	68.0[59.0 - 78.3]		70.7[54.3 - 91.8]		41.2[30.5 - 55.6]		2.7	-26.8***	-29.5**
Yes	56.8[44.0 - 73.2]		51.6[42.8 - 62.1]		45.1[39.4 - 51.6]		-5.2	-11.7**	-6.5
<b>Mother slept under a net previous night<sup>3</sup></b>		0.188		0.003**		0.832			
No	67.8[59.3 - 77.4]		71.6[59.5 - 86.0]		42.1[35.0 - 50.6]		3.8	-25.7***	-29.5***
Yes	50.8[36.0 - 71.5]		39.8[30.4 - 51.9]		46.5[39.4 - 54.8]		-11.0*	-4.3	6.7
<b>Number of children slept under mosquito net previous net</b>		0.002**		<0.001***		<0.001***			
None	69.9[61.3 - 79.7]		78.5[65.7 - 93.7]		56.9[48.6 - 66.6]		8.6	-13.0***	-21.6**
One or more	41.7[28.8 - 60.2]		32.9[24.6 - 44.0]		33.2[27.3 - 40.4]		-8.8	-8.5	0.3
<b>Overall</b>	65.0[57.4 - 73.5]		56.7[48.7 - 66.0]		44.4[39.3 - 50.2]		-8.3 *	-20.6***	-12.3***

p-value notation: \*\*\*p<0.001, \*\*p<0.01, \*p<0.05. CI: Confidence interval



Table S7\_1: Under-five mortality rate [U5MR] in the five years preceding the survey and the difference in U5MR between surveys, by selected characteristics of the household, Ghana 2003, 2008, and 2014.

Characteristics of the households	2003 GDHS Ref. period:		2008 GDHS Ref. period:		2014 GDHS Ref. period:		The difference in U5MR between surveys		
	U5MR [95% CI]	P-value	U5MR [95% CI]	P-value	U5MR [95% CI]	P-value	2003 - 2008	2003 - 2014	2008 - 2014
<b>Sex of household head</b>		0.069		0.995		0.143			
Male	104.1[89.2-121.4]		83.9[70.1-100.3]		57.3[49.5-66.3]		-20.2	-46.8***	-26.6*
Female	121.7[98.4-150.1]		81.4[61.4-107.4]		74.7[57.2-97.2]		-40.3**	-47.0**	-6.7
<b>Place</b>		0.124		0.840		0.906			
Urban	100.5[76.2-132.0]		87.5[66.3-115.1]		60.5[49.1-74.4]		-13.0	-40.0**	-27.0
Rural	110.6[96.1-127.1]		81.3[67.8-97.4]		62.3[52.7-73.6]		-29.3**	-48.3***	-19.0
<b>Region</b>		0.109		<0.001***		0.001**			
Western	133.5[89.1-197.5]		41.4[22.4-75.9]		36.1[22.2-58.5]		-92.1*	-97.4**	-5.3
Central	92.4[60.1-140.8]		138.6[78-239.6]		66.3[45.5-96.3]		46.2	-26.1	-72.3
Greater Accra Central	96.8[62.2-149.0]		59.5[36.2-97.0]		32.4[18.9-55.5]		-37.3	-64.4	-27.1
Volta	129.2[84.4-195.3]		34.5[16.1-73.0]		52.2[34.3-79.0]		-94.7***	-77.0**	17.7
Eastern	80.4[53.1-121.0]		69.8[43.2-111.9]		73.4[46.8-114.2]		-10.6	-7.0	3.6
Ashanti	103.5[74.0-143.7]		71.5[48.7-104.4]		83.1[56.2-122.1]		-32.0	-20.4	11.6
Brong Ahafo	101.6[66.2-154.3]		57.5[32.4-101.0]		47.1[30.9-71.6]		-44.1	-54.5*	-10.4
Northern	111.2[84.8-145.1]		119.7[90.3-157.8]		91.9[68.6-122.6]		8.5	-19.3	-27.8
Upper East	68.6[29.2-156.5]		69.3[31.4-149.4]		36.7[22.7-59.2]		0.7	-31.9	-32.6
Upper West	150.9[111.2-203.0]		144.3[103.3-199.6]		74.7[53.3-104.1]		-6.6	-76.2**	-69.6*
<b>Wealth</b>		0.672		0.457		0.853			
Poorest	115.7[93.7-142.5]		92.5[71.9-118.7]		61.7[50.5-75.3]		-23.2	-54.0*	-30.8
Poorer	109.6[84.4-141.8]		67.7[48.3-94.7]		73.1[54.6-97.4]		-41.9**	-36.5**	5.4
Middle	110.6[84.8-143.7]		92.3[66.9-126.7]		63.4[45.5-88.1]		-18.3	-47.2**	-28.9*
Richer	86.5[63.1-118.1]		88.1[56.6-135.7]		52.7[38.8-71.2]		1.6	-33.8	-35.4
Richest	108.5[67.4-172.3]		66.5[43.7-100.6]		47.0[33.5-65.9]		-42.0	-61.5*	-19.5
<b>Household</b>		0.108		0.097		<0.001***			
<5 residents	116.7[97.1-140.0]		102.9[80.3-131.4]		87.9[70.5-109.2]		-13.8	-28.8**	-15.0
5-7 residents	102.3[84.0-124.4]		71.6[56.0-91.4]		43.5[35.6-53.1]		-30.7**	-58.8***	-28.1*
8+ residents	106.8[79.4-142.9]		76.9[56.5-104.4]		60.9[47.3-78.3]		-29.9	-45.9	-16.0
<b>Household access to improved water source</b>		0.609		0.770		0.929			
Improved	107.0[92.3-123.9]		82.0[70.0-96.0]		60.8[53.0-69.7]		-25.0*	-46.2***	-21.2*
Not improved	111.3[87.0-142.0]		92.6[57.2-148.1]		66.9[44.6-99.7]		-18.7	-44.4**	-25.7
<b>Household access to improved sanitation</b>		0.020*		0.866		0.579			
Improved not shared	189.7[120.6-291.5]		81.2[50.4-129.5]		43.0[29.0-63.5]		-108.5	-146.7**	-38.2
Improved shared	85.0[70.7-102.0]		86.5[69.0-108.3]		58.8[48.9-70.6]		1.5	-26.2**	-27.7*
Not improved	118.9[98.7-143.0]		81.5[64.9-102.1]		68.2[55.6-83.5]		-37.4*	-50.7***	-13.3
<b>Overall</b>	108.1[95.2-122.6]		83.3[71.5-96.8]		61.6[54.1-70.1]		-24.8 *	-46.5***	-21.7***

p-value notation: \*\*\*p<0.001, \*\*p<0.01, \*p<0.05.

Table S7\_2: Under-five mortality rate [U5MR] in the five years preceding the survey and the difference in U5MR between surveys, by selected characteristics of the mother, Ghana 2003, 2008, and 2014.

Characteristics of mother	2003 GDHS		2008 GDHS		2014 GDHS		Difference in U5MR between surveys		
	U5MR [95% CI]	P-value	U5MR [95% CI]	P-value	U5MR [95% CI]	P-value	2003 - 2008	2003 - 2013	2008 - 2013
<b>Mother's age at child's birth</b>		0.014*		0.867		0.748			
< 18	152.8[119.9 - 193.8]		83.1[63.3 - 108.7]		60.0[45.8 - 78.5]		-69.7**	-92.8***	-23.1
18 - 34	91.3[79.5 - 104.8]		83.0[69.1 - 99.5]		62.0[53.4 - 71.9]		-8.3	-29.3***	-21.0
35+	105.3[15.5 - 546.3]		111.1[16.4 - 567.0]		90.8[23.3 - 318.7]		5.8	-14.5	-20.3
<b>Marital status</b>		0.537		0.148		0.118			
Never married	175.0[83.1 - 347.3]		24.9[8.1 - 75.2]		106.6[57.6 - 192.9]		-150.1*	-68.4	81.7
Currently married	104.0[91.1 - 118.5]		85.1[72.7 - 99.6]		57.4[49.9 - 66.0]		-18.9*	-46.6***	-27.7**
Formerly married	139.1[85.3 - 222.6]		93.1[52.3 - 163.2]		77.9[51.8 - 116.4]		-46.0	-61.2	-15.2
<b>Educational attainment</b>		0.034*		0.071		0.123			
None	121.7[101.1 - 146.1]		94.8[75.6 - 118.6]		74.1[61.0 - 89.9]		-26.9	-47.6**	-20.7
Primary	119.2[96.0 - 147.4]		102.9[75.3 - 140]		59.8[43.4 - 82.3]		-16.3	-59.4**	-43.1
Secondary	80.1[61.1 - 104.7]		60.9[47.3 - 78.2]		51.5[41.4 - 64.1]		-19.2	-28.6**	-9.4
Tertiary	51.3[13.1 - 189.8]		16.0[2.3 - 108.2]		59.6[34.2 - 102.7]				
<b>Body mass index</b>		0.857		0.326		0.135			
Underweight	125.1[72.3 - 211.7]		108[58.2 - 195.7]		55.0[27.8 - 107.0]		-17.1	-70.1	-53.0
Normal	111.6[95.5 - 130.2]		79.5[66.7 - 94.7]		59.3[45.0 - 77.8]		-32.1**	-52.3***	-20.2
Overweight	88.7[65.2 - 120.2]		66.4[47.1 - 93.2]		71.9[53.3 - 96.6]		-22.3	-16.8	5.5
Obese	107.2[64.6 - 175.0]		141.3[78.7 - 246.7]		49.1[30.8 - 77.9]		34.1	-58.1	-92.2
<b>Overall</b>	108.1[95.2-122.6]		83.3[71.5-96.8]		61.6[54.1-70.1]		-24.8 *	-46.5***	-21.7***

p-value notation: \*\*\*p<0.001, \*\*p<0.01, \*p<0.05.

Table S7\_3: Under-five mortality rate [U5MR] in the five years preceding the survey and the difference in U5MR between surveys, by selected characteristics of the child, Ghana 2003, 2008, and 2014

Characteristics of the child	2003 GDHS Ref. period:		2008 GDHS Ref. period:		2014 GDHS Ref. period:		Difference in U5MR between surveys		
	U5MR [95% CI]	P-value	U5MR [95% CI]	P-value	U5MR [95% CI]	P-value	2003 - 2008	2003 - 2014	2008 - 2014
<b>Sex of Child</b>		0.630		0.458		0.204			
Male	104.2[87.4 - 124.0]		86.8[70.5 - 106.5]		67.0[56.1 - 80.0]		-17.4	-37.2***	-19.8
Female	112.0[93.4 - 134.2]		79.6[63.6 - 99.5]		55.7[46.0 - 67.3]		-32.4*	-56.3***	-23.9
<b>Birth type</b>		<0.001***		<0.001***		<0.001***			
Single birth	100.5[87.7 - 115.0]		77.9[66.2 - 91.7]		55.3[47.8 - 63.9]		-22.6**	-45.2***	-22.6**
Multiple birth	296.7[215.1 - 400.4]		198.4[135.6 - 285.3]		181.1[139.6 - 233.1]		-98.3	-115.6*	-17.3
<b>Birth order</b>		0.410		0.062		0.132			
First	102.3[80.3 - 130.1]		72.9[54.6 - 97.0]		64.7[49.2 - 84.9]		-29.4	-37.6**	-8.2
Second	98.7[69.9 - 138.6]		64.4[44.2 - 93.2]		53.6[37.4 - 76.4]		-34.3	-45.1	-10.8
Third	102.7[71.8 - 145.8]		66.4[46.4 - 94.8]		48.2[35.3 - 65.8]		-36.3	-54.5*	-18.2
Fourth or higher	116.3[97.1 - 138.9]		105.7[83.9 - 132.8]		69.7[57.7 - 84.0]		-10.6	-46.6***	-36.0
<b>Birth Interval</b>		<0.001***		0.041*		0.047*			
< 2 years	168.5[131.4 - 214.7]		119.2[84.4 - 166.8]		95.0[61.7 - 144.9]		-49.3	-73.5**	-24.2
2 years	112.2[84.4 - 148.4]		84.0[58.5 - 119.8]		63.9[50.5 - 80.6]		-28.2	-48.3	-20.1
3+ years	93.9[75.1 - 117.0]		80.2[62.6 - 102.5]		50.7[41.8 - 61.4]		-13.7	-43.2***	-29.5*
<b>Overall</b>	108.1[95.2-122.6]		83.3[71.5-96.8]		61.6[54.1-70.1]		<b>-24.8 *</b>	<b>-46.5***</b>	<b>-21.7***</b>

p-value notation: \*\*\*p<0.001, \*\*p<0.01, \*p<0.05.

Table S7\_4: Under-five mortality rate [U5MR] in the five years preceding the survey and the difference in U5MR between surveys, by selected characteristics of the recommended maternal and delivery care, Ghana 2003, 2008, and 2014.

RECOMMENDED MATERNAL AND DELIVERY CARE	2003 GDHS Ref. period:		2008 GDHS Ref. period:		2014 GDHS Ref. period:		Difference in U5MR between surveys		
	U5MR [95% CI]	P-value	U5MR [95% CI]	P-value	U5MR [95% CI]	P-value	2003 - 2008	2003 - 2014	2008 - 2014
<b>Number of ANC visits attended<sup>1</sup></b>		0.623		0.271		0.049*			
None	81.6[44.8 - 146.0]		76.2[25.4 - 216.7]		75.0[37.8 - 146.2]		-5.4	-6.6	-1.2
1 - 3 times	95.6[43.1 - 204.9]		69.6[42.9 - 112.0]		35.3[18.9 - 65.6]		-26.0	-60.3**	-34.3*
4 + times	82.0[63.0 - 106.4]		50.1[34.6 - 72.2]		44.8[33.6 - 59.6]		-31.9**	-37.2***	-5.3
<b>Mother received tetanus injections<sup>1</sup></b>		0.921		0.952		0.310			
None	62.8[40.0 - 97.8]		90.6[31.3 - 247]		47.8[29.2 - 77.9]		27.8	-15.0	-42.8
One	96.7[58.2 - 158.5]		51.0[34.3 - 75.5]		51.2[29.9 - 86.7]		-45.7	-45.5**	0.2
Two or more	82.5[63.1 - 107.5]		48.9[36.5 - 65.5]		40.6[28.7 - 57.2]		-33.6*	-41.9***	-8.3
<b>Delivered in health facility<sup>2</sup></b>		0.791		0.387		0.165			
No	105.3[88.8 - 124.6]		86.3[69.5 - 107.1]		72.8[58.3 - 90.8]		-19.0	-32.5**	-13.5
Yes	101.2[82.2 - 124.3]		75.9[60.7 - 94.7]		55.1[47.0 - 64.5]		-25.3*	-46.1***	-20.8
<b>Household owns a mosquito net<sup>3</sup></b>		0.302		0.039*		0.530			
No	109.5[94.8 - 126.4]		109.2[82.3 - 144]		75.3[55.4 - 101.9]		-0.3	-34.2***	-33.9**
Yes	104.0[80.0 - 134.7]		73.2[61.6 - 87.0]		58.5[50.7 - 67.4]		-30.8	-45.5**	-14.7
<b>Mother slept under a net previous night<sup>3</sup></b>		0.188		0.003**		0.832			
No	111.5[97.1 - 127.8]		98.0[80.7 - 118.6]		63.8[52.6 - 77.4]		-13.5	-47.7***	-34.2***
Yes	90.9[66.7 - 123.4]		66.5[52.3 - 84.4]		59.2[49.8 - 70.3]		-24.4*	-31.7	-7.3
<b>Number of children slept under mosquito net previous net</b>		0.002**		<0.001***		<0.001***			
None	116.9[102.1 - 133.6]		112.0[93.7 - 133.6]		80.7[68.5 - 94.9]		-4.9	-36.2***	-31.3**
One or more	65.3[4.06 - 92.3]		50.9[38.7 - 66.9]		43.9[35.6 - 54.1]		-14.4	-21.4	-7.0
<b>Overall</b>	108.1[95.2-122.6]		83.3[71.5-96.8]		61.6[54.1-70.1]		<b>-24.8 *</b>	<b>-46.5***</b>	<b>-21.7***</b>

p-value notation: \*\*\*p<0.001, \*\*p<0.01, \*p<0.05.

Table S8: Country-level indicators used in the penalized regress

INDICATOR	DESCRIPTION OF INDICATOR	SOURCE
Birth rate	Crude birth rate indicates the number of live births occurring during the year, per 1,000 population estimated at midyear. Subtracting the crude death rate from the crude birth rate provides the rate of natural increase, which is equal to the rate of population change in the absence of migration.	Global economy
Health spending per capita	Current expenditures on health per capita in current US dollars. Estimates of current health expenditures include healthcare goods and services consumed during each year.	Global economy
Tuberculosis	The incidence of tuberculosis is the estimated number of new and relapse tuberculosis cases arising in a given year, expressed as the rate per 100,000 population. All forms of TB are included, including cases in people living with HIV. Estimates for all years are recalculated as new information becomes available and techniques are refined, so they may differ from those published previously.	Global economy
Access to electricity (% of the population)	Access to electricity is the percentage of the population with access to electricity. Electrification data are collected from industry, national surveys, and international sources.	World data bank
Access to drinking water, rural	The percentage of people using drinking water from an improved source that is accessible on premises, available when needed and free from fecal and priority chemical contamination. Improved water sources include piped water, boreholes or tube-wells, protected dug wells, protected springs, and packaged or delivered water.	Global economy
Access to drinking water, urban	Access to an improved water source, urban, refers to the percentage of the urban population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection).	Global economy
Voice and accountability	The index for Voice and Accountability captures perceptions of the extent to which the citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	Global economy
Rule of law	The index for Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	Global economy
Government effectiveness	The index of Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	Global economy
Control of corruption	The index for Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as the capture of the state by elites and private interests.	Global economy
Political stability	The index of Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. The index is an average of several other indexes from the Economist Intelligence Unit, the World Economic Forum, and the Political Risk Services, among others.	Global economy
Internet users	Internet users are individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.	Global economy
Mortality rate, under-5 (per 1,000 live births)	The under-five mortality rate is the probability per 1,000 that a newborn baby will die before reaching age five if subject to age-specific mortality rates of the specified year	world data bank
Prevalence of HIV refers to the percentage of people ages 15-49 who are infected with HIV	Prevalence of HIV refers to the percentage of people ages 15-49 who are infected with HIV.	Global economy
Net official development assistance received (constant 2015 US\$)	Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10 percent). Data are in constant 2014 U.S. dollars.	world data bank
Immunization, measles (% of children ages 12-23 months)	Child immunization, measles, measures the percentage of children ages 12-23 months who received the measles vaccination before 12 months or at any time before the survey. A child is considered adequately immunized against measles after receiving one dose of vaccine.	world data bank
Labor force, female (% of total labor force)	Female labor force as a percentage of the total shows the extent to which women are active in the labor force. Labor force comprises people ages 15 and older who supply labor for the production of goods and services during a specified period.	world data bank
Mortality rate, adult, female (per 1,000 female adults)	Adult mortality rate, female, is the probability of dying between the ages of 15 and 60—that is, the probability of a 15-year-old female dying before reaching age 60, if subject to age-specific mortality rates of the specified year between those ages.	world data bank
Net bilateral aid flows from DAC donors, Total (current US\$)	Net bilateral aid flows from DAC donors are the net disbursements of official development assistance (ODA) or official aid from the members of the Development Assistance Committee (DAC). Net disbursements are gross disbursements of grants and loans minus repayments of principal on earlier loans.	World data bank
Net ODA received per capita (current US\$)	Net official development assistance (ODA) per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients; and is calculated by dividing net ODA received by the midyear population estimate	world data bank

Urban population (% of total)	Urban population refers to people living in urban areas as defined by national statistical offices. The data are collected and smoothed by the United Nations Population Division	world data bank
Vitamin A supplementation coverage rate (% of children ages 6-59 months)	Vitamin A supplementation refers to the percentage of children ages 6-59 months old who received at least two doses of vitamin A in the previous year.	world data bank
Women's share of population ages 15+ living with HIV (%)	Prevalence of HIV is the percentage of people who are infected with HIV. The female rate is as a percentage of the total population ages 15+ who are living with HIV.	world data bank
Government expenditure on education, total (% of government expenditure)	General government expenditure on education (current, capital, and transfers) is expressed as a percentage of total general government expenditure on all sectors (including health, education, social services, etc.). It includes expenditure funded by transfers from international sources to the government. The general government usually refers to local, regional and central governments.	world data bank
People using safely managed sanitation services (% of the population)	The percentage of people using improved sanitation facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite. Improved sanitation facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines: ventilated improved pit latrines, composting toilets or pit latrines with slabs.	world data bank
Maternal mortality ratio (per 100,000 live births)	Maternal mortality ratio is the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births. The data are estimated with a regression model using information on the proportion of maternal deaths among non-AIDS deaths in women ages 15-49, fertility, birth attendants, and GDP	world data bank
Fertility rate, total (births per woman)	Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year.	world data bank