

Trend and factors associated with under-five mortality in Ethiopia further analysis of 2000-2016 Ethiopian demographic and health survey: A Multivariate decomposition analysis

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Abstract

Background: The under-five mortality rate is the probability that a newborn will die before reaching the age of five years. It is usually expressed as a rate per 1000 live births. Nearly 7 million children worldwide die before their fifth birthdays, with almost all of such death occurring in developing countries **Objective:** To assess the trend and factors associated with under-five mortality in Ethiopia further analysis of 2000-2016 Ethiopian demographic and health survey: a decomposition analysis

Methods: A secondary serial cross-sectional analysis was conducted utilizing data from four rounds of EDHS administered in 2000, 2005, 2011 and 2016. The Ethiopian health and demographic survey in 2000-2016 used a two-stage stratified sampling technique to select a nationally representative sample. In the first stage the total number of enumeration areas was 539 in 2000, 540 in 2005, 624 in 2011 and 645 EAs in 2016 were selected with probability proportional to EA size and with independent selection in each sampling stratum. In the second stage of selection, a fixed number of 28 households per cluster were selected with an equal probability systematic selection from the newly created household listing.

Result: Looking at the overall trend, Ethiopia has shown a significant decrease in under-five mortality over the study period from 166 per 1000 births in 2000 to 67 per 1000 birth in 2016 with annual rate of reduction of 3.7%. The trends in under-five mortality showed a variation according to their characteristics. Among home delivery, the largest decrement was observed around 6.5% decrease from 2000 to 2016 and in health facility delivery decreased by 8.3% The decomposition analysis shows that 100.74% of the decrease in under-five mortality was accredited to the difference in the effects of characteristics.

Conclusion: Under-five mortality decreased significantly over the last one and a half decades. One of the remarkable findings from the decomposition analysis is the effect of education, place of delivery and maternal age. the government of Ethiopia shall do all daughters will be educated and to build health facilities the whole place of the country

Keywords: Under-five mortality decomposition analysis, trend

Background

The under-five mortality rate is the probability that a newborn will die before reaching the age of five years(1). It is usually expressed as a rate per 1000 live births. Nearly 7 million children worldwide die before their fifth birthdays, with almost all of such death occurring in developing countries(1).

Over the last two decades, the world made substantial progress in reducing mortality among children and young adolescents (including children under age 5, children aged 5 – 9 and young adolescents aged10-14) (2–4). Till, in 2017 alone, an estimated 6.3 million children and young adolescents died, mostly from preventable causes. Children under age 5accounted for 5.4 million of these deaths. Globally, the majority of child and young adolescent deaths occurred during the earliest ages with 85 percent of the 6.3 million deaths in 2017 occurring in the first five years of life(5). Sub-Saharan Africa continues to be the region

with the highest under-five mortality rate in the world 76 deaths per 1,000 live births in 2017(6). This translates to 1 child in 13 dying before his or her fifth birthday 14 times higher than the average ratio of 1 in 185 in high-income countries and 20 times higher than the ratio of 1 in 263 in the region of Australia and New Zealand(2,3,7,8).

Reducing under-five has long been a global public health priority particularly for developing countries. In 2011 Ethiopia demography and health survey (EDHS) the number of under-five mortality for every 1000 live birth were 88 and in 2016 EDHS the number of under-five mortality for every 1000 live birth were 67 reduced by 31.34% but. However, the rate remains at a very high level compared to the rest of the world(9–12).

Studies on determinants of under-five mortality in Ethiopia identified several proximate health behaviors and child care practice as the driver of under-five mortality(13–15). Few studies that explore socio determinants of childhood mortality also reported inverse association woman's level of education and childhood mortality. However, to our knowledge, there are no studies to date that examine the population composition and covariates influence under-five mortality

In this study, we examine the relationship between population composition (endowment) characteristics and under-five mortality. The research adds to the body of knowledge on the pathways through endowment characteristics that may lead to the differential of under-five mortality. Estimates of the under-five mortality rate (U5MR) are used to track progress in reducing child mortality and to evaluate countries' performance related to Millennium Development Goal.

Under-five mortality is caused by easily manageable or preventable diseases such as malaria, measles, pneumonia, diarrheal diseases (or a combination of such diseases)(13).

Methods

Study design

A secondary serial cross-sectional analysis was conducted utilizing data from four rounds of EDHS administered in 2000, 2005, 2011 and 2016. EDHS is a regular survey conducted every five years by the Central Statistical Authority of Ethiopia.

Study Period

The study was based on Cross-sectional studies conducted in Ethiopia. EDHS 2000 Preparatory work for the DHS was initiated in June 1999 and fieldwork was carried out between early February and mid-June 2000. EDHS 2005 (from April 27 to August 30, 2005), EDHS 2011 (from December 27, 2010, to June 3, 2011) and EDHS 2016 (from January 18 to June 27, 2016) (9–12)

Study Area

The study was conducted in Ethiopia. Ethiopia is an ancient country with a rich diversity of peoples and cultures and a unique alphabet that has existed for more than 3,000 years. The country has always maintained its independence(16).

Ethiopia is situated in the Horn of Africa between 3 and 15 degrees north latitude and 33 and 48 degrees east longitude(17). It is a country with great geographical diversity; its topographic features range from the highest peak at Ras Dashen, which is 4,550 meters above sea level, down to the Afar Depression at 110 meters below sea level. The climatic condition of the country varies with the topography, with temperatures as high as 47 degrees Celsius in the Afar Depression and as low as 10 degrees Celsius in the highlands. The total area of the country is about 1.1 million square kilometers(18).

Sampling technique

The Ethiopian health and demographic survey in 2000–2016 used a two-stage stratified sampling technique to select a nationally representative sample. In the first stage the total number of enumeration areas was 539 (138 urban and 401 rural) in 2000, 540 (145 urban and 395 rural) in 2005, 624 (187 urban and 437 rural) in 2011 and 645 EAs (202 in urban areas and 443 in rural areas) in 2016 were selected with probability proportional to EA size and with independent selection in each sampling stratum(9–12,16,19).

In the second stage of selection, a fixed number of 27 and 28 households per cluster were selected with an equal probability systematic selection from the newly created household listing(17). All women age 15–49 and all men age 15–59 who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey were eligible to be interviewed(9,16,18)

Data Sources

This study used four successive nationally representative household surveys: 2000, 2005, 2011 and 2016 EDHS. Data were accessed from the DHS program official database (www.measuredhsprogram.com)

Variables Of The Study

In EDHS under-five mortality was estimated within 5 years preceding surveys. In EDHS there is a question about the year of childbirth, whether the child was alive at the time of the survey and how old the child as if the child has died. Then a child who was born in the 5 years preceding the survey but unfortunately died within the five years of life was classified as under-five mortality and was coded as 0 if the child was alive and 1 if the child has died. The unit of analysis in this study is all live births in the five years preceding the survey.

Socioeconomic Characteristics

The exposure variable was maternal education status. Educational status was assessed based on the highest category of school completed (no education, primary, secondary or higher-level education) on an

ordinal scale.

Wealth index, categorized in quintiles to reflect the cumulative living standard of a household in terms of relative wealth, was measured based on "easy to-collect data 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". Women were categorized into five categories: poorest, poorer, middle, richer, and richest in terms of where their household falls in the distribution of the original sample, place of residence and region.

Demographic Characteristics

Child's sex, mother's age at birth, birth order and previous birth interval

Data Management And Analysis

The data analysis is done using SPSS 20 and STATA 14 statistical packages. In this study decomposition analysis is conducted to find out the determinants of under five-mortality in Ethiopia. This study engaged a descriptive and trend analysis of under-five mortality. Decomposition of changes in under-five mortality. The trend in under-five mortality was analyzed using descriptive analysis, stratified by region, urban-rural residence, and selected socio-demographic characteristics. The trend was examined separately for the periods 2000–2005, 2005–2011, 2011–2016, 2000–2011, 2005–2016 and 2000–2016.

Trend And Decomposition Analysis

We apply decomposition analysis to identify the possible explanatory variables which affected the decline of under-five mortality in Ethiopia. The approach presents a statistical decomposition of changes in the mean of a variable, in this case, the probability of death, measured per 1000 live births. The decomposition is derived starting from the following:

$$U5M_{2005}-U5M_{2000} = \beta\bar{Y}_{2005}- \beta\bar{Y}_{2000}$$

$$U5M_{2011}-U5M_{2005} = \beta\bar{Y}_{2011}- \beta\bar{Y}_{2005}$$

$$U5M_{2016}-U5M_{2011} = \beta\bar{Y}_{2016}- \beta\bar{Y}_{2011}$$

$$U5M_{2011}-U5M_{2000} = \beta\bar{Y}_{2011}- \beta\bar{Y}_{2000}$$

$$U5M_{2016}-U5M_{2005} = \beta\bar{Y}_{2016}- \beta\bar{Y}_{2005}$$

$$U5M_{2016}-U5M_{2000} = \beta\bar{Y}_{2016}- \beta\bar{Y}_{2000}$$

This equation describes the difference in the average number of under five deaths per 1000 live births between 2000–2005, 2005–2011, 2011–2016, 2000–2011, 2005–2016 and 2000–2016 respectively as

a function of the means of explanatory variables and estimated coefficients β . The decomposition separates the change into an explained and unexplained portions

$$U5M_{2005}-U5M_{2000} = (\bar{Y}_{2005}-\bar{Y}_{2000}) \beta_{2005} + (\beta_{2005}-\beta_{2000}) \bar{Y}_{2005}$$

$$U5M_{2011}-U5M_{2005} = (\bar{Y}_{2011}-\bar{Y}_{2005}) \beta_{2011} + (\beta_{2011}-\beta_{2005}) \bar{Y}_{2011}$$

$$U5M_{2016}-U5M_{2011} = (\bar{Y}_{2016}-\bar{Y}_{2011}) \beta_{2016} + (\beta_{2016}-\beta_{2011}) \bar{Y}_{2016}$$

$$U5M_{2011}-U5M_{2000} = (\bar{Y}_{2011}-\bar{Y}_{2000}) \beta_{2011} + (\beta_{2011}-\beta_{2000}) \bar{Y}_{2011}$$

$$U5M_{2016}-U5M_{2005} = (\bar{Y}_{2016}-\bar{Y}_{2005}) \beta_{2011} + (\beta_{2016}-\beta_{2005}) \bar{Y}_{2016}$$

$$U5M_{2016}-U5M_{2000} = (\bar{Y}_{2016}-\bar{Y}_{2000}) \beta_{2016} + (\beta_{2016}-\beta_{2000}) \bar{Y}_{2016}$$

Explained part

unexplained part

The Explained component refers to the part of the differential due to differences in population composition or endowments. The unexplained component refers to that part of the differential attributable to differences in coefficients or effects. The explanatory part is presented using percentages, tables and a line graph for under-five mortality over the study period.

Result

Characteristics Of The Study Population

Table 1 presents the characteristics of the respondents over the two Ethiopian demography and health survey. Among the respondents, about 63% in the two surveys were an age less than 20 years and about 35% of the respondents were age 20–29 the remaining 2% of the respondents were age 30–49. In terms of education, in 2000 about 82% of the respondents were no educated. About 13% of the respondents were primary educated and the other 5% were secondary and above educated. In 2016 about 66% of the respondents were no educated. About 27% of the respondents were primary educated and the remaining 7% of the respondents were secondary and above educated. The percentage with no education decline from 82% in 2000 to 66% in 2016, while the percentage with primary education rose from 13% in 2000 to 27% in 2016. With regard to the place of delivery, in 2000 95% of the mothers were home delivered and the other 5% were health facility delivered. In 2016 74% of the mothers were delivered in the home and 26% of mothers were delivered health facility. The proportion with a home delivery declined by 21% and the proportion with health facility delivery rose by 21%

Table 1

Frequency and Percentage distribution of characteristics of respondents in 2000 and 2016 Ethiopian Demographic and Health Surveys

Characteristics	Category	EDHS 2000 Weighted frequency (%) (N = 12260) percentage	EDHS 2016 Weighted frequency (%) (N = 11023)
Mothers age	< 20 years	6797(62.51)	7051(63.97)
	20–29 years	3960(36.42)	3829(34.74)
	30–49 years	116(1.07)	143(1.29)
Residence	Rural	10984(89.59)	9807(88.97)
	Urban	1276(10.41)	1216(11.03)
Region	Tigray	788(6.42)	716(6.49)
	Afar	126(1.03)	114(1.04)
	Amhara	3202(26.12)	2072(18.8)
	Oromia	4999(40.78)	4851(44.01)
	Somalia	142(1.16)	508(4.61)
	Benishangul-Gumuz	124(1.16)	122(1.10)
	SNNP	2602(21.22)	2296(20.83)
	Gambela	29(0.24)	27(.24)
	Harari	25(0.21)	26(.23)
	Addis Ababa	182(1.49)	244(2.21)
	Dire Dawa	40(0.33)	47(.43)
Mothers education	No education	1063(82.07)	7284(66.08)
	Primary education	1597(13.02)	2951(26.77)
	Secondary and above	601(4.90)	788(7.15)
Place of delivery	Home	11625(94.82)	8131(73.76)

Characteristics	Category	EDHS 2000 Weighted frequency (%) (N = 12260) percentage	EDHS 2016 Weighted frequency (%) (N = 11023)
	Health facility	635(5.18)	2892(26.24)
Preceding birth interval (in year)	< 2	2308(18.82)	2254(20.45)
	2-3	3714(30.3)	2800(25.41)
	≥4	6238(50.88)	5969(54.15)

Table 2
trend in under five mortality by selected characteristics EDHS from 200–2016

Characteristics	2000 (N = 12260)	2016 (N = 11375)	Percentage difference in under-five mortality (2016 – 2000)
Place of residence			
Urban	10.6	4.3	-6.3
Rural	12.5	5.6	-6.9
Maternal age (in years)			
< 20	12.0	5.7	-6.3
20–29	13.0	5.2	-7.8
30–49	6.0	3.8	-2.2
Maternal education			
No education	12.8	5.9	-6.9
Primary	10.7	4.9	-5.8
Secondary and above	7.5	4.5	-3.0
Place of delivery			
Home delivery	12.3	5.8	-6.5
Health facility delivery	12.8	4.5	-8.3
Preceding birth interval (in years)			
< 2	17.5	8.5	-9.0
2–3	11.3	5.3	-6.0
≥ 4	11.0	4.4	-5.6

Table 3
Overall decomposition analysis of under-five mortality in Ethiopia, 2000–2016

Under five mortality	Coef.	[95% Confidence Interval]	Pct.
E	0.00045	-0.00268 0.0035439	-0.74095
C	-0.062	- .069723 -0.053398	100.74**
R	-0.061	-0.068676 -0.053539	
*E = Endowment; C = Characteristics; R = Residual; **=p-value < 0.01			

Table 4
The detailed decomposition analysis of under-five mortality in Ethiopia, 2000–2016

Experiencing stillbirth		Difference due to characteristics		Difference due to coefficient	
		Coef.	Pct.	Coef.	Pct.
Place of delivery	Home delivery	0.00207[-0.0269, 0.0310]	-3.2	-0.0039[-0.00647, -0.0122]	6.4
	Health facility				
Mothers education	No education				
	Primary education	0.000305[-0.0040, 0.00464]	-0.5	0.0059 [-0.00210, 0.0033]	0.9
	Secondary and higher	0.0000255[-0.00082, 0.0088]	0.04	0.0038 [0.0115, 0.0643]	-6.2
Mothers age	< 20 years	0.000004[-0.00065, 0.0059]		-0.00276(-0.0086, -0.00120)	4.5
	20–29 years	0.0000255[-0.000221, 0.2278]	0.3	0.00034[0-0.00351, 0.00102]	-0.55
	30–49 years				

Regarding the place of residence, no difference was observed between 2000 and 2016 in the proportion of both urban and rural.

The Trend In Under-five Mortality

This section presents the trend in under-five mortality during the period 2000–2016. Looking at the overall trend, Ethiopia has shown a significant decrease in under-five mortality over the study period from 166 per 1000 birth in 2000 to 67 per 1000 births in 2016

The trends in under-five mortality showed a variation according to their characteristics. A significant increment was observed in most of the variables. Among home delivery, the largest decrement was observed around 6.5% decreases from 2000 to 2016 and health facility delivery decreased by 8.3%. In terms of maternal education, among mothers with no educated decreased by 6.9%.

The regional level variation in under-five mortality in Amhara, Tigray, and Addis Ababa was 59.5%, 59% and 59.3% declination over the study period respectively. Those three regions the maximum percentage declination of under-five mortality in Ethiopia (Fig. 1).

Decomposition analysis

Decomposition analysis of under-five mortality in Ethiopia

The decomposition analysis shows that the turndown in under-five mortality was due to the change in coefficient but the change due to difference in characteristics was not significant.

The decomposition analysis shows that 100.74% of the decrease in under-five mortality was accredited to the difference in the effects of characteristics between the survey period. The overall decrement in under-five mortality between 2000 and 2016 attributable to the change in coefficients, the most important independent variables that provide significant contribution are the place of delivery, mothers education and mothers age accounting for 6.4%, 6.2% and 4.5% respectively

Discussion

This study observed the trend and determinants of under-five mortality in Ethiopia. The study was deliberated to identify the major factors positively or negatively contributing to the change in under-five mortality in the past 16 years.

Under-five mortality decreased significantly over the last one and half decades. One of the remarkable findings from the decomposition analysis is the effect of education. Mothers whose no educated show a higher under-five mortality decrement in the past 16 years compared with the overall under-five mortality in Ethiopia. This may be due to the comprehensive education program by the government and other non-governmental organizations, through improvement in the education infrastructure to meeting the millennium development goal through education sectors. Currently, daughter education is one of the government priority agendas in Ethiopia, therefore, the proportion of educated daughter is expected to decline and to continue having an impact on under-five mortality in the future(13)(20).

Another striking finding from the decomposition analysis is the effect of place of delivery. The contribution of the place of delivery displays a clear decrement in under-five mortality among mothers who were delivered in the home compared with health facility delivery. Mothers whose delivered in health facilities increasing over the study period. Under-five mortality and health facility delivery has a negative association This means that the number of health facility delivered mothers increase the rate of under-five mortality to be decreased. This may be due to a comprehensive health program by the government

and other non-governmental organizations, through improvement in the health care infrastructure to meeting the millennium development goal through health sector development strategies(14)(21).

100.74% of the change in under-five mortality over the study period (2000–2016) was attributed to the change in coefficients. Change in coefficients of the mother's place of delivery showed a significant effect on the change in under-five mortality. This might be due to increasing the number of health institutions and health education in Ethiopia over the last one and half decade and increased health institutions and health education has a significant role in the decrement of under-five mortality.

Strength and limitation of the study

This study had several strengths and limitations. The first strength of the study consumed large datasets representing the whole country, Ethiopia. The other strength of the study had used advanced statistical analysis methods and the findings based on sufficient statistical power. The other important strength of the study had any statistical analysis were done after the data were weighted for the sampling probabilities.

The limitation of the study had most of the population compositions are insignificance which affects our conclusions and some significant variables are not collected in the four different EDHS such as wealth index, birth order, and others.

Conclusion

In our study, the under-five mortality rate has been declined over the last one and half decades. Based on EDHS 2000, 2005, 2011 and 2016 About 101% of the overall decrease in the under-five mortality rate over the study period was attributable to the change in coefficients or characteristics of the population between 2000 and 2016. according to the place of delivery, age of mothers and mothers education were the main cause for the decrease in under-five mortality rate over the study period but appropriate to the change in composition were not significant

Recommendation

The most important conclusion of this study is to reduce under-five mortality. But till con did not achieve the minimum rate of under-five mortality in Ethiopia. The under-five mortality rate is an indicator of child health as well as the overall development and well-being of the population. As part of their sustainable development goals, the united nations has set a target of reducing under-five mortality 25 per 1000 live births by 2030. So, the government of Ethiopia shall do all daughters will be educated and to build health facilities the whole place of the country and to give health education the importance of health facility delivery as compared to home delivery

Abbreviations

CSA=Central Statistical Agency; DHS=Demographic health survey; EAs=Enumeration areas; EDHS=Ethiopian demographic and health survey; SNNP=Southern nations and nationalities of people

Declarations

Ethical approval and consent to participate

Ethical clearance was obtained from measure DHS through filling requesting form for accessing data. The data used in this study are publicly available, aggregated secondary data which hasn't any personal identifying information that can be linked to study participants. Confidentiality of data was maintained anonymously.

Consent for publication

Not applicable

Availability of data and materials

Data is available online and you can access it from www.measuredhs.com.

Competing Interests

Authors declare that they have no conflict of interest

Funding

No funding was obtained for this study.

Authors' contribution

WS conception of the idea; extraction of data, data analysis, interpretation of data and manuscript preparation, GA, MG, and DA were participating throughout the paper from proposal development, analysis, interpretation of the data, manuscript preparation and developed the final version of the manuscript. Finally, all authors read and approved the manuscript.

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References

1. Osei-Kwakye K, Otupiri E, Owusu Dabo E, Browne E, Adjuik M. Determinants of Under-Five Mortality in Builsa District, Upper East Region, Ghana. *J Sci Technol.* 2010;30(1):45–53.
2. Waterston T. Child health and the Arab spring. Vol. 57, *Journal of Tropical Pediatrics.* 2011. 239–240 p.

3. A Decomposition of Trends in the Infant Mortality Disadvantage Index in the United States: 1983-2010. 2010;1983–2010.
4. Lutz W. and Under-Five Mortality Disparities. 2018;
5. Ferri N. United nations general assembly. *Int J Mar Coast Law*. 2010;25(2):271–87.
6. Developed E, Group I, Mortality C, Estimation M, Unicef, WHO, WBG UN. *Child Mortality 2018*. 2018; (September):48.
7. Van Malderen C, Amouzou A, Barros AJD, Masquelier B, Van Oyen H, Speybroeck N. Socioeconomic factors contributing to under-five mortality in sub-Saharan Africa: A decomposition analysis. *BMC Public Health*. 2019;19(1):1–19.
8. Mejía-Guevara I, Zuo W, Bendavid E, Li N, Tuljapurkar S. Age distribution, trends, and forecasts of under-5 mortality in 31 sub-saharan african countries: A modeling study. *PLoS Med*. 2019;16(3):1–21.
9. 2016 CSA (CSA) [Ethiopia] and I. Ethiopia Demographic and Health Survey 2016. 2016.
10. 2005. CSA [Ethiopia] and OM. Ethiopia Demographic and Health Survey 2005. 2005.
11. Macro. CSA [Ethiopia] and O. Ethiopia Demographic and Health Survey 2000. 2000.
12. Health CSA [Ethiopia] and II. Ethiopia Demographic and Health Survey 2011. 2011.
13. Alemayehu YK, Theall K, Lemma W, Hajito KW, Tushune K. The Role of Empowerment in the Association between a Woman’s Educational Status and Infant Mortality in Ethiopia: Secondary Analysis of Demographic and Health Surveys. *Ethiop J Health Sci*. 2015;25(4):353–62.
14. Mehretie Adinew Y, Feleke SA, Mengesha ZB, Workie SB. Childhood Mortality: Trends and Determinants in Ethiopia from 1990 to 2015—A Systematic Review. *Adv Public Heal*. 2017;2017:1–10.
15. Woldeamanuel BT. Socioeconomic, Demographic, and Environmental Determinants of Under-5 Mortality in Ethiopia: Evidence from Ethiopian Demographic and Health Survey, 2016. *Child Dev Res*. 2019;2019.
16. Central Statistical Agency Ethiopia, MEASURE DHS - ICF Macro. Ethiopia Demographic and Health Survey 2011: Preliminary Report. 2011;1–29.
17. Kaewkiattikun K. Effects of immediate postpartum contraceptive counseling on long-acting reversible contraceptive use in adolescents. Vol. Volume 8, Adolescent Health, Medicine and Therapeutics. 2017. 115–123 p.
18. Survey H. Ethiopia. 2000;
19. Central Statistical Agency [Ethiopia], ICF International. Ethiopia Demographic and Health Survey 2011. 2012;1–452.
20. Akinyemi JO, Bamgboye EA, Ayeni O. Trends in neonatal mortality in Nigeria and effects of bio-demographic and maternal characteristics. *BMC Pediatr*. 2015;15(1):1–12.
21. Li Z, Hsiao Y, Godwin J, Martin BD, Wakefield J, Clark SJ. Changes in the spatial distribution of the under-five mortality rate: Small-area analysis of 122 DHS surveys in 262 subregions of 35 countries

Figures

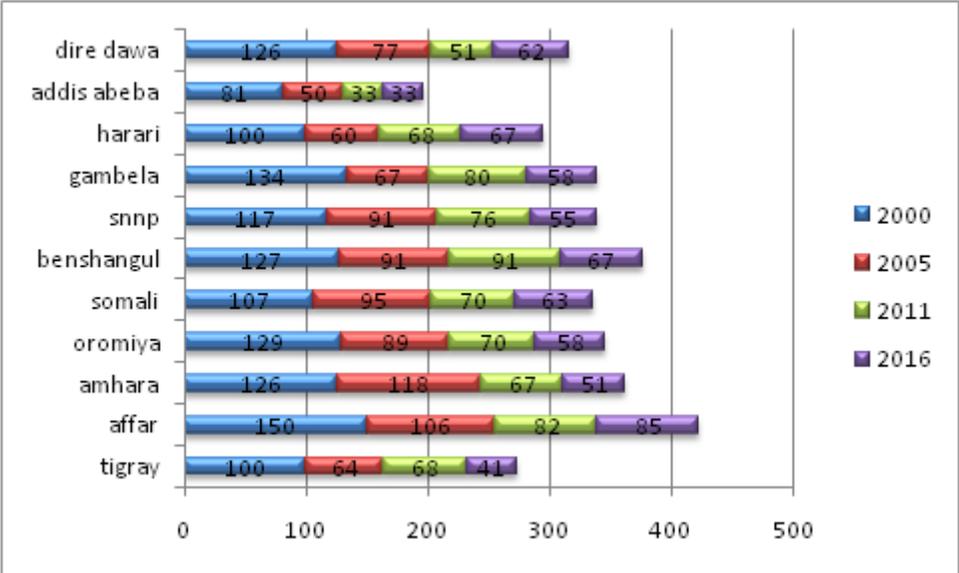


Figure 1

Trends in under five mortality rate over time by regions in 2000, 2005, 2011 and 2016, Ethiopia