Trend, Levels and Differences for Under-Five Mortality Rate in Uganda (U5MR): Is Uganda on Track in Achieving the Millennium Development Goal 4?

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Abstract

This study employed the analytic induction from the statistical phenomenon on U5MR in Uganda to arrive at the trend, levels and sex differences related to U5MR. The study followed a quantitative research paradigm which was particularly descriptive, longitudinal panel research. It was found out that the trend of U5MR was generally declining and that there was a significant difference between the U5MR of male and female children. The 2013 annual average reduction rate (AARR) was 4.3%, just 0.1% less than the required 4.4% for Uganda to achieve Millennium Development Goal 4. Based on the findings, it was concluded that there exists higher chances for Uganda to achieve the MDG4, considering the recent trend of U5MR in Uganda.

Keywords: differences, levels, trends, under-five mortality rate

1. Introduction

The September 2000 Millennium Summit gathering of 189 world leaders adopted the UN Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of eight time-bound targets. These became known as the Millennium Development Goals (MDGs). Among these MDGs, reducing global child mortality by two thirds by 2015 was goal four (Pardosi, Adair, Rao, Kosen and Tarigan, 2014). Kimani-Murage, Fosho, Egondi, Abuya, Elungata, Ziraba, Kabiru, & Madise (2014) observe that there are global indicators that show the global progress towards this goal.

The global progress in reducing child deaths since 1990 has been very significant with the under-five mortality rate declining by nearly half-from 90 deaths per 1,000 live births in 1990 to 48 per 1,000 in 2012 (UNICEF, 2013). The report further contends that an estimated annual number of under-five deaths has fallen from 12.6 million to 7.6 million by 2010 and to 6.6 million by 2012. According to the United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME, 2014), the leading causes of death of under-five children are preterm birth complications (17 percent), pneumonia (15 percent), intrapartum-related complications (11 percent), diarrhoea
(9 percent) and malaria (7 percent) and nearly half of under-five deaths globally are attributable to undernutrition. Sub-Saharan Africa remains the region with the world's highest child mortality, but the annual rate of decline has doubled from 1.2% between 1990 and 2000 to 2.4% in the following 10 years, to 2010. But one in eight (1 in 8) children still does not make their fifth birthday, more than 17 times the average for developed regions (1 in 143). The region with the second-highest death rate is southern Asia (1 in 15) which it defines as Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan and Sri Lanka (UN IGME, 2011).

According to UNICEF (2011), Uganda has one of the highest child mortality rates in the world, with an infant mortality rate of 130 out of 1,000 births. MDG report (2010) for Uganda indicates that, towards reducing child mortality by two-thirds between 1990 and 2015, the under-five mortality rate is still rated as slow which also concurs with UNICEF report (2009) that posits that there is insufficient progress in reducing child mortality. However, the MDG report (2013) observes that towards this goal, Uganda is on track. The report opines that “if the recent accelerated rate of progress is maintained, Uganda has a chance to meet the MDG target by 2015 (p. 22)”.

According to the MDG number four, Uganda is expected to reduce U5MR by two thirds from 178 deaths per 1000 (in 1990) to 59 deaths per 1000 in 2015. In order to achieve this goal, the annual average reduction rate (AARR) of U5MR should be more than 4.4% (UNICEF, 1996). Recent analyses showed that the AARR of 4.4% has never been reached in Uganda (Nuwaha et al, 2009). Besides, according to the Uganda Demographic Health Surveys (UDHS) of 1995 and 2000, the U5MR increased from 147.3 deaths per 1000 live births to 151.5 deaths per 1000 live births (Uganda demographic Health Survey, 1995, Uganda Demographic and Health Survey 2000-2001). There was therefore a need to investigate the trend, levels and sex-specific differences in U5MR in Uganda. These will help to check the progress and ask questions that if not, why and what can be done to achieve MDG goal four.

Based on the UN-IGME (2014), Alba et al (2014) and Kimani-Murage et al (2014), the research hypothesized that: \( H_1: \) The trend and levels of U5MR in Uganda (1990-2013) are reducing. The challenge in most health surveys is that they do not establish whether the mortality difference between male and female children is significant or not. Besides, there are no studies establishing these differences within the context of Uganda. It is therefore important that such differentials be examined in Ugandan context. With respect to these studies, this research hypothesized that: \( H_2: \) There is a significant difference in U5MR between male and female in Uganda.

2. Review of Related Literature

2.1 Under-Five Mortality Rate

Child mortality is the probability per 1,000 that a newborn baby will die before reaching age five (UNICEF, 2008). This is also referred to as under-five mortality rate (U5MR). In this research, child mortality means the number of children who die before their fifth birthday. Infant mortality is defined as the number of infant deaths (one year of age or younger) per live births (WHO, 2011), post-neonatal mortality or deaths that occur at ages 1 to 11 months (WHO, 2010). According to Nuwaha and Mukulu (2009), U5MR, child mortality rate (CMR) and infant mortality rates (IMR) are the indices of child mortality and they defined U5MR as the “probability of dying between birth and the fifth birth day, the child mortality rate (CMR) which
is the probability of dying between exact age one and the fifth birth day and the infant mortality rate (IMR) which is the probability of dying between birth and the first birth day (p. 125)”. Therefore U5MR (deaths that occur between birth and exact age 5) covers all children who die before their fifth birthday (child mortality), deaths that occur between birth and exact age one (infant mortality), deaths that occur during first 28 days of life (neonatal mortality) and deaths of children that occur from 29-365 days after birth (post-natal mortality).

Under-five mortality rates measure the wellbeing, health and nutrition status of children (Bradshaw, Bourne & Nannan, 2003, Nuwaha et al, 2009, UN-IGME, 2014) and declining child mortality highlights economic growth of the country (Subramanyam, Kawachi, Berkman & Subramaniam, 2011), overall development (Alba et al, 2014) and social welfare of the population (Avogo et al, 2010) and a key indicator towards achieving MDG goal four. Despite these advantages that would accrue to the country out of reduced child mortality, according to UN-IGME (2014), the level of child mortality in Sub-Saharan Africa is still high with 92 deaths per 1000 live birth which is 15 times more than the average death in developed world. Towards achieving MDG goal four (MDG4), Uganda is on track but the AARR is still low (MDG report, 2013, Nuwaha et al, 2009). Based on these aspects, there was therefore a need to investigate the new trend and levels of U5MR and carry out a comparative analysis of the levels of U5MR between sexes in Uganda and examine the progress towards MDG4.

Several studies have been conducted pertaining to child mortality. Such studies include Alba, Nathan, Schulze, Mshinda and Lengeler (2014), Aksan and Chakraborty (2014), Avogo and Agadjanian (2010), Hossain, Sumi, Haque and Bari (2014), Kimani-Murage et al (2014), Nuwaha and Mukulu (2009), Pardosi et al (2014), Smith-Greenaway and Thomas (2014). In the study carried out by Alba et al (2013) on child mortality patterns in rural Tanzania, in which they estimated the contribution of increased supply of insect treated nets and improved access to effective malaria treatment in relation to decrease in child mortality. Time series and Poisson regression analyses were applied. They found out that child mortality decreased by 42.5% from 1997 to 2009, child mortality was strongly associated with rainfall and food security and that malaria control interventions were associated with decreases in child mortality. Smith-Greenaway et al (2014) explored child mortality risks that are associated with diverse patterns in maternal migration in Haiti where a sample of 11,273 children were used and a series of discrete-time hazard models were applied. They found out that those children born to lateral migrants (rural-to-rural and urban-to-urban) generally experience low mortality. Avogo et al (2010) investigated the effects of forced migration on child survival and health in Luanda, Angola where a survey data collection method was used. They examined the differences among the three groups (that is, migrants who moved due to war, migrants whose move was not related to war and non-migrants). They found out that the hazard of child death were higher in families that experience war-related migration.

### 2.2 Trend and Levels of Under-Five Mortality Rates in Uganda

The global reduction of U5MR is on the increase since the adoption of MDGs. In fact, the UN-IGME (2014) posits that the U5MR on a global scene is falling faster with annual reduction rate more than tripling from 1.2 percent for 1990-1995 to 4.0 percent for 2005-2013 than the past 20 years but the progress remain insufficient to reach MDG4 in Sub-Saharan Africa. Nuwaha et al (2009) studied the trends of U5MR in Uganda using the data from 1954 to 2000, with the view
of predicting whether MDG 4 will be met in 2015. They found out that the levels and trends of U5MR were reducing but noticed that the AARRs for the U5MR of -1.05-3.05% were below the 4.4% required to achieve MDG 4. Different studies also note that the U5MR trends and levels have been reducing (for example, Alba et al, 2014 and Kimani-Murage et al, 2014). The studies by Alba et al (2014) and Kimani-Murage et al (2014) were carried out in Tanzania and Kenya respectively but this study was not carried out in Uganda.

Hossain et al (2014) carried out a study to investigate the consequences of intimate partner violence (IPV) against women on under-five child mortality in Bangladesh. They applied survival analysis and Cox proportional multiple regression models and found out that women subjected to IPV were likely to experience higher under-five child mortality in comparison to women not subjected to IPV. Kimani-Murage et al (2014) carried out a study to describe the trends in child mortality in Kenya with attention to differences in under-five mortality rates (U5MR) between urban and rural and intra-urban. They found out that there was a downward trend in infant mortality rate (IMR), child mortality rate (CMR) and U5MR in both rural and urban areas as well as in slum areas. Nuwaha et al (2009) carried out a study investigating the trends of U5MR in Uganda from 1954-2000 where they used a retrospective analysis of Uganda national censuses of 1969, 1991 and 2000, to find out whether the MDG4 will be met in Uganda. They found out that U5MR in Uganda has decreased from 261 to 180 deaths per 1000 live birth for the period of 1954 and 1966 with an annual average reduction rate (AARR) of 3.05%, increased in the period of 1975 and 1988 and decreased from 205 to 152 deaths per 1000 live with an AARR of 2.46%. Most of these studies were not all carried out in the context of Uganda, and for Nuwaha et al (2009), at least 5 years have passed which makes this study relevant. Also the above studies were not carried out to compare the differences in U5MR sexes (male or female) which this study considered while investigating these trends of U5MR.

2.3 Sex-Specific Differences in Under-Five Mortality Rates in Uganda

Studies like Alba et al (2014), Avogo et al (2009), Hossain et al (2014) and Smith-Greenaway et al (2014) were mainly concerned with general trends and levels of U5MR. On the other hand, other studies were concerned with investigating the differences in the level of child mortalities between sex and regions. For example, Krishnan, Nawi, Byass, Pandav and Kapoor (2013) assessed sex-specific differentials in U5MR in rural Ballabgarh and found out that mortality for female were consistently and significantly higher than that of male from 1992-2011 both during post-natal and childhood. Uganda Demographic Health Surveys –UDHS (2006 and 2011) record that the level of U5MR among male children is consistently higher than that of female children.

3. Methods and Techniques

3.1 Research Design

This study employed the quantitative research paradigm as this study was based on variables measured with numbers and analyzed using statistical procedures (Creswell, 2009). In particular, the study was descriptive, longitudinal panel research. The study was longitudinal-panel research because, the data used under this study were a time series data that covered a period of 24 years (1990-2013). It was descriptive in nature because it aimed at describing the trends and levels of U5MR and predicted the future trend and levels of U5MR. This also illustrated the trends of under-5 mortality rates of male and female for the same period but also tested whether there was
a significant difference of under-5 mortality rates between male and female utilizing the two sample t-test. All the analyses were processed using STATA 12 and analytic induction to elicit an accurate reflection of the studied phenomena on U5MR in Uganda.

3.2 Data and Sources

Uganda, like most developing countries has also a challenge with reference to having comprehensive civil registration systems that record all birth and deaths as they occur accurately, continuously and covers the entire population. This therefore limits availability of high-quality data over time (Alkema & New, 2014). Thus, many of the mortality data is mainly collected through household surveys such as UNICEF-supported Multiple Indicator Cluster Surveys and the US Agency for International Development–supported Demographic and Health Surveys, which ask women about the survival of their children, are the bases of child mortality estimates for most developing countries. The data used in this research were compiled by United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) from sources such as data from vital registration systems, population censuses, household surveys and sample registration systems. This research then embarked on data synthesis/statistical synthesis from different UN IGME reports such as 2011, 2012, 2013 and 2014 UN IGME reports and also the compiled data obtained from http://data.unicef.org in April, 2015. The rates of 1990 to 2013 were used to show the U5MR phenomenon in Uganda in terms of trend, levels, differences and forecasts.

3.3 Data Analysis

To illustrate the trend of U5MR from 1990 to 2013 the data set (Appendix A) of U5MR was drafted through a line graph, as shown in figure 1 and for the levels of U5MR, the descriptive statistics (means, standard error (Std. Error), standard deviation (Std. Dev.), minimum and maximum) were used. The results of the statistical analyses are presented in table 1.

4. Findings and Interpretations

4.1 The Trend of Under-Five Mortality Rates in Uganda

The trend of under-5 mortality rates in Uganda from 1990-2013 is illustrated in figure 1.

![Figure 1: The Trend of Under-5 Mortality Rates in Uganda (1990-2013)](image-url)
The value for mortality rate, under 5 (per 1,000 live births) in Uganda was 60 as of 2013. Figure 1 above shows that, over the past 24 years, the U5MR was reducing from 178 (the maximum) in 1990 to the minimum of 66 in 2013.

4.2 The Levels of Under-5 Mortality Rates in Uganda (1990-2013)
The results in table 1 shows the minimum and maximum values of U5MR for 1990-2013.

<table>
<thead>
<tr>
<th>Mean</th>
<th>Std. Error</th>
<th>Std. Dev.</th>
<th>[95% Conf. Interval]</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>131.7917</td>
<td>7.050537</td>
<td>34.54044</td>
<td>117.2065-146.3768</td>
<td>66</td>
<td>178</td>
</tr>
</tbody>
</table>

Source: UN IGME (1990-2013)

The minimum and maximum values of U5MR for 1990-2013 are 66 and 178 respectively. The mean level of U5MR since 1990-2013 is approximately 132 (mean = 132) and standard error of 7 units with standard deviation at almost 35 units. The 95% confidence interval of these statistics ranges from 117.2065 to 146.3768 units.

4.3 Differences in U5MR between Sexes in Uganda
The graphical representation of differentials between sexes is illustrated in figure 2 and the results from two-sample t test with unequal variances are shown in table 2 below.

![Figure 2: Sex-Specific Differences of U5MR in Uganda (1990-2013)](image)

The value for mortality rate, under-5 for female (per 1,000 live births) in Uganda was 60 as of 2013. As the graph (figure 1) above shows, over the past 24 years, this indicator reached a maximum value of 164 in 1990 and a minimum value of 60 in 2013. The value for mortality rate,
under-5 for male (per 1,000 live births) in Uganda was 72 as of 2013. As the graph (figure 1) above shows, over the past 24 years this indicator reached a maximum value of 192 in 1990 and a minimum value of 72 in 2013. The levels of mortality rate, under-5 for boys have been noticeably above the level of mortality rate than under-5 for girls over the past 24 years (1990-2013).

4.4 Significant Difference in Sex-Specific Trends of U5MR in Uganda (1990-2013)

To test whether the differences between sex-specific trends in U5MR are significant in Uganda, the two-sample t-test with unequal variances was applied. The results are shown in table 2.

**Table 2: Differences in Sex-Specific Trends of U5MR in Uganda (1990-2013)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Err.</th>
<th>Std. Dev.</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>u5mrf</td>
<td>24</td>
<td>120.9583</td>
<td>6.51172</td>
<td>31.09089</td>
<td>107.4907 - 134.4279</td>
</tr>
<tr>
<td>u5mrm</td>
<td>24</td>
<td>141.75</td>
<td>7.55591</td>
<td>37.01615</td>
<td>126.1194 - 157.3806</td>
</tr>
<tr>
<td>combined</td>
<td>48</td>
<td>131.3542</td>
<td>5.16161</td>
<td>35.76072</td>
<td>120.9733 - 141.738</td>
</tr>
</tbody>
</table>

\[
\text{diff} = \text{mean(u5mrf)} - \text{mean(u5mrm)}
\]
\[
t = \frac{-20.79167}{9.974375} = -2.0645
\]

Ho: \( \text{diff} = 0 \)
Welch's degrees of freedom = 46.9325

<table>
<thead>
<tr>
<th>Ha: ( \text{diff} &lt; 0 )</th>
<th>Ha: ( \text{diff} \neq 0 )</th>
<th>Ha: ( \text{diff} &gt; 0 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Pr(T &lt; t) = 0.0213 )</td>
<td>( \Pr(</td>
<td>T</td>
</tr>
</tbody>
</table>

The results in table 2 reveal that the mean level of U5MR for female is 120.9583 (std. dev. = 31.09089) and for the male is 141.75 (std. dev. = 37.01615). This implies that there are unequal variances between the levels of U5MR for boys and girls. Also the results reveal that there exists a significant difference in sex-specific U5MR between boys and girls in Uganda (\( t = -2.0845 \), sig. = 0.0426 < 0.05).

This research shows the trend and levels of U5MR in Uganda, sex differentials in U5MR of the same periods under study and prediction for further values of U5MR. The findings reveal that there is evidence of reducing U5MR in Uganda for the period under this study. The falling rate of U5MR is a global occurrence and this study agrees with the studies of Alba et al (2014), Kimani-Murage et al (2014) and Nuwaha et al (2009). The average annual reduction rate (AARR) was 4.3% as of 2013 (UN IGME, 2014) which is just 0.1% less the recommended AARR by Nuwaha et al (2009). The AARR for previous years have been lower than that 2013 as reported in UN IGME (2011, 2012, & 2013). The values of U5MR showed a leap from 2011 to 2012 with AARR of 3.3% in 2011 to AARR of 4.3% in 2012. This gives the indication of reducing trend of U5MR. Therefore the research hypothesis that the trends and levels of U5MR in Uganda are reducing is accepted. According to UN IGME (2014), the target level of U5MR was 60 per 1000 births. Since the rate of reduction is high in recent years, there are high chances that this level will be achieved.
With regard to sex-specific differentials, as earlier noted, the levels of male children under-5 mortalities are consistently higher than that of the female children for the period considered under this study. The results indicated that there is a significantly higher difference between the U5MR of male over the female. UDHS reports for 2005/06 and 2011 all showed that under 5 mortality rates for female were lower than those of the male. However, whether the difference was significant was not tested. The present results contend that U5MR of males are significantly higher than those of the female inclusive from 1990-2013. These findings however contradict the finding of Krishnan et al (2013). The hypothesis that there is a significant difference in U5MR between male and female in Uganda is accepted.

5. Conclusions

The levels of U5MR are continuously reducing. In the years 2011, 2012 and 2013 there was a sharp decline in U5MR implying that if the same trend continues, Uganda have a higher probability of achieving the MDG4. Also, there exist a significant difference in sex-specific U5MR in Uganda. The mortality rates, under-5 for male is consistently higher than that of the female.

6. Recommendations

If the MDG4 is to be achieved, the Ugandan government need to put forward intensified measures to further reduce the spread of malaria, pneumonia, diarrhea to children. These are still the leading causes of death to Ugandan children. There is a need to further improve health care, transport and communication so that access to health centers is plausible. This death rates in rural areas can be explained by poor roads as one of the contributory factors. However in addition to these developments, a consistent nationwide mobilization of the public regarding mosquito net use, proper maternity care and nutrition of new born children is of utmost concern.

In a broader context, a paradigm shift towards a holistic view in implementing the MDGs at international, national and local political levels and approach it considering the broader socio-, economic or environmental aspects by revisiting and redrafting the national sustainable development policy of the country with relevance to the next Sustainable Development Goals drive.

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