FORECASTING UNDER-FIVE MORTALITY IN KENYA USING THE GENERALIZED LEE-CARTER MODEL

**INTRODUCTION**

Child mortality is a key indicator of a country’s socio-economic progress (Alkema & New, 2015). The UN IGME (2013) does not consider these to be rates of mortality but probability estimations that a child born in a given year will die before age 5. Besides mortality rates, various socioeconomic, healthcare, and environmental factors are known to influence under-5 mortalities. Some of the most critical factors include maternal health indicators, socioeconomic indicators especially female literacy, healthcare infrastructure, nutrition and food security, and environmental factors such as access to clean drinking water. Additionally, policy and governmental initiatives affecting government expenditure on healthcare, child protection programs, and public health policies determine the trend of child mortality.

In the last 50 years (since 1974) Kenya’s child mortality (under-5 mortality) has dropped from 133 to 41.1 deaths per 1000 live births (by 2022) (UN IGME, 2022). Several other developing countries have recorded significant changes in child mortality in the last 50 years. Liberia and Bangladesh have had some of the best improvements in child mortality in this period. In 1990, Liberia had the highest infant mortality rate in the world, but by 2016 it had reduced infant deaths from over 170 to 53 per 1,000 live births (WEF, 2016). Between 1989 and 2014, Bangladesh's child mortality rate declined by 65%, from 133 to 46 deaths per 1,000 live births (Khan & Awan, 2017). Benchmarking a developed country, France's infant mortality rate has gradually decreased over the past few decades, from around 21.8 per 1,000 in the 1960s to 3.2 per 1,000.

Kenya's Sustainable Development Goal (SDG) for child mortality by 2030 is to reduce the under-five mortality rate (U5MR) to 25 deaths or fewer per 1,000 live births. With less than 6 years to achieve this, the trend is very wanting and calls for re-assessment of key indicators and influencing factors of child mortality in the nation. To understand where our policies should focus, it is important to begin looking at countries that are doing much better than us. For Bangladesh, the most influential factor has been improving **maternal and child healthcare access**, complemented by **female education** and **vaccination programs** (Murad et al., 2023). In Liberia, post-Ebola healthcare reforms, including the rebuilding of healthcare infrastructure and focus on WASH (Water, Sanitation, and Hygiene) programs, played a major role (Tambo et al., 2017). Both countries also benefited from robust vaccination efforts and targeted policy support to drive reductions in child mortality rates.

This paper seeks to assess Kenya’s trajectory by projecting child mortality rates up to the year 2030. The aim is to check how far off Kenya is to achieving 2030 SDG goals on childhood mortality. With a clear lack of forecast data in Kenya, we resort to using estimations provided by agencies such as UN IGME, World Bank, and The DHS (Demographic and Health Surveys) Program. The Lee-Carter model has been used extensively in forecasting mortality rates due to its simplicity. The Lee-Carter model, traditionally used in demography, shall be modified to incorporate additional covariates accounting for three key parameters influencing childhood mortality: maternal and child healthcare access, female education, and vaccination programs. This paper shall use the Generalized Lee-Carter Model (GLCM) using a time-varying function to link covariates to the mortality index to project under-five mortality rates for years 2012-2022. A comparison of the results with the observed values shall be made to ascertain the accuracy of the model to project rates up to the year 2030.

**PROBLEM STATEMENT**

Child mortality rate is an important indicator of a country’s overall health condition and socioeconomic development as well as contributes to population projections of a country. It is still unclear whether vision 2030 on under-five mortality rate in Kenya will be achieved. As of 2022 UN IGME statistics, the mortality rate stood at 41.1/1000 live births. Comparing to the SDGs of 25/1000 live births, Kenya still has a long way to go. To clearly understand where the state of the country on this matter, it is important to check the key factors influencing child mortality and how targeting these areas can further lower child mortality rates. To come up with plans and policies on childcare and resource allocation, policy-makers and other stakeholders have to be aware of the prevailing trends and the influencing factors. This project aims at studying the trend of under-five mortality rate over the recent years and forecasting future mortality rates up to the year 2030 using the GLCM.