



# Wood fuel consumption and mortality rates in Sub-Saharan Africa: Evidence from a dynamic panel study



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## HIGHLIGHTS

- The relationship between wood fuel consumption and mortality rates examined.
- Under-five children are more adversely affected by wood smoke than the adults.
- The adverse effect of wood fuel consumption is more on women than men.
- Policy intervention is needed to curtail indoor air pollution from wood fuel burning.

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## ABSTRACT

This study examined the impact of wood fuel consumption on health outcomes, specifically under-five and adult mortality in Sub-Saharan Africa, where wood usage for cooking and heating is on the increase. Generalized method of moment (GMM) estimators were used to estimate the impact of wood fuel consumption on under-five and adult mortality (and also male and female mortality) in the region. The findings revealed that wood fuel consumption had significant positive impact on under-five and adult mortality. It suggests that over the studied period, an increase in wood fuel consumption has increased the mortality of under-five and adult. Importantly, it indicated that the magnitude of the effect of wood fuel consumption was more on the under-five than the adults. Similarly, assessing the effect on a gender basis, it was revealed that the effect was more on female than male adults. This finding suggests that the resultant mortality from wood smoke related infections is more on under-five children than adults, and also are more on female adults than male adults. We, therefore, recommended that an alternative affordable, clean energy source for cooking and heating should be provided to reduce the wood fuel consumption.

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## 1. Introduction

The relationship between mortality and indoor air pollution from biomass fuels burning through some infections is a grave concern to World health organisations and other international bodies. For instance, statistics show that about 4.3 million deaths occurred due to diseases related to indoor air smoke globally (WHO, 2014). The report further stated that indoor air pollution is responsible for about four to five millions recent cases of bronchitis and its economic burden is between 0.5% and 2.5% portion of

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World's gross domestic products (GDP). Environmental Information Administration (2000) reports the monetary loss to indoor air pollution to be between \$150 and \$750 billion annually. This figure makes it be one of the major environmental causes of ill health.

This public health threat varies according to the level of country's or region's development. For instance, in low and middle-income countries, 10% of the total mortality is caused by indoor air pollution, whereas only 0.2% is reported for high-income countries (Bruce and Smith, 2012). Also, empirical studies such as Dherani et al. (2008), Pennise et al. (2009) and Smith et al. (2000) have linked indoor air pollution from wood fuels with some respiratory and pulmonary diseases in the developing World. Pope et al. (2010) assert that about 10% of illness related deaths in Africa is as a result of indoor air pollution from burning biomass fuels.

IEA (2006) shows that about 2.5 billion people depend on

traditional biomass for cooking in developing countries. In the majority of these countries, traditional fuel such as fuelwood, charcoal, agricultural waste, and animal dung, contribute over 90% of the household energy use. If the current trend continues, about 2.7 billion of the world's population will still be depending on these fuels by 2030. [World Bank \(2011\)](#) reports that about 81% of Sub-Saharan African households depend on wood-based biomass energy, mostly fuelwood and charcoal, for cooking. The degree of the dependence is highest among all the regions of the world. Given the population growth, high prices of alternative fuels, and low electrification rate in Sub-Saharan Africa, [IEA \(2010\)](#) predicts the number of traditional biomass consumers to reach one billion by 2030. The main component of the biomass in the sub-Saharan Africa consumed by households is wood fuel, which [Ezzati and Kammen \(2001\)](#) maintain that it provides at least 90% of households' energy demand.

Wood fuels are mostly used with traditional stoves by households, which are inefficient and polluting and, hence leading to an adverse effect on human health. These fuels are the main source of concentrated air pollutants, which comprises of gases (nitrogen oxides and carbon monoxide) and particulate matter ([Kebede et al., 2010](#)). These gases and particulate matter are potential causes of some pulmonary and respiratory diseases that are life threatening, which can sometimes, lead to death.

[American Thoracic Society \(2008\)](#) reports the smoke from cooking with wood fuels causes pulmonary organs related diseases in women, example, emphysema and chronic bronchitis. In Sub-Saharan Africa, stinging eyes, coughs, backaches and headaches resulting from cooking with wood fuel are daily worries ([WHO, 2008](#)). [WHO \(2010\)](#) indicated that indoor air pollution in Sub-Saharan Africa was the second cause of premature deaths after HIV/AIDS, overtaking tuberculosis and malaria, and projected that if the current pace continued, it would be the number one killer by 2030. Specifically, exposure to indoor air pollution from traditional biomass accounts for an annual pre-matured death of 1.3 million people, mostly women and children ([IEA, 2006](#)). Based on the current trend of wood fuel consumption, [World Bank \(2011\)](#), equally estimated that over 4000 people would be prematurely dying daily by 2030, from wood fuel's indoor air pollution.

[Balakrishnan et al. \(2002\)](#) assert that indoor air pollution is now a major global health concern and contributor to the global disease burden. Moreover, [UNDP \(2009\)](#) reports that about 44% of the indoor air pollution disease burden recorded globally, based on disability-adjusted life year (DALY) measure, occurs in Sub-Saharan Africa. Therefore, the effect of indoor air pollution from wood-based fuels based on years lost as a result of ill-health, early death and disability, is worst in Sub-Saharan Africa compare to other regions.

This study aims to estimate the impact of wood fuel consumption on health outcomes in Sub-Saharan Africa. The health outcomes chosen for this study are an adult and under-five mortality rates. The adults, particularly women mostly remain indoor and are the ones in charge of cooking in Sub-Saharan Africa. Similarly, the under five-aged children also usually stay indoor with their mothers and sometimes they play beside their mothers during cooking. Those children below the age of one, are most at times carried on the back by their mothers while cooking. This circumstance exposes both the mothers and the children to the health hazard as a result of inhalation of smoke from wood fuels burning.

The remainder of the paper is structured as follows. Section two presents the survey of the literature. Section three contains data and methods. Section four presents and discusses the results of the study. Lastly, Section five concludes and recommends.

## 2. Survey of literature

Health problems linked to wood fuel consumption is one of the major health concern in developing World. Smoke from incomplete combustion of woods during cooking is linked to serious health complications in the previous studies. The smoke contains some pollutants such as suspended particulate matter and carbon monoxide, which may hurt an individual's health status. Pollution generally can have harmful effects on public health (see, [Aliyu and Ismail, 2016](#); [Bari and Kindzierski, 2017](#); [Kim et al., 2017](#)). Indoor air pollution from traditional biomass is one of the developing countries' health challenges, particularly sub-Saharan African region. [WHO \(2000\)](#) reports that health effect of smoke from cooking with biomass could be clearly seen among the rural population and also, among the urban poor. The report further links household air pollution from cooking with biomass to many diseases that are life threatening.

It is important to note that wood fuel constitutes more than 80% of biomass consumed in sub-Saharan Africa ([Max Roser, 2015](#)). The earlier study to link indoor air pollution to mortality rate was by [Sofoluwe \(1968\)](#). Later, [Anderson \(1978\)](#) linked the two in his study for Guinea. Recent literature emphasised the relationship between the indoor air pollution from cooking with biomass and health problems. For example, [Bruce et al. \(2000\)](#) have established that indoor air pollution from biomass burning is responsible for lower acute respiratory diseases and other health complications. [Ezzati et al. \(2002\)](#) also have reported that the amount of PM<sub>10</sub> in the smoke emitted from cooking with biomass could cause acute respiratory diseases and lung cancers. Other such as [Smith and Mehta \(2003\)](#) and [Schirnding et al. \(2002\)](#) showed that smoke from biomass use is the cause of acute respiratory illness in many developing countries.

The relationship between biomass utilisation and death rate among infants has been stressed by [WHO \(2000\)](#). [Uherek \(2004\)](#) noted that wood biomass is currently receiving some attention around the globe due to its contribution to particles and gases in the atmosphere, which pose a danger to human health and in many cases results in morbidity. Some factors such as poverty level, unavailability of modern fuel and low technological advancement are hinderers to fuel switch in many developing countries, as observed by [Clay \(2002\)](#) and [Viswanathan and Kumar \(2005\)](#). [Schirnding et al. \(2002\)](#) substantiate [Reddy et al. \(1996\)](#) by revealing that the inefficient combustion of biomass results in the production of a mixture of formaldehyde, particulate matter, carbon monoxide and sulphur oxide that exceed the standard level of indoor air pollutants. These pollutants can cause adverse health effects to those in the immediate environment. [Yeh \(2004\)](#), in a cross-country analysis, discloses that the use of biomass fuel could increase the rate of infant, child mortality and their mothers.

Moreover, [Pope et al. \(2010\)](#) showed that indoor air pollution from solid fuel use domestically causes acute respiratory diseases in children, mostly under-five of age and chronic obstructive lung and cancer diseases in adults. They further reveal evidence of the linkage between indoor air pollution from solid fuels to the other health complications such as adverse pregnancy outcomes and low birth weight. In the same light, [Bruce and Smith \(2012\)](#) maintained that the wood biomass burning affects pregnant women adversely by increasing the risk of adverse pregnancy outcomes. They further argued that the effect could also weaken proper cognitive development.

Many studies reported a strong link between chronic pulmonary diseases among adults and biomass fuel consumption. These studies include [Smith et al. \(2004\)](#), [Ezzati \(2005\)](#), [Atkinson et al. \(1999\)](#), [Hong et al. \(2002\)](#), [Saha et al. \(2005\)](#), [Pokhrel et al. \(2005\)](#), and [Laden et al. \(2006\)](#) among others.

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