Background

Diabetes Mellitus is one of the four major non-communicable diseases (NCDs) comprising - cardiovascular diseases, cancers and chronic respiratory diseases jointly contributing to 63% of NCD deaths worldwide [1, 2]. From 1980 to 2014 the number of people living with diabetes globally increased from 108 million to 442 million [3, 4]. In 2017, the estimated figure had risen to 425 million people around the world and the majority were in low and middle income countries [5] with direct annual cost on the world estimated at US$825 billion [2]. Mortality from diabetes occurred every 8 seconds in 2017 estimated at 4 million among 20–79 year olds [5]. If the current diabetes trends continue unchanged, both the number of people living with diabetes and the deaths from diabetes are expected to increase. Low income countries are expected to experience the highest increase in diabetes prevalence (92%) followed by lower-middle income countries (57%), upper- middle income countries (46%) and higher income countries (25%) [3, 4, 6].

Undiagnosed cases of diabetes are a public health concern with costly public health implications. Globally, undiagnosed diabetes are common. Worldwide estimates for undiagnosed diabetes was 50% among people 20–79 years; the proportion of undiagnosed diabetes in Africa (69%) is almost double that of high-income countries (37%) [5]. This contributes to the high morbidity and mortality burden, which occurs at a younger age in Africa. Undiagnosed individuals with diabetes are likely to experience complications even before a diagnosis is made [5]. This can have additional cost implications for households [7] and on already overburdened health systems [8], thus a need to increase screening efforts worldwide to prevent the progression to diabetes.

Pre-diabetes, defined as glycemic levels that are higher than normal, but lower than diabetes thresholds (fasting glucose $> 6{\cdot}0$ mmol/L and $< 7{\cdot}0$ mmol/L) is considered an important risk factor for diabetes and its associated complications such as nephropathy, diabetic retinopathy, and increased risk of macrovascular disease [4, 9–11]. Thus, understanding pre-diabetes is important for future diabetes projections. Some national studies in the US and China estimate adult pre-diabetes prevalence of 36.2% and 50.1%, respectively [12, 13]. One study projects that by 2030, 470 million people will have pre-diabetes globally [14]. Studies have suggested that progression to diabetes is occurring among those diagnosed with pre-diabetes. Tabak et al. suggested that the risk of people with pre-diabetes developing diabetes is 5–10% per year [15]. Larson et al. in a study among postmenopausal women showed that 25% of subjects with impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) test progressed to type 2 diabetes (T2DM) in 5 years [16]. However, there is also evidence indicating that managing pre-diabetes with lifestyle modifications such as physical activity [17] and healthy diets [18, 19] can prevent or delay the progression of pre-diabetes to diabetes while another study reported that behavioral modifications alone reduced the risk of diabetes by 40–70% [15]. It is thus important to identify people in the pre-diabetic state for timely preventive interventions.

Previous population based studies in both rural and urban Kenya found a diabetes prevalence of 3.5–5%, with higher proportions among those in the urban areas [20–23]. These studies are not nationally representative because they lacked national geographic coverage. In 2015, the international Diabetes Federation (IDF) estimated the diabetes prevalence for Kenya to be 2.2% [24]. However the IDF estimates are based on a combination of several data sources including health facility data, small population studies and modelling that may not provide robust estimates. There is need for empirical data at population level to accurately determine the true burden of diabetes in Kenya. Therefore, this study seeks to determine the prevalence, awareness, treatment and control of diabetes and its determinants in a nationally

areas (3.5%) than rural areas (2.7%), among female (3.3%) compared to male (2.8%) and those in the richest wealth quintile (4.9%) compared to poorest quintile (3.3%) though these were not statistically significant. Similarly, the age adjusted prevalence of diabetes was highest among

The pre-diabetes prevalence of the current study was 3.1%. Malawi and Ghana reported diabetes cut off points that include the current study's pre-diabetic sample and found a prevalence similar to the combined diabetes and pre-diabetes prevalence in the current study [37, 38]. Similar to studies conducted in Uganda [36] and South Africa [39] this study reported significantly higher diabetes prevalence in urban areas. This can be attributed to a faster epidemiological transition in urban areas associated with urbanization [40].

As observed in many settings [6, 41–43], pre-diabetes prevalence is higher than diabetes prevalence in our study. Available literature shows that persons with diabetes pass through a pre-diabetic phase during which if no prevention measures are instituted, they become diabetic [44, 45]. Pre-diabetes is a known risk factor for type 2 diabetes [46–48]. It is therefore critical to identify groups at risk of pre-diabetes for lifestyle changes to prevent progression to diabetes. In our study we identified two groups; both men and women with no formal education and women with high total cholesterol levels to be at risk of pre-diabetes. Any form of formal education was associated with lower odds of pre-diabetes as shown by studies in Sweden, China and other European countries [49–51]. Education improves access to relevant prevention messages and comprehension of such information thus influences health behaviors [52].

Diabetes on the other hand was associated with older age, raised blood pressure, and obesity among women as established in literature on metabolic syndrome [53]. The strong associations between advancing age and diabetes ng age d8(n)-6n theUes,45]. 60-695.sdg 5710(vio)]TJ25(60-2et

Our results also show that diabetes treatment levels are low. Only 21.3% of the patients with diabetes

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