

# The cost of influenza-associated hospitalizations and outpatient visits in Kenya



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## Abstract

**Background:** We estimated the cost-per-episode and the annual economic burden associated with influenza in Kenya.

**Methods:** From July 2013–August 2014, we recruited patients with severe acute respiratory illness (SARI) or influenza-like illness (ILI) associated with laboratory-confirmed influenza from 5 health facilities. A structured questionnaire was used to collect direct costs (medications, laboratory investigations, hospital bed fees, hospital management costs, transportation) and indirect costs (productivity losses) associated with an episode of influenza. We used published incidence of laboratory-confirmed influenza associated with SARI and ILI, and the national population census data from 2014, to estimate the annual national number of influenza-associated hospitalizations and outpatient visits and calculated the annual economic burden by multiplying cases by the mean cost.

**Results:** We enrolled 275 patients (105 inpatients and 170 outpatients). The mean cost-per-episode of influenza was



within the last seven days with a measured temperature  $\geq$  38 C° and cough.

**Confirmatory testing for influenza**

incidence (between 2007 and 2013) of influenza-associated hospitalizations and outpatient visits for children < 5 years and persons  $\geq 5$  years [15]. We carried out a sensitivity analysis for the best- and worst-case scenario assuming a low and high incidence of influenza-associated illness respectively [15]. We applied the incidence rates to the population size in 2014, projecting an annual growth rate of 2.7% from the 2009 national census, to estimate the annual number of hospitalizations and outpatient visits associated with influenza illness [16, 17]. We used bootstrap samples – with 1000 replications of the same size as the original dataset and sampled with replacement – to estimate the mean costs which were then applied to the hospitalizations and outpatient visits to estimate overall costs. All costs reported in our analysis are in United States (U.S.) Dollars (1 US\$ =

(SD) cost associated with hospitalization was US\$75.42 (71.10) for children < 5 years and US\$75.45 (36.27) for persons  $\geq$ 5 years (Table 2 and Additional file 2: Table S2). For outpatient visits the mean (SD) cost was US\$8.62 (6.15) for children < 5 years, and US\$5.97 (4.07) for persons  $\geq$ 5 years (Table 3 and Additional file 2: Table S3). The overall mean (SD) indirect cost-per-episode of influenza-associated illness was US\$42.01 (41.54) (< 5 years = US\$38.94 [38.59]; and  $\geq$  5 years = US\$58.61 [53.37]) among hospitalized patients compared to US\$12.84 (27.17) (< 5 years = US\$13.87 [31.36]; and  $\geq$  5 years = US\$10.88 [16.65]) among outpatients.

National economic burden of influenza-associated illness  
Assuming the lowest (< 5 years = 2.7 per 1000 children;  $\geq$ 5 years = 0.2 per 1000 persons) and highest (< 5 years = 4.7 per 1000 children;  $\geq$ 5 years = 0.4 per 1000 persons) published incidence of hospitalizations associated with influenza activity in Kenya [15], we estimated total hospitalizations to range from 25,154 to 45,672 (< 5 years = 17,875 - 31,115;  $\geq$ 5 years = 7279 - 14,557). These would result in costs ranging from US\$ 2.96 to 5.37 million (< 5 years = US\$2.04–3.55 million;  $\geq$ 5 years = US\$1.00–1.99 million) (Table

Influenza vaccine is the most effective way to prevent influenza and should be considered for groups at risk of influenza-associated complications and hospitalizations in Kenya.

The overall cost-per-episode of influenza-associated hospitalizations was six times higher when compared to outpatient visits. This was driven by the facility-based medical cost component, where the hospitalization cost was thirteen-fold higher, and was similar to the results published in Bangladesh [13]. Because of the higher frequency of outpatient visits, the annual economic burden for outpatient influenza-associated illness in Kenya was substantially high relative to hospitalizations, which is consistent with results reported from other studies [3, 13]. However, the overall cost-per-episode of influenza in our study was lower than reported elsewhere in developed countries [5, 18]. This could be explained by the relative lower cost of healthcare and the comparatively low income level in Kenya where the gross national income per capita is estimated at US\$939 [19].

The duration of hospitalization was higher for children < 5 years compared to older persons. This is contrary to findings reported elsewhere [6] and may be explained by the fact that in our study population only 7 persons were > 40 years old. Older adults tend to stay longer in hospital due to complications associated with underlying diseases [20]. We also found that the cost-per-episode when the illness involved a child < 5 years old was similar to the cost among older patients aged  $\geq 5$  years. Other than the effect of underrepresentation of older patients in our study, this finding could also be explained by the fact that a higher percentage (46%) of children < 5 years compared to older patients (20%) had sought healthcare or had drugs bought over the counter prior to the hospitalization or

Influenza-associated illness also resulted in school absenteeism among sick children, with a median of 4 days of missed school, which was comparable to findings from a study conducted in Hong Kong [23], and another study conducted in the US [4]. Notably, we found that school absenteeism was higher among households of outpatients compared to those of hospitalized patients. A possible explanation could be that older siblings may be asked to stay at home and take care of the younger ones as the caretakers take the sick child to a health facility. However, in a case of hospitalization - where it may not be certain when the mother/parent will return - young children may be left at the care of relatives or neighbors. of [

Overall, a single episode of influenza-associated hospitalization resulted in a substantial cost of approximately 60% of the household average monthly income while outpatient-associated influenza costs represented 12%. Regardless of the fact that medical costs at the hospital were covered by the government for children < 5 years [12], the overall resultant costs from an influenza-associated hospitalization - which were paid out-of-pocket (40% of the household average monthly income)

- could put a financial strain on families [24] and may also negatively impact on other competing household priorities such as food and education. Our data showed that approximately 64% of household members lost days at work which in many cases imply lost income as most were self-employed. Considering the possibilities of influenza-associated complications, the financial impact to the household arising from such cases could even be greater.

The mean cost-per-episode of influenza among children < 5

years was estimated to be

US\$1,326 (95% CI US\$1,000-1,652)

for outpatients and

US\$165 (95% CI US\$100-230) for hospitalized patients.

These findings are consistent with those of a study

conducted in

account for potential variation on influenza circulation from year to year, we used a sensitivity analysis based on the range of previously estimated rates of influenza hospitalization in Kenya. Moreover, due to the small sample size, we were not able to breakdown costs associated with influenza by small age groups. The sample size may also have affected our ability to find any differences in influenza-associated costs by type and sub-type of viruses; some studies have suggested differences in severity of influenza-associated disease based on type and subtype of virus which could lead to differences in costs [26, 27]. Another potential limitation was that older patients were underrepresented in our patient-population as healthcare seeking is low in this group [28], and our cost estimates associated with influenza could be underestimated, principally considering the high prevalence of underlying medical conditions among older patients that could lead to prolonged hospitalization. Indeed, as routinely seen in our hospital-based surveillance, only 3% of the study participants were aged  $\geq 40$  years and only 5% of the study participants had been tested for HIV. Additionally, data on other underlying comorbidities such as asthma, diabetes, cardiac disease, and tuberculosis were

limited. With regard to the calculation of costs, we estimated the facility-based medical-costs by applying charges that were recorded on the hospital bill charge sheets, the price catalogue charts, and the receipts that were issued to the patients as a proxy for the actual cost. As such, the actual costs may have varied by the extent to which these charges approximated the true cost to the hospital. Moreover, we did not include the physician'



## Conclusions

Our findings show that medically attended, influenza-associated illness in Kenya generate substantial direct and indirect costs. The burden is driven mostly by outpatient visits. Whereas this study highlights an important societal economic impact of influenza-associated illness, further studies should explore the cost-effectiveness of targeted influenza vaccination in Kenya and account for years lost due to death or disability in order to guide vaccine recommendation policies.

## Additional files

[Additional file 1](#): Supplemental methods. (DOCX 28 kb)

[Additional file 2](#): Supplemental tables. (DOCX 26 kb)

**About this supplement**

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**Authors' contributions**

All authors have read and approved this final manuscript. GOE, LKN, MLW, JWP, KV, and JAM were involved in concept and design of manuscript; GOE, LKN, NAO, IWN, and PMM were involved in data collection; KW conducted the laboratory tests; GOE analyzed the data and was the lead author in writing the manuscript; GOE, LKN, MLW, JWP, JD, SSC, KV, and JAM were involved in interpretation of data; and GOE, LKN, MLW, JWP, JD, SSC, NAO, KW, IWN, PMM, KV, and JAM participated in writing the manuscript. All authors read and approved of the final manuscript.

**Ethics approval and consent to participate**