


Impact of devolution on the trends of Paediatric Malaria Admissions and Mortality in Homa-Bay County, Kenya- An Interrupted Time Series Analysis

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Abstract

Background: Malaria is a leading cause of paediatric admissions, morbidity and mortality. Its burden is borne mainly in the endemic areas, like Homa-Bay in Kenya, which are also the poorest. It is therefore important for the County
to prioritize preventing paediatric malaria. Paediatric malaria admission and mortality have recently increased in the lake region unlike the rest of Kenya. It is also not clear whether after devolution was implemented in the year 2013, the trend has changed. The objective of the study was to investigate the impact of devolution on paediatric malaria admission and mortality trends in public health facilities in Homa Bay County.

**Methodology:** A retrospective quasi-experimental study was performed. The study population comprised all public health facilities in Homa-Bay County. We purposively sampled 164 public health facilities from which six-year data on paediatric admissions and mortality was collected. Sub-County level data was obtained on excel from the electronic health records at the County headquarters. Hard copy data from the health facilities were also inspected at the 8 sub-Counties. Data was analyzed by the Interrupted Time Series (ITS) method. Devolution, which was taken as the intervention, occurred around the 36th month of the follow-up period.

**Results:** From January 2013, deaths increased gradually until around the 33rd month when it rose abruptly to nearly 800 then declined to below 200 in the 34th month around the time of devolution. This was followed by a period of stability. Admissions had a similar trend.

**Conclusions and recommendations:** Paediatric malaria admission and mortality rates in Homa Bay increased around the time of devolution. More studies are necessary to assess progress towards universal access to care post devolution.

**Keywords:** Devolution, paediatric malaria, admissions, mortality, Homa-Bay.

**Introduction**

Malaria is a protozoal disease prevalent mostly in the tropics and sub-tropics. Children of ages 5 years and below are the most vulnerable to malaria. The socio-economic burden of Malaria is greatest in the endemic areas of Kenya such as the Lake Victoria region. Devolution of healthcare was introduced in Kenya in the year 2013 to attempt to increase access to health care. This new system of government which was aimed at taking services closer to the people was put in place after the general elections of March 2013. Health care is among the functions of government that was devolved. The national government formulate health policy whereas the county governments are responsible for health service provision. The need to assess the impact of devolution especially in the marginalized and far flung counties like Homa Bay County is immense. Since the advent of devolution, health care providers have consistently resisted it. Initially, the resistance was seen in practising professionals, but empirical research has documented similar sentiments from students as well [1]. Most of them look forward to working in the private sector upon graduating. The public health managers in the county governments complain of poor work environment, transition challenges, restricted decision space, resource constrains and uncertainty among other challenges in rolling out devolution of health care services [2]. The typical bottle necks for progress of devolution often involve lack of clear policies, poor transition processes and human resource malpractices [4, 5, 6]. On the other hand, the main aim of devolving health care was to improve access. Studies from Cote D’Ivoire [7, 8] and Kenya have shown that devolution may lead to equity and edging towards universal health coverage [9, 10]. This is because it removes barriers to care [11] and improves ownership and public participation in health care decisions [12, 13, 14]. For devolution of health to succeed, it is important to understand the needs of stakeholders such as the user communities, political leaders and health care providers [15, 16, 17].

Africa has in the recent past recorded varying trends in paediatric malaria admissions from country to country and between health facilities [18]. Even though overall paediatric malaria admission rate has been on the decrease in Kenya, that in the Kenyan lake region are on an upward trend [19]. In Malawi, the trend is similarly of an increase in admissions despite interventions aimed at reducing transmission such increased insecticide treated nets (ITN) coverage [18]. Around the same time when Artemisinin combination therapy (ACT) antimalarial drugs had been made to be first line, Uganda also recorded a significant increase in paediatric malaria admission rates [19]. Mortality rates due to paediatric malaria were also on an increasing trend despite a decrease in the number of microscopically confirmed cases. These trends seemed to correlate with the trends in ITN use, ACT stock levels and rainfall intensity[20]. Similar trends were recorded in Ethiopia [21], Malawi [20], Rwanda [20] and Ghana [22]. In the year 2016, even though malaria cases, admissions and deaths declined significantly, all cause admissions, all cause deaths and non-malaria cases and admissions increased significantly, showing the need to combat childhood illnesses in an integrated manner [22]. There is a deficiency of studies interrogating health policy correlates and implications of these trends. It is also not clear whether in Kenya, with devolution, the trend has improved, worsened or remained the same. The purpose of this study was, therefore, to investigate the impact of devolution on paediatric malaria admission and mortality trends in public health facilities in Homa Bay County.

**Methods**

We performed a retrospective quasi-experimental study from January 2010 until December 2016 in Homa Bay County. The study involved analysis of county paediatric malaria admission and mortality records. This information was obtained by reviewing the county and sub-County health records. The study population consisted of all public health facilities in Homa-Bay County. Homa-Bay County currently has 164 public health facilities with one County
Teaching and Referral Hospital, four County hospitals, seven Sub-County Hospitals, 38 Health Centers, 88 Dispensaries, 7 Voluntary Counselling and Testing (VCT) Centers and 73 privately owned health institutions. For the purposes of this study, a total of 164 public health facilities were included. The study adopted purposive sampling since all the health facilities which presented admission and mortality data to the sub-County and County aggregation centers were included in the study. Health facilities that started operating after 2012 were excluded from the study since they lacked adequate pre-devolution data. Data from the 164 public health facilities were analyzed. Ethical approval was obtained from the KNH/U.o.N-Ethics and Review Committee (Ref-P389/05/2016). Confidentiality was ensured by using password protection when mailing data. Hard copy data was kept under lock and key accessible to the investigator only. Data was obtained from the electronic records at the Homa-Bay County teaching and referral hospital after authorization by the County secretary for health and the head of County Health Management Information Systems. The data was obtained in an excel sheet which was sent to the e-mail of the investigator under password protection. Data was then inspected for completeness and those facilities that lacked adequate pre-devolution data were excluded from the study. The data so obtained was an aggregate of facility level monthly admission and mortality. For purposes of triangulation, hard copy data from the health facilities were also inspected at the 8 sub-Counties. Data was analyzed by the Interrupted Time Series (ITS) analytic model. This involved plotting monthly paediatric malaria admissions and mortality against time from January 2010 to December 2016, with devolution, being the intervention, occurring around the 36th month. The plot was then visually inspected to see if devolution had an impact on the indicators. Interrupted time series analysis is a special type of time series analysis where treatment/intervention occurs at a specific point and the series is broken up by the introduction of the intervention. If the treatment has a causal impact, the post-intervention series will have a different level or slope. This design was used to quantitatively scrutinize trends of paediatric malaria admissions and deaths three years prior to and three years after the roll out of devolution of health care services in Kenya.

The Model: The time series analysis was done based on the logistic regression model represented by the following equation:

\[
\hat{Y}_t = \beta_0 + \beta_1 \times \text{time} + \beta_2 \times \text{intervention} + \beta_3 \times \text{time after intervention} + \epsilon_t
\]

Where; \( \hat{Y}_t \) is the outcome time indicates the number of quarters from the start of the series, \( \beta_0 \) estimates the base level of the outcome at the beginning of the series, \( \beta_1 \) estimates the base trend, i.e. the change in outcome per quarter in the pre-intervention segment, \( \beta_2 \) estimates the change in level in the post-intervention segment, \( \beta_3 \) estimates the change in trend in the post-intervention segment and \( \epsilon_t \) estimates the error. Intervention is a dummy variable taking the values 0 in the pre-intervention segment and 1 in the post-intervention segment. Time after intervention is 0 in the pre-intervention segment and counts the quarters in the post-intervention segment at time.

**Results**

**Descriptive data.** A total of 275,936 admissions and 10,239 deaths were included in our analysis. These deaths therefore represented 37.1% of all paediatric malaria admissions in the County during the period of study. The deaths before 2013 were treated as death before devolution while deaths after 2013 were treated as deaths after devolution. The same applied for admissions. The descriptive summary statistics are shown in table 1 and graphically presented in figures 1 and 2 below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Admissions</th>
<th>Total Admissions</th>
<th>Deaths</th>
<th>Total Deaths</th>
<th>Proportion of deaths by admissions</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>90</td>
<td>1,084</td>
<td>8</td>
<td>90</td>
<td>8.3</td>
<td>4.8</td>
</tr>
<tr>
<td>2011</td>
<td>2,903</td>
<td>34,835</td>
<td>140</td>
<td>1,683</td>
<td>4.8</td>
<td>6.2</td>
</tr>
<tr>
<td>2012</td>
<td>3,283</td>
<td>39,397</td>
<td>204</td>
<td>2,442</td>
<td>6.2</td>
<td>6.2</td>
</tr>
<tr>
<td>2013</td>
<td>2,847</td>
<td>34,167</td>
<td>157</td>
<td>1,883</td>
<td>5.5</td>
<td>After</td>
</tr>
<tr>
<td>2014</td>
<td>2,056</td>
<td>24,668</td>
<td>183</td>
<td>2,190</td>
<td>8.9</td>
<td>After</td>
</tr>
<tr>
<td>2015</td>
<td>2,608</td>
<td>31,300</td>
<td>163</td>
<td>1,951</td>
<td>6.2</td>
<td>After</td>
</tr>
</tbody>
</table>

Table 1 is an aggregated summary of yearly admissions and deaths for three years before and three years after devolution. The single horizontal line above the year 2013 indicates the time when devolution of health services to the county governments was implemented, thus being the intervention in this natural experiment. The average proportion of deaths by admissions before devolution was 6.4% compared to 6.9% after devolution. This represented a slight increase in deaths per admission after devolution.

**Inferential data.** The data on paediatric malaria admissions and deaths were plotted against time in months. Trends of admissions and deaths were as captured in figure 1. The graph was generated by a logistic regression modelling technique coupled with an interrupted time series analytic model.

Figure 1 (Next Page) shows trends of paediatric malaria deaths and admissions per month. From month zero, January 2013, deaths increased gradually until around the 33rd month when it rose abruptly to nearly 800 and declined back to below 200 in the 34th month. This was then followed by a stable trend of deaths being around 180 per month. Admission data started from near zero at month zero, increased sharply to almost 1000 in month five then fell equally sharply to zero in month 10. From month 12, admissions rose drastically to above 4000, stabilized around 3800 up to month 40 then gradually declined to month 60 after which a gradual increase started.
Discussion

The admissions increased from 2010 and stabilized around 2013. This abrupt rise was around the 36th month when devolution of health care was implemented. This was followed by a gradual decline in which again stabilized around 2014. The increase in the admissions may be attributed to anticipation of better services given that devolution of other services had begun by 2011. The people’s perceptions may have improved in the backdrop of impending devolution of health services. The message that was given to citizens during the campaigns for the new constitution was that with devolution, they would participate more in making decisions about their health thus improving access and quality of health they would receive. In the year 2001, residents of Saskatchewan reported a similar experience. Most of them felt that devolution had resulted in greater local control and better quality of health care decisions [13]. Having been promulgated in the year 2010 August 27th, the new constitution seems to have given the citizens of Homa Bay County a new hope of better health services in their public health facilities. On the other hand, deaths seemed to have declined between 2010 and 2011, stabilized until 2013 after which there was a sharp increase. The possible explanation for this observation is that given the increase of admissions around the year 2013 when devolution was implemented, the number of deaths would be expected to similarly increase merely due to increase in the number of sick children admitted to the hospitals. Alternatively, there is a possibility that admissions and deaths increased due to better health records management after devolution. If the increasing trend of deaths reflected a genuine pattern, then this may be attributed to many factors including the fact that most health facilities were not properly prepared for the intricate realities of devolving health care and hence were struggling with management of health service delivery in the new context of devolution [2,5]. Autonomy of the County health care resource management was also not yet adequate. For example, a lot of money was being used to upgrade the infrastructure of small facilities to higher level hospitals. Such challenges were experienced in Tanzania where health services were devolved earlier [23]. As was reported from a study in Nepal, other issues that may act as bottlenecks to achievement of benefits of devolution early enough may include poor coordination among different sectors, improper handover process, poor selection management committees and incoherent capacity building [24]. It is however prudent to note that determinants of disease incidence are often a complex combination of several interacting factors that may not be effectively studied retrospectively [17]. Moreover, managing specialized health services in a devolved health system is usually challenging [10]. At that time, as it is largely still to date, there was poor harmonization of terms of service, incentives and amenities available to health workers in remote areas like Homa Bay County [3]. This could have affected the morale of health care providers hence poor service delivery. The process of devolution is work in progress and by 2013, it was in its infancy stages. It has been noted that devolution plans are not often implemented as intended [8]. It is therefore likely that there were deviations in implementation of health care devolution in Kenya, thus leading to unintended outcomes like has been observed in this study.

Conclusion and Recommendations

These findings provide evidence that devolution of healthcare still has erratic and fluctuating outcomes with specific reference to paediatric malaria admissions and deaths in Kenya. In general, devolution seemed to have increased paediatric admission and mortality rates in Homa Bay over the period of the study. More studies need to be mounted in different Counties or as a national survey to take stock of the benefits or otherwise of devolution of health care to the citizens. This would help unmask whether there are significant intercounty variations or not. Periodic audits of the progress towards universal access to health care needs to be conducted in many Counties in Kenya to visualize the real impact of devolution on our health care service delivery. A study focusing on facility level analysis of paediatric malaria indicator data would be useful to unearth any trends unique to each facility as well as trends across facility levels.

References


