Improving outcomes of childhood pneumonia in Kenya through pneumococcal vaccination and case management
Ayieko, P.O.

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Improving outcomes of childhood pneumonia in Kenya through pneumococcal vaccination and case management

Summary

The research work presented in this thesis is based on the theme of pneumonia treatment and prevention in children aged under five years in developing countries. More specifically, the main studies presented here focus on Kenyan children admitted to hospital with pneumonia and managed using the WHO case management approach and national guidelines for treating pneumonia. In addition, a study evaluating the cost-effectiveness of pneumococcal conjugate vaccination to reduce pneumonia morbidity and mortality is presented.

Chapter 1 presents the introduction to this thesis and its objectives. Childhood pneumonia is the most common single cause of child mortality worldwide and most of these deaths occur in developing countries. Currently, provision of early effective treatment and prevention of disease through vaccination are among the most promising interventions available for reducing childhood pneumonia mortality. Each of the studies presented here addresses at least one of these two areas mentioned above namely, effective treatment of pneumonia or its prevention. Firstly, to ensure that pneumonia treatment recommendations remain effective in the face of changes in pneumonia epidemiology and advances from research into clinical management of pneumonia we conducted two systematic reviews of published studies undertaken after formulation of WHO case management guidelines. By conducting systematic reviews of recent studies we aimed to identify evidence supporting the current guideline recommendations, and the potential implication of emerging research for updating these guidelines.

Secondly, apart from availability of effective guidelines several studies have reported implementation experience for inpatient pneumonia treatment that can impact on treatment outcomes and there is a need incorporate these experiences into patient management. For example in a Kenyan study health workers rarely prescribed antibiotics for very severe pneumonia for 71% of pneumonia admission although only 16% of admission had very severe pneumonia. The same study also documented serious shortcoming with regard to pneumonia supportive care including oxygen therapy.
Thirdly, to address pneumonia prevention strategies we evaluate the costs of treatment for pneumonia admissions and the cost-effectiveness of pneumococcal vaccination among Kenyan infants. We also estimate the robustness of estimates of inpatient pneumonia mortality to determine appropriateness of estimates applied in evaluating impact of pneumonia vaccination in preventing pneumonia mortality.

In Chapter 2 we evaluate the WHO pneumonia case management strategy formulated in 1991 which has since been adopted as the basis for pneumonia management in Kenya and similar settings. The literature reviews supported the current clinical criteria of classifying pneumonia. Clinical trial data also indicated that WHO recommended therapy is effective in treatment of at least 80% of pneumonia cases. However, the reviews demonstrated that use of pulse oximetry should be promoted although clinical signs can be used to detect hypoxaemia in centers which lack pulse oximetry.

The setting of the studies presented in chapter 3 and 4 are Kenyan District hospitals and their focus is on the quality of care and outcome of care among inpatient admissions, respectively. Chapter 3 reports the findings of a cluster randomized trial of a multifaceted intervention to implement guidelines and improve admission care of children in eight Kenyan District hospitals. At the end of 18-month intervention period there was improvement in quality of care in both intervention and control hospitals. Compared to the partial (control) intervention the multifaceted intervention comprising evidence-based guidelines, training, job aides, local facilitation, supervision, and face-to-face feedback was associated with greater changes in practice spanning multiple, high mortality conditions including pneumonia. In Chapter 4 data collected among pneumonia admission in nine district hospitals is used to explore whether there are significant variations in mortality across hospitals. Overall, 5.9% of all admission with a pneumonia diagnosis died in before discharge. The study found evidence of significant variations in mortality between hospitals. Such variations in mortality are not addressed by existing epidemiological models and need to be considered in allocating resources to improve child health.
Knowledge of treatment cost is essential in assessing cost effectiveness in healthcare. There is however, a dearth of data related to treatment costs in developing countries especially in sub-Saharan Africa. Chapter 5 also based within seven Kenyan District hospitals presents the economic costs covered by Kenya households and healthcare providers during common childhood illnesses including pneumonia. The findings of this study showed that treatments cost for inpatient malaria, pneumonia and meningitis vary by facility type, with mission and tertiary referral facilities being more expensive compared to primary referral. Households of sick children contribute significantly towards provider cost through payment of user fees. These findings could be used in cost effectiveness analysis of health interventions.

The costs presented in chapter 5 are then used in chapter 6 along with Kenyan data on pneumococcal disease incidence calculated by syndrome together with African evidence of vaccine efficacy to estimate the cost-effectiveness of delivering PCV10 in routine immunization services in Kenya. We include the vaccine impact against both morbidity and mortality and also explore the impact on cost-effectiveness of incorporating indirect effects and of switching to 13-valent vaccine (PCV13). The findings in this chapter demonstrate that introducing either PCV10 or PCV13 in Kenya is cost-saving from a government perspective and highly cost-effective from a societal perspective. Indirect effects, if they occur, would significantly improve the cost-effectiveness.

Chapter 7 summarizes the findings presented in this thesis. It also discusses the policy implications of the findings. The findings of the systematic review support the utility of the current case management strategy in assessing children with ARI, classifying pneumonia severity and providing treatment appropriate to the degree of pneumonia severity. There is need for studies on adequacy or penicillin monotherapy or oral antibiotics for severe pneumonia, and studies on treatment of children with HIV. The studies presented in this thesis indicate that implementation of inpatient case management can be improved through applying a multifaceted approach to improving quality of care, and that pneumococcal vaccination is highly cost effective. This finding justifies the continued funding of pneumococcal immunization using government funds at the end of the donor supported funding period. Implementation of the
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