

Antibiotic use and respiratory pathogens with focus on *Streptococcus pneumoniae* in Tanzanian children

Akademisk avhandling som för avläggande av medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet, kommer att offentligen försvaras i Arvid Carlsson, Academicum, Medicinaregatan 3, Göteborg, torsdagen den 20 april 2023, klockan 9.00

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Avhandlingen baseras på följande delarbeten

- I. Emgård M, Msuya SE, Nyombi BM, Mosha D, Gonzales-Siles L, Norden R, Geravandi S, Mosha V, Blomqvist J, Franzen S, Sahlgren F, Andersson R and Skovbjerg S. Carriage of penicillin non-susceptible pneumococci among children in northern Tanzania in the 13-valent pneumococcal vaccine era. *International journal of infectious diseases* 2019; 81:156-66.
- II. Emgård M, Andersson M, Gonzales-Siles L, Msuya SE, Nyombi BM, Nordén R, Muro F, Lindh M, Andersson R and Skovbjerg S. Presence of respiratory pathogens and serotype distribution of *Streptococcus pneumoniae* in the nasopharynx of Tanzanian toddlers following introduction of the PCV13. *Manuscript*
- III. Emgård M, Mwangi R, Mayo C, Mshana E, Nkini G, Andersson R, Msuya SE, Lepp M, Muro F and Skovbjerg S. Tanzanian primary healthcare workers' experiences of antibiotic prescription and understanding of antibiotic resistance in common childhood infections: A qualitative phenomenographic study. *Antimicrobial Resistance and Infection Control*. 2021;10(1):94.
- IV. Emgård M, Mwangi R, Mayo C, Mshana E, Nkini G, Andersson R, Msuya SE, Lepp M, Skovbjerg S and Muro F. Antibiotic use in children under 5 years of age in Northern Tanzania; a qualitative study exploring the experiences of the caring mothers. *Antimicrobial Resistance and Infection Control*. 2022;11(1):130.

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ABSTRACT

This thesis describes the epidemiology of *Streptococcus pneumoniae* (pneumococci) and other respiratory pathogens after introduction of the 13-valent pneumococcal conjugate vaccine (PCV13) and further portrays antibiotic use in Tanzanian children. Pneumococci are a leading cause of pneumonia in children. However, respiratory infections among children may be associated with over-use of antibiotics leading to bacterial resistance, a significant threat to global child health.

In a *quantitative* study, conducted in urban Moshi, Northern Tanzania 2013-2015, 775 children <2 years of age attending public primary healthcare facilities for routine care were sampled from the nasopharynx. Structured interviews with the parent/guardian revealed that more than half of the children had received antibiotics in the past 3 months. Isolated pneumococci ($n=244$) showed increasing resistance to phenoxymethylpenicillin from 35% in 2013 to 60% in 2015, but resistance to amoxicillin, the first line pneumonia treatment, remained low (1%). Although vaccine-type pneumococci decreased significantly during the study period, the prevalence of residual vaccine-types remained high (21%). Detection of respiratory syncytial virus or adenovirus were associated with parent-reported rapid or difficult breathing and antibiotic treatment in the past week.

A *qualitative* phenomenographic study was subsequently conducted in urban and rural Moshi in 2019. Individual in-depth interviews with primary healthcare workers showed a reliance on physical examination of the child and history from the mother when deciding whether to prescribe an antibiotic. However, their confidence in providing advice as to non-antibiotic treatment varied. Most mothers attending the focus group preferred seeking care for their sick child at healthcare facilities, but they faced barriers including unforeseen costs, travel, and lack of support from their husbands. Pharmacies were often perceived as cheap and convenient place to obtain antibiotics for children, whilst some mothers sought health advice from a trusted neighbour.

Conclusions: Increasing resistance to antibiotics and residual vaccine-types require continued epidemiological surveillance of pneumococci in the post PCV13 era. Healthcare workers need support to develop their clinical and consultation skills, meanwhile mothers should be supported in seeking appropriate healthcare for their children. For this, improved equity and increased presence of community health workers are necessary.

Keywords: Antimicrobial stewardship; Drug resistance, Bacterial; Drug prescribing; infant; pneumococcal conjugate vaccines; *Streptococcus pneumoniae*; Tanzania; viruses