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Exposure to household air pollution among mothers and children in Ethiopia: *Socio-cultural factors and association with airway health*

Akademisk avhandling

som för avläggande av medicine doktorsexamen vid Sahlgrenska akademin, Göteborgs universitet, kommer att offentligen försvaras i Hörsal Arvid Carlsson, Academicum, Medicinaregatan 3, Göteborg, torsdagen den 17 december klockan 13.00

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Avhandlingen baseras på följande delarbeten

I. **Tamire M**, Addissie A, Skovbjerg S, Andersson R, Lärstad M. *Socio-cultural reasons and community perceptions regarding indoor cooking using biomass fuel and traditional stoves in rural Ethiopia: A qualitative study*. Int J Environ Res Public Health 2018; 15: 2035.

II. **Tamire M**, Addissie A, Kumie A, Husmark E, Skovbjerg S, Andersson R, Lärstad M. *Respiratory symptoms and lung function among Ethiopian women in relation to household fuel use*. Int J Environ Res Public Health 2019; 17: 41

III. **Tamire M**, Addissie A, Gizaw S, Abebe T, Geravandi S, Nilsson S, Gonzales Siles L, Lärstad M, Nordén R, Andersson R, Skovbjerg S. *Household fuel use and its association with potential respiratory pathogens among healthy mothers and children in Ethiopia.* Manuscript.

IV. **Tamire M**, Kumie A, Addissie A, Ayalew M, Boman J, Skovbjerg S, Andersson R, Lärstad M. *High levels of particulate matter (PM2.5) from burning solid fuels in rural households of Butajira, Ethiopia.* Manuscript.

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Abstract

Using solid fuel generates emissions of many health-damaging pollutants including inhalable fine particulate matter ($PM_{2.5}$). Such exposure is known to cause morbidity and mortality in low- and middle-income countries, including Ethiopia, where solid fuel, mainly wood, is a primary source of energy. This thesis aimed to explore the reasons of using solid fuel and traditional stoves and to determine the levels of pollution and associated effects on the respiratory health of mothers and their children.

Qualitative exploration in the **first paper** showed that economic status, lack of commitment, cultural views and concern along with safety and security issues were barriers to change from traditional to cleaner means of cooking in rural areas of Butajira, Ethiopia. The com-munity perceived wood smoke to have negative health effects on their eyes and respiratory health but as beneficial for postpartum mothers and newborns, ridding the house of bad smells and insects. The **second paper** involved 545 mothers from urban and rural settings to assess the association between solid fuel use and self-reported respiratory symptoms and lung function, as determined by spirometry with reversibility testing. Significantly higher prevalence of cough, phlegm, wheeze and irritation of nose and lower forced expiratory volume in the first second (FEV1) were found among mothers using solid fuels than among those using cleaner fuels. The odds of developing at least one respiratory symptom were twice as high for women who cooked inside the house when compared with those using cleaner fuels. In the **third paper**, nasopharyngeal swabs were taken from 168 mothers and 175 children and analyzed for bacteria and virus by multiplex PCR. Detection of *Streptococcus pneumoniae* and *Haemophilus influenzae* was significantly more frequent among solid fuel users, when compared with those using cleaner energy. In the **fourth paper**, measurements of $PM_{2.5}$ were conducted in 147 rural households for 24 hours during both rainy and dry seasons. The 24-hour mean level of $PM_{2.5}$ was 410 $\mu g/m^3$, 16 times higher than the WHO 24-hour mean air quality guideline of 25 $\mu g/m^3$.

Based on the high level of $PM_{2.5}$ emission and sole reliance on solid fuel use, there is an unaddressed threat for the health of Ethiopian women and children. Sustainable measures to shift to the use of cleaner energy along with education for awareness of their health and cultural myths, need to be addressed to solve this problem.

Keywords: Household air pollution, solid fuel use, *Streptococcus pneumoniae*, particulate matter, socio-cultural barriers, Ethiopia.

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