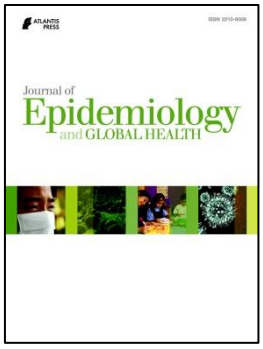

ATLANTIS PRESS

Journal of Epidemiology and Global Health

ISSN (Online): 2210-6014 **ISSN (Print): 2210-6006**
Journal Home Page: https://www.atlantis-press.com/journals/jegh

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To cite this article: Emi Watanabe, Colleen M. McBride, Abebayehu Tora, Desta A. Ayode, David Farrell, Gail Davey (2014) Use of footwear and foot condition among rural Ethiopian school children, Journal of Epidemiology and Global Health 4:4, 323–325, DOI: https://doi.org/10.1016/j.jegh.2014.06.001

To link to this article: https://doi.org/10.1016/j.jegh.2014.06.001

Published online: 23 April 2019

Journal of Epidemiology and Global Health (2014) 4, 323–325

http:// www.elsevier.com/locate/jegh

Use of footwear and foot condition among rural Ethiopian school children

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Received 18 March 2014; received in revised form 30 May 2014; accepted 8 June 2014
Available online 23 August 2014

KEYWORDS
Footwear;
Prevention;
Children;
Assessment

Abstract *Objective:* To evaluate whether shoe-wearing affords foot protection among school children living in southern Ethiopia.

Methods: Data collectors conducted a standardized foot assessment with children in an elementary school in southern Ethiopia ($N = 168$).

Results: 54% reported wearing shoes consistently in the prior three days. Children wearing closed-toed shoes showed less adherent soil and toe nail dystrophy than those wearing open-toed sandals. There were no differences by shoe type with regard to signs of foot trauma or heel fissures.

Conclusions: Shoe wearing provided limited foot protection. Interventions are needed to build behavioral skills, including foot washing and wearing appropriate shoes that maximize foot protection.

1. Introduction

Infrequent use of shoes is particularly problematic in areas in which a range of soil-transmitted and foot-related diseases are prevalent. Soil-transmitted helminths (hookworm, roundworm and whipworm) are major causes of negative physical, intellectual and cognitive impacts in the most deprived communities globally [1]; an estimated 270 million pre-school-age children and over 600 million school-age children live in areas where soil-transmitted helminths are prevalent [5]. A recent systematic review showed that consistent use of footwear is associated with lower odds of acquiring soil-transmitted parasites [3]. In this brief report, two questions were asked: (1) What

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http://dx.doi.org/10.1016/j.jegh.2014.06.001
2210-6006/Published by Elsevier Ltd. on behalf of Ministry of Health, Saudi Arabia.

proportion of school-age children in southern Ethiopia reports wearing shoes consistently and what types of shoes do they wear? and (2) Is reported shoe-wearing associated with a greater degree of foot protection?

2. Methods

A cross-sectional study was conducted among school children aged 7–15 years in grades 1 to 8 who were attending a government elementary school in a rural village named Damot Mokonisa in the Wolaita zone of southern Ethiopia. Permission was obtained from the school principal, who gave the study team an appointment for a time at which both 'shifts' (morning and afternoon students) could be evaluated. Ethical approval was gained from the Institutional Review Boards of the School of Health Sciences, Addis Ababa University, Ethiopia, and the National Human Genome Research Institute, National Institutes of Health, USA.

Data collectors recorded whether the child was wearing shoes and the type of shoe worn (open or closed). Children were asked how often and for how long they had worn shoes over the past three days using a standardized questionnaire. Data collectors examined each child's feet using a standardized assessment tool. Both were examined for the presence of adherent soil, sock or shoe marks/impressions, trauma (cuts, puncture wounds or abrasions), toe nail dystrophy and heel fissures.

Observed differences between the shoe wearing groups were tested for significance using the Chi square test for categorical variables and Student's *t*-test for continuous variables.

3. Results

3.1. Proportion of children wearing shoes

Of the 168 children screened, 54% reported consistently wearing shoes in the three days prior to the foot assessment day. The majority (92%) who reported wearing closed shoes had visible sock/shoe imprints suggesting the veracity of their self-report. Children who wore shoes consistently were significantly older than those who reported not having worn shoes consistently (12.3 vs. 10.9 years old; $p < 0.01$). Additionally, girls were significantly more likely to report wearing shoes than boys (70% vs. 45%; $p < 0.01$).

3.2. Condition of children's feet among those consistently wearing shoes and those not wearing shoes

Indicators of foot conditions that were assessed were tabulated by the type of shoe worn (i.e., no shoes, open-toed shoes, closed-toed shoes) as presented in Table 1. Adherent soil was present on the majority of children's feet regardless of shoe type. However, virtually all (97%) of the children who reported *not* wearing shoes consistently had adherent soil present on their feet. Half of those who reported wearing closed-toed shoes had adherent soil present and 74% of those wearing open-toed shoes had adherent soil present ($p < 0.001$).

Likewise there was a similar gradient observed for the prevalence of foot trauma, heel fissures, and nail dystrophy. Those who reported wearing closed-toed shoes were significantly less likely to show toenail dystrophy than the other two groups. Neither the presence of foot trauma nor heel fissures was associated with the type of shoes worn.

4. Discussion

Foot health and the protections afforded by adequate footwear and foot hygiene are increasingly being regarded as the first level of defense in promoting general health in low- and middle-income countries. In this study, only half of elementary school children reported consistently wearing shoes. Wearing closed-toed shoes was associated with significant reduction in adherent soil on the feet and toe nail dystrophy. However, half of those

Table 1 Comparison of foot condition indicators by reported shoe wearing.

Foot condition indicators		Did not wear shoes ($N = 68$)	Wore open shoes ($N = 76$)	Wore closed shoes ($N = 15$)	p-value
Visible sock imprint		15	61	92	0.0001
Adherent soil present (%)		97	74	50	0.001
Signs of foot trauma (%)		16	18	14	0.59
Toenail dystrophy (%)	None	0	1	7	0.03
	1–2	24	26	50	
	>2	76	72	43	
Heel fissures (%)		68	58	71	0.65

who reported wearing shoes consistently were found to have soil adhering to the foot, and the great majority had heel fissures and toe nail dystrophy. Thus, if contact with soil is to be minimized, interventions that promote footwear also will need to emphasize foot-washing. Promotion of foot-washing may be efficiently integrated with that of hand- and face-washing in areas where soil-related diseases coexist with hygiene—preventable diseases such as trachoma.

Currently there are a number of international efforts underway supported by several philanthropists that focus on distributing shoes to children (see for example [4,2]). While these efforts are laudable, past experiences in the context of distributing bed nets for malaria prevention show that access is not necessarily a corollary to use. Promoting appropriate foot hygiene as well will likely require community-based interventions that encourage both consistent use of footwear and foot washing.

Conflict of interest

We have no conflicts of interest to disclose.

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