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Increasing compliance with protective eyewear to reduce ocular injuries in stone-quarry workers in Tamil Nadu, India: A pragmatic, cluster randomised trial of a single education session versus an enhanced education package delivered over six months

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ABSTRACT

Objective: To evaluate the efficacy of standard education versus enhanced education in increasing compliance with protective eyewear to prevent ocular injuries in stone-quarry workers.
Design: Pragmatic, allocation concealed, participant and outcome assessor blinded, cluster randomised trial.
Setting: Six stone-quarries around Vellore, Tamil Nadu, South India.
Participants: 204 consenting adult stone quarry workers.
Interventions: Protective eyewear plus enhanced education (one education session, plus 11 sessions of group education, individual discussions, and educational plays over six months) versus protective eyewear plus standard education (one education session and 5 follow up visits).
Outcomes: The primary outcomes were observer-rated compliance with protective eyewear and reduction in incidence of ocular injuries (slit-lamp examination by an observer blinded to allocation status) at three and six months. Analysis was by intention to treat.
Results: Quarries and participants were similar at enrolment. All quarries; 92/103 (90%) of workers in three quarries given enhanced intervention, and 91/101 workers (89%) in three quarries given standard education, completed six months follow up. Compared to standard education, enhanced education significantly increased compliance with protective eyewear by 16% (95% CI 3–28%) at three months (OR 2.1; 95% CI 1.2–3.8); and by 25% (95% CI 11–35%) at six months (OR 2.7; 95% CI 1.5–4.8). Protective eyewear and enhanced education reduced the incidence of eye injuries at three months by 16% (95% CI 7–24%); and standard education by 13% (95% CI 4–22%), compared to the three months before interventions. The cumulative reduction over baseline in eye injuries at the six months was greater with enhanced education (12% decrease; 95% CI 3–21%) than with standard education (7% decrease; 95% CI 17% decrease to 3% increase). However, this incidence did not differ significantly between intervention arms at three months (OR 0.7% 95% CI 0.3–2.1); and at six months (OR 0.8; 95% CI 0.4–1.5).
Conclusion: Provision of appropriate protective eyewear reduces the incidence of eye injuries in stone-quarry workers. Periodic educational and motivational sessions with individuals and groups facilitates sustained use of protective eyewear.

Introduction

Ocular injury is an important preventable cause of blindness and a global public health problem. It is estimated that 55 million eye injuries occur each year that restrict activities for more than a day; in about 1.6 million these injuries lead to blindness, with an additional 2.3 million people developing bilateral low vision, and

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an estimated 19 million developing unilateral blindness or low vision.[1] Ocular injury most often occurs in the workplace in low- and middle-income countries, particularly in the construction, agricultural, mining, and manufacturing industries. Environmental factors; migrant labour; unorganised working conditions; lack of implementation of regulations; lack of knowledge, availability, or regular use of protective equipment such as safety goggles; and delays in seeking appropriate treatment, lead to a high burden of ocular trauma, high treatment-related and productivity-related economic costs, and lower quality of life in affected people in these countries.[2–27]

Occupations involving hammering, drilling, and the use of pneumatic chisels are hazardous, where projectile chips of stone, metal, and wood result in corneal lacerations and penetrating ocular injuries.[4,5,10,17,18,28] A particularly hazardous occupation in relation to the potential for ocular injuries in India is stone-quarrying. Quarry or mining workers are at significantly elevated risk of multiple, non-fatal injuries than construction, or other, workers.[29] India has numerous stone quarries that cater to the growing domestic and international construction industry. India is a leading exporter to the EU and to other countries, of granite, sandstone, marble, and other natural stones. Quarries in India employ several hundreds of men and women workers mostly from migrant, socio-economically disadvantaged sections, who are vulnerable to ocular and other injuries. Whilst there are many regulations governing mining and quarrying in India, their enforcement is unsatisfactory, and quarry owners are not mandated to provide safety equipment to their workers. Studies on ocular injuries in stone quarry workers from India are scant, though one hospital-based survey did document a high rate of eye injuries in stone-crushers, amongst those with work-related eye-injuries that required hospitalisation.[29]

We conducted a pilot study (un-published) from July to October 2005 in six granite quarries around Vellore town to document the prevalence of work-related eye injuries and to evaluate the efficacy and acceptability of protective eyewear amongst stone quarry workers. Over the three months prior to the baseline survey, 15.1% of 218 consenting adult workers (18–65 years) reported eye injuries sufficiently severe for them to seek treatment, often from private clinics; 10% of these were vision threatening. After documenting and charting the injuries using a hand-held slit lamp, we distributed plastic protective eyewear to all workers after an educational session consisting of a health-education talk stressing the importance of regular use of the protective eyewear, and display of posters depicting ocular trauma due to stone quarrying. At the end of three months, a repeat slit-lamp examination documented that the incidence of fresh eye injuries had reduced to 6% (13/218), and none were vision threatening. Regular use of protective eyewear was monitored by a health worker during surprise checks, and at three months 188/218 workers (86%) were regularly using them. Whilst workers expressed the need for protective eyewear, they were dissatisfied with the fogging and staining with sweat, a feeling of heaviness, and easy development of scratches within two weeks in them, leading to difficulty with vision and requiring their frequent replacement. This pilot study demonstrated the acceptance of protective eyewear amongst quarry owners and workers, and their efficacy in reducing the incidence of eye trauma; but highlighted the need for scratch-proof, impact-resistant, lightweight, affordable eyewear, and for follow up education and motivation to encourage their sustained and regular use.

Evidence from published reports of interventions or strategies to promote the use of protective eyewear during work has not shown any particular strategy to be effective. A systematic review of published and unpublished research till 1999 of the effectiveness of interventions that were designed to prevent work-related eye injuries in the construction, manufacturing and agricultural industries, reported that policy changes were effective in changing behaviours and reducing eye injuries in the manufacturing settings, either in conjunction with a broader programme focusing on eye safety or by policy alone. However, this review found limited scientific literature about the effectiveness of interventions in preventing eye injuries and called for more well-designed studies.[30] A Cochrane systematic review evaluated the effectiveness of educational interventions in preventing ocular injuries from randomised controlled trials (RCTs) and controlled before and after studies undertaken and reported till August 2008, and found no reliable evidence from the five included studies that educational interventions reduced ocular injuries. The authors stressed the need for well-conducted RCTs, particularly from low- and middle-income countries, and with longer periods of follow-up.[31]

In this report we describe a pragmatic, cluster randomised trial that was designed to compare the effectiveness of an enhanced educational package over standard education in increasing the regular use of protective eyewear and in reducing the incidence of eye injuries amongst quarry workers around Vellore, in the southern state of Tamil Nadu, India. This study was approved by the Institutional Review Board (Research & Ethics committees) of the Christian Medical College, Vellore.

Participants and methods

Objectives

The primary objectives of this study were to compare two strategies of education, one more intensive and sustained than the other, in increasing compliance with the use of protective eyewear amongst stone-quarry workers; and to evaluate whether participants allocated to either educational strategy differed in the incidence of detected eye injuries three months and at six months after commencement of the study, compared to the three-month incidence of eye-injures before the study.

Design

We used a pragmatic, cluster randomised design where the units of randomisation were stone-quarries. A cluster randomised design was chosen to prevent contamination of the two types of educational interventions between quarries. The design was pragmatic in that we used few exclusion criteria, employed no additional research staff for this study, and utilised outcomes that were practical and relevant to real-world conditions. We were guided in the design and reporting of this trial by the CONSORT extension for cluster randomised trials.[32]

Inclusion and exclusion criteria

Selection and randomisation of quarries

Of the 152 registered stone (blue-metal) quarries in the district of Vellore, in Tamil Nadu in 2006, 41 were situated around the district headquarter town of Vellore. They ranged from small quarries (employing around 10–20 workers), to larger quarries (employing >30 workers) and their registered legal status was often unclear. Quarries were eligible for inclusion if they employed more than 30 workers aged 18–60 years, were situated within a 20 km radius of the district headquarters town of Vellore, and if the quarry owners consented to participate in the study. Since there are no accurate geographical maps or lists of these registered quarries, we approached all quarries within a 20 km radius of Vellore town to create a list of eligible quarries. Randomisation and allocation of quarries to interventions was achieved using a simple, computer-generated, randomisation sequence by a statistician