

## ORIGINAL RESEARCH

# Working Conditions, Workplace Violence, and Psychological Distress in Andean Miners: A Cross-sectional Study Across Three Countries

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### Abstract

**BACKGROUND** Psychosocial working conditions are well-known determinants of poor mental health. However, studies in mining populations where employment and working conditions are frequently precarious have, to our knowledge, only focused on occupational accidents and diseases.

**OBJECTIVES** The aim of this study was to assess psychosocial working conditions and psychological distress in Andean underground miners.

**METHODS** The study population consisted of 153 Bolivian miners working in a silver mining cooperative, 137 Chilean informal gold miners, and 200 formal Peruvian silver miners employed in a remote setting. High work demands, minimal work control, minimal social support at work, and workplace exposure to violence and bullying were assessed using the Spanish short form of the European Working Condition Survey. A general health questionnaire score  $>4$  was used as cutoff for psychological distress. Associations between psychosocial work environment and psychological distress were tested using logistic regression models controlling for potential confounding and effect modification by country.

**FINDINGS** Prevalence of psychological distress was 82% in the Bolivian cooperative miners, 29% in the Peruvian formal miners, and 22% in the Chilean informal miners ( $p^2_{\chi} < 0.001$ ). 55% of the miners had suffered violence during the 12-months before the survey. Workplace demands were high (median 12.5 on a scale from 7-14), as was social support (median 5.5 on a scale from 3-6). After adjustment for country and other relevant exposure variables and considering interactions between country and job strain, miners in active (odds ratio [OR], 6.8; 95% confidence interval [CI] 2.1-22.7) and high strain jobs (OR, 7.2; 95% CI, 1.7-29.9) were at increased odds of distress compared with those in low strain jobs. Violence at work also contributed to increased odds of distress (OR, 1.86; 95% CI, 1.1-3.1).

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**CONCLUSIONS** Psychological distress is associated with the psychosocial work environment in Andean underground miners. Interventions in mining populations should take the psychosocial work environment into account.

**KEY WORDS** developing countries, epidemiology, Karasek, mental health, precarious employment

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## INTRODUCTION

The work environment influences not only the physical but also the mental well-being of workers. Several models have been proposed to evaluate the effect of work on mental health. One of the most prominent models is the demand-control model.<sup>1</sup> The model assumes that negative health effects may result if workers do not have enough control over their work in relation to how demanding it is. This effect might be modified by social support.<sup>2</sup>

Most of the knowledge about the association between working conditions and psychosocial effects stems from industrialized countries. To our knowledge, only few studies have been carried out in developing countries.<sup>3</sup> In these countries, changing working conditions in a globalized world are frequently combined with other challenges like poverty, precarious employment and informal work, lack of social security, malnutrition, and illiteracy.<sup>4</sup>

Mining is an important and rapidly growing industry in many developing countries. The mining process includes physically demanding jobs and exposes workers to various physical risks such as extreme temperatures, humidity, noise, and vibrations, as well as extended work hours and shift work.<sup>5,6</sup> Additionally, the incidence of occupational accidents is known to be particularly high in traditional and small mines.<sup>7</sup> Furthermore, the geographical location of many mines in Latin America requires working at high altitudes,<sup>8</sup> frequently combined with internal migration to the mining zones where many miners live in camps far from their families.<sup>9</sup> Informal mining with lack of knowledge about potential health risks, lack of safety equipment, and long working hours is also common and employs up to 13 million workers worldwide.<sup>10</sup> These special employment and working conditions in the mining industry may cause psychological distress.<sup>11–15</sup> Studies evaluating such working conditions and their associations with mental health—especially in developing countries—are sparse.<sup>16</sup> Carrying out high-quality epidemiologic studies is particularly difficult in this occupational group in these countries due to

limited access and awareness, illiteracy among the miners, and lack of standardized and valid measures to assess psychosocial stressors in this profession.

Because of these gaps in the current evidence, this study aimed to evaluate the special working conditions in the mining industry and psychological distress in miners from Bolivia, Chile, and Perú, 3 Andean countries in which mining is among the most important economic activities.<sup>17</sup>

## MATERIALS AND METHODS

**Study Population and Settings.** Cross-sectional interview studies were carried out in underground miners between 2010 and 2012. In each country, populations were chosen to present 1 of 3 typical employment conditions. The study included Bolivian miners working in a silver mining cooperative in a traditional mining town (~190,000 inhabitants); informal miners from northern Chile working and living in the gold mining sector in a traditional mining village (~10,000 inhabitants); and formal silver miners employed in a large international mining enterprise in a remote setting of Perú. Further characteristics of each mine are presented in Table 1.

The same core protocol was used in all settings. However, because of cultural and organizational differences, sampling strategies were adapted to each location (Table 1). Because no complete lists of miners existed in Bolivia and Chile, convenience sampling was carried out. In Bolivia, contact was established through the board of the miners' cooperative and miners were informed about the study during a meeting organized by the board. During the following days, all those interested could answer the questionnaire in an office of the board located near the main pithead. As relatively few miners followed the invitation, miners were also actively invited to participate in the study by direct contact before their work around the pithead. In Chile, the interviews were carried out after explaining the study to the miners in 1 of 3 meetings organized by the local union, at the mines' entrances and in

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