



Occupational exposure to pesticides, nicotine and minor psychiatric disorders among tobacco farmers in southern Brazil



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ABSTRACT

Introduction: Exposure to pesticides has been associated with psychiatric problems among farm workers, although there is still controversy as to chemical types, intensity and forms of exposure that represent risk factors for neuropsychological problems. Furthermore, tobacco workers are exposed to dermal absorption of nicotine, although its effect on mental health has not yet been studied.

Objectives: To identify the prevalence of minor psychiatric disorders (MPD) among tobacco farmers and associated factors, paying special attention to pesticide and nicotine exposure.

Methods: This is a cross-sectional study with a representative sample of tobacco growers, characterizing economic indicators of the farms, socio-demographic factors, lifestyle habits and occupational exposures. Multivariate analysis was performed using a hierarchical Poisson regression model.

Results: A total of 2400 tobacco farmers were assessed and MPD prevalence was 12%. MPD was higher among women (PR 1.4), workers aged 40 or over, tenants/employees (PR 1.8) and those who reported having difficulty in paying debts (PR 2.0). Low socioeconomic status was inversely associated with MPD prevalence. Tasks involving dermal exposure to pesticides showed risk varying between 35% and 71%, whereas tobacco growers on farms using organophosphates had 50% more risk of MPD than those not exposed to this kind of pesticide. The number of pesticide poisoning and green tobacco sickness episodes showed linear association with MPD.

Conclusions: The study reinforces the evidence of the association between pesticide poisoning and mental health disorders. It also points to increased risk of MPD from low socioeconomic status, dermal pesticide exposure as well as from exposure to organophosphates. Furthermore, the study reveals intense nicotine exposure as a risk for tobacco farmers' mental health.

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1. Introduction

Intensive pesticide use has been accompanied by increased concern about the potential acute and chronic effects of pesticides on health in general and on mental health in particular. In Brazil, a country with a large number of farm workers, this problem is of great relevance. Brazil has been the world's largest pesticide consumer since 2008. Consumption has increased 190% in the last decade, considerably above average global growth of 93% (ANVISA, 2012).

Several studies have found association between pesticide poisoning and psychiatric problems, especially depression (London

et al., 2005, 2012; Stallones and Beseler, 2002; Faria et al., 1999; Wesseling et al., 2010; Beseler et al., 2006, 2008; Beseler and Stallones, 2008) among farmers and farm workers. Moreover studies in Brazil (Meyer et al., 2010; Poletto and Gontijo, 2012), Spain (Parron et al., 2011) and the USA (Beseler et al., 2008; Mackenzie Ross et al., 2010) have identified association between pesticide exposure and psychiatric problems. A study conducted with fruit farmers in the Brazilian state of Rio Grande do Sul found association between pesticide poisoning and increased prevalence of minor psychiatric disorders (MPD) (Faria et al., 1999). Another Brazilian study, conducted in the state of Rio de Janeiro, documented higher rates of hospitalizations owing to mood disorders and suicide attempts among those living in areas with more intensive pesticide use (Meyer et al., 2010). However, controversy remains as to the effect of routine pesticide use – not involving acute poisoning – and the occurrence of psychiatric problems among agricultural workers (London et al., 2005, 2012; Wesseling et al., 2010; Keifer and Firestone, 2007).

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In addition to intense exposure to pesticides, frequently multichemical, other forms of occupational exposure in agriculture may also be mental health risk factors, such as strenuous work, long working days and farming production losses. Studies among farmers in Brazil (Meyer et al., 2010; Poletto and Gontijo, 2012) and in several other parts of the world (London et al., 2012; Wesseling et al., 2010; Kim et al., 2013; Hounsome et al., 2012; Sanne et al., 2004) relate agricultural activity to excessive stress and/or mental suffering (Roy et al., 2013).

Tobacco production is seasonal and involves annual production cycles. This crop is characterized by intensive pesticide use and a large number of workers directly exposed to these chemicals. In Brazil more than 220,000 families are involved in tobacco production. The country is the world's second largest tobacco producer and has been the world's leading exporter since 1993 (Sindiabaco, 2013). Some studies indicate increased prevalence of psychiatric problems among tobacco growers in southern Brazil (Poletto and Gontijo, 2012). However, the prevalence of mental health problems and associated risks factors in this group of workers are not clear. In addition to pesticides and other chemical risks common to other farming activities, these workers are also heavily exposed to dermal absorption of nicotine (Fassa et al., 2014). However, the effect of these exposures on worker's mental health is not clear.

This study aims to identify MPD prevalence among tobacco growers and associated factors, paying special attention to pesticide and nicotine exposure.

2. Methods

A cross-sectional study was conducted with tobacco farmers in São Lourenço do Sul-RS in southern Brazil. According to the 2010 Census, this town had around 43,100 inhabitants, 44% of whom were living in the rural area. Most of the population is German descent (Pomeranian ethnicity and Lutheran religion). Its economy is based on tourism and agriculture, mainly tobacco (it is the second largest producer in Southern Brazil) and grains (rice, soybeans and corn) (IBGE, 2014).

The sample size was estimated so as to measure 20% MPD prevalence with a 2.0 pp margin of error and associations with a prevalence ratio greater than 1.8, a 95% confidence level, 80% statistical power and a 14:1 unexposed: exposed ratio with regard to pesticide poisoning. A further 10% was added to account for missing data and refusals as well as 15% for confounding factors. The sample size required was about 2600 workers. Based on an estimated of 2.5 workers per farm, 1040 farms needed to be studied.

The sample was selected based on invoices issued in 2009 for tobacco sales, which is mandatory for all sales of agricultural products. A total of 1100 invoices (database obtained in the Municipal Agriculture Office) were selected randomly and the farms (agricultural establishment or production unit) that issued the invoices were identified.

The Brazilian Agricultural-Census-IBGE (2006) (Censo Agropecuario, 2013) considered a production unit to be any productive structure under the same management. Following to this criterion, all agricultural establishments, dedicated to tobacco production activities (fully or partially) under the same management were included regardless of size. At each farm, all workers aged 18 or over engaged in farming activities for at least 15 h a week were selected (Faria et al., 1999). The workers were interviewed at their farms and the fieldwork covered a period of around eight weeks, during the 2011 harvest (January and February).

The majority of the interviewers had been community health workers and/or Brazilian Census interviewers, who lived in the region being studied. They received training to perform the interviews and to use Personal Digital Assistants for data input.

Two questionnaires were used. The first questionnaire characterized the farms and obtained economic indicators such as their area, amount of tobacco produced annually, other agricultural production, degree of mechanization, ownership of vehicles, financial debts and crop diversification (based on the proportion of income arising from tobacco production). The types of pesticides used were informed by the farm operator by looking at cards containing photographs and the trade names of the 56 pesticides most used in the region.

The second questionnaire assessed each worker and examined socio-demographic factors (gender, age, marital status and schooling), history of suicide in the family, employment status (owner or tenant/employee), lifestyle habits (smoking and alcohol consumption, religion practiced), occupational exposures, comorbidities and mental health. Smoking was categorized as non-smoker, smoker (one cigarette or more per day) former smoker (stopped smoking a month or more ago) and alcohol consumption according to the number of daily units drunk on weekdays. Types of occupational exposure to pesticides were assessed, such as applying, mixing, loading the sprayer tank, cleaning equipment, entering a treated area following application, washing contaminated clothing, being exposed during transportation and storage, having contact through soaked clothes with pesticide during application and having contact with leaves containing pesticide residues. Intensity of exposure was evaluated by the sum of these nine types of exposure, and categorizing this information in four groups (none; up to four types; five to six; seven to nine types). Monthly exposure frequency and type of personal protective equipment (PPE) used were also investigated. Cumulative exposure was estimated based on years of exposure to pesticides.

Assessment of comorbidities included the number of pesticide poisoning episodes during workers' lives based on information reported by them. Chronic low back pain (CLBP) was considered to be indicated by complaints of pain lasting for three months a year or more. Green tobacco sickness (GTS) was characterized by the number of episodes of headache or dizziness together with nausea or vomiting in the previous year occurring after contact with tobacco leaves (Arcury et al., 2008, 2003). The outcome – minor psychiatric disorders (MPD) – defined as non psychotic mental disorders, was assessed using the SRQ-20 questionnaire. The Self-Reporting Questionnaire 20 items (SRQ-20) is derived from four psychiatric morbidity instruments with a wide variety of cultural backgrounds. It was developed by Harding et al. (1980) for a WHO collaborative study to screen for common mental disorders in primary health care (Harding et al., 1980; Harpham et al., 2003).

SRQ-20 reflects the multidimensional nature of 'mental illness' screening for disorders such as depression, anxiety and somatic disorders. Factor analyses have shown that one group of SRQ-20 questions taps into a somatic factors (headaches, appetite, digestion, sleep); another into depressive/anxiety symptoms (frightened, unhappy, crying, feeling worthless); while a third captures more cognitive/decreased energy factors (not able to concentrate or make decisions, suffering at work, unable to enjoy daily activities) (Harpham et al., 2003). The SRQ-20 is a cost-effective way to measure mental health and was considered to be positive if there were six or more answers showing alteration in men and eight or more answers showing alteration in women (Mari and Williams, 1986). For the purpose of comparison with other studies, SRQ-20 prevalence was also described considering other cut-off points: tests with seven and eight answers showing alteration in both genders were considered as positive results (Harpham et al., 2003; Mari and Williams, 1986).

For descriptive analysis, continuous variables (such as age, schooling, tobacco production, percentage of income from tobacco, days per month of exposure, years of exposure and others) were categorized. Variables representing intensity of exposure and

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