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## Understanding farmers' safety behaviour towards pesticide exposure and other occupational risks: The case of Zanjan, Iran

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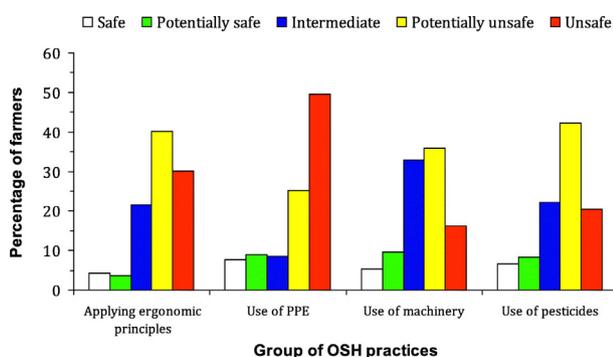
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### HIGHLIGHTS

- A model for farmers' use of occupational safety and health (OSH) practices was developed.
- The examined OSH practices included a range of behaviours grouped in four categories.
- Almost half of the farmers (49.5%) showed totally unsafe behaviour in the use of PPE.
- Farmers were prone to different occupational hazards in the agricultural sector.
- Attitude, knowledge, and self-efficacy in safety affected the use of OSH practices.

### GRAPHICAL ABSTRACT



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### ABSTRACT

Preventive interventions for reducing occupational risks and health problems among farmers require the identification of factors contributing to unsafe behaviour, but research on this topic is rather limited. A theoretical model for studying factors affecting farmers' use of occupational safety and health (OSH) practices in Iran was developed. The model was empirically tested using data collected from a survey of 301 tomato farmers of Zanjan Province of Iran. The examined OSH practices encompassed a wide range of behaviours, grouped in four categories, i.e., use of pesticides, use of machinery, use of personal protective equipment (PPE), and applying ergonomic principles (i.e., fitting the task to the individual, designing the workplace based on human factors, taking into account the interaction between the workplace and the workers, exercising during work or rest). Almost half of the farmers (49.5%) showed unsafe behaviour in the use of PPE. Moreover, significant proportions of the farmers showed potentially unsafe behaviour in the use of pesticides (42.2%), in applying ergonomic principles (40.2%) and in the use of machinery (35.9%). Attitude towards OSH practices, knowledge on OSH practices, and self-efficacy in safety had a direct positive effect on farmers' use of OSH practices, explaining 73% of the variance in farmers' safety behaviour. Overall, findings contribute to a better understanding of the use of OSH practices among farmers, providing empirical evidence in the cognitive processing of farmers' with respect to safety behaviour in farming and offering practical information that can be incorporated into OSH intervention programs in Iran and other developing countries.

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## 1. Introduction

Agriculture is one the most hazardous economic sectors (Colémont and Van den Broucke, 2008; ILO, 2011), which along with mining and construction has the highest occupational hazard rate (Das et al., 2016). Data from ILO (International Labour Organization) and FAO (Food and Agriculture Organization) show that out of a total of 335,000 fatal workplace-related accidents worldwide, there are about 170,000 deaths among agricultural workers per year (Padilla, 2013). Thus, the rate of fatal accidents in farming is at least twice as high as in other occupations (Das et al., 2016). In fact, because of the difficulty and physical nature of agricultural activities and because agricultural work is typically performed in the open air (Kaewboonchoo et al., 2015), farmers can be exposed to various hazards and are susceptible to several occupational injuries. Toxicological hazards brought about by pesticides, also including fertilizers, fuels, and other organic substances, are common problems among most agricultural workers (Damalas and Eleftherohorinos, 2011; Padilla, 2013; Damalas and Koutroubas, 2016). Risk of slips, trips, and falls from heights as well as lifting heavy weights and other activities giving rise to musculoskeletal disorders are additional occupational hazards (ILO, 2011). Finally, other working conditions common to rural environments, such as exposure to extreme temperatures, inclement weather, and wild animals can be occupational hazards in the agricultural sector (ILO, 2011).

A review of the literature and empirical studies in the field of OSH show that many factors can affect the use of OSH practices among farmers and that one of the most important of these variables is the attitude towards OSH (Brosseau and Li, 2005; Damalas et al., 2006b; Colémont and Van den Broucke, 2008; Raksanam et al., 2012; Adebola, 2014; Aluko et al., 2016). The attitude towards a particular behaviour reflects the overall positive or negative evaluation of an individual to perform that behaviour. In general, the more favorable the attitude towards the behaviour, the stronger should be the individual's intention to perform it (Armitage and Conner, 2001). A farmer will use safety measures only if he believes that the health benefits of using those measures are greater than the cost of using them (Kien, 2015). Therefore, the attitude can be considered as a crucial predictor of the behaviour of individuals (Ajzen, 2002; Peres et al., 2005). According to these issues, the first hypothesis of this study was developed as follows:

**Hypothesis 1.** Attitude towards OSH has a positive and significant effect on farmers' use of OSH practices (Fig. 1).

Another variable influencing the use of OSH practices that has been considered in various studies is knowledge on OSH practices (Damalas et al., 2006a; Atreya, 2007; Gupta et al., 2012; Raksanam et al., 2013; Kumari and Reddy, 2013; Mohanty et al., 2013; Kien, 2015). Generally, knowledge is defined as a fluid mix of framed experience, contextual

information, values and expert insight that provides a basis for evaluating and integrating new information and experiences (Davenport and Prusak, 1998; Kien, 2015). The level of knowledge can affect the health-related behaviour of individuals; the higher the knowledge level, the more likely the individual is to show safe behaviours (Glanz et al., 2008; Kien, 2015). According to the mentioned issues, the second hypothesis of this study was developed as follows:

**Hypothesis 2.** Knowledge on OSH has a positive and significant effect on farmers' use of OSH practices (Fig. 1).

Finally, in addition to the two variables mentioned, another main determinant of the use of OSH practices is self-efficacy in safety (DeJoy, 1996; Pettinger, 2000; Brown et al., 2000; Wagner et al., 2013). The concept of self-efficacy, derived from the cognitive social theory of Bandura (1997), refers to one's belief in his ability to mobilize cognitive resources, motivation, and a course of action, which are required to perform a particular task (Wood and Bandura, 1989); accordingly, self-efficacy in safety is defined as the beliefs about one's ability to follow indicated safety measures successfully (DeJoy, 1996). Since self-efficacy has an effect on the individual's subsequent effort and persistence in performing activities (Bandura, 1997), people who have a high sense of self-efficacy for a particular task, perform better than those who have a low sense of self-efficacy for that task (Gist and Mitchell, 1992). The level of confidence of individuals in their abilities to work safely, i.e., self-efficacy in safety, would determine to what extent those individuals actually engage in safe or unsafe practices in the workplace (Brown et al., 2000). Accordingly, the third hypothesis of the study was developed as follows:

**Hypothesis 3.** Self-efficacy in safety has a positive and significant effect on farmers' use of OSH practices (Fig. 1).

Despite the importance of OSH and the necessity of planning for reducing the occupational injuries of farmers, evidence shows that OSH in the Iranian agricultural sector is a neglected and almost unknown issue, as few farmers receive training in occupational health (Karami et al., 2016). Furthermore, relatively few provinces in Iran (i.e., about 35%) have agricultural health committees and centers for providing OSH services. In addition, there are several limitations for providing professional health services to agricultural workers through Primary Health Care (PHC) networks (Rafiei et al., 2015). On the other hand, studies about OSH are limited in Iran, particularly in the agricultural sector. Therefore, there is a big gap of knowledge regarding farmers' behaviour towards OSH, so that studies on farmers' behaviour towards OSH and factors affecting behaviour are necessary. The results of such studies can provide a basis for decision-making and development of preventive interventions to reduce occupational injuries among farmers. Considering the importance of this issue, the aim of this study was to examine the

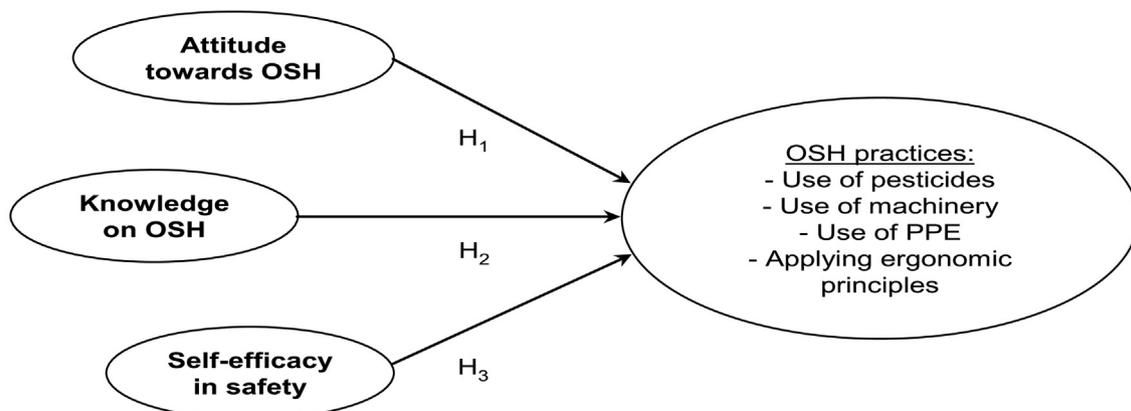


Fig. 1. Theoretical research framework.

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