

# Occupational Health Problems among Seasonal and Migrant Farmworkers in Ethiopia: A Cross-Sectional Study

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**Background:** Migrant and seasonal farmworkers are at increased risk for occupational fatalities and injuries. Although such employment-related geographical mobility is receiving increasing attention, there is limited evidence about occupational health problems among seasonal farmworkers. Therefore, this study aims to investigate occupational health problems among seasonal and migrant farmworkers in Ethiopia.

**Methods:** A cross-sectional study design was employed from October to December 2019 among seasonal and migrant farmworkers. The study was carried out in two sites of Amhara regional state, northwest Ethiopia. A cluster sampling technique was used to recruit 990 study participants. Bivariable and multivariable binary logistic regression analyses were performed using SPSS version 20 to identify factors associated with injuries. The significance level was obtained at 95% CI and  $p$ -value  $\leq 0.05$ .

**Results:** In this study, the period prevalence of work-related injury among seasonal and migrant farmworkers was 32.5% (95% CI: 29.7, 35.9). Being unemployed before migration (AOR = 2.22, 95% CI: 1.26, 3.91), working for >8 h/day (AOR = 1.62, 95% CI: 1.16, 2.27), stress (AOR = 1.38, 95% CI: 1.02, 1.88) and thermal discomfort (AOR = 1.48, 95% CI: 1.09, 1.98) were the significant risk factors for work-related injury. In addition, nearly two-third (60.9%) of the study participants have shown three or more heat-related illness symptoms. Moreover, the prevalence of work-related stress among seasonal and migrant farmworkers was 67.6% (95% CI: 64.6, 70.7).

**Conclusion:** Occupational health problems among seasonal and migrant farmworkers in northwest Ethiopia remain a major public health problem. Hence, implementing tailored preventive measures like training on health and safety, and hazard control measures would be supremely important to minimize the risk.

**Keywords:** injury, stress, seasonal and migrant workers, occupational health, Ethiopia, University of Gondar

## Background

Migration has been known for centuries all over the world, where people have moved to other areas for different purposes including work.<sup>1,2</sup> According to the International Labor Organization's (ILO) estimates, there are 150 million immigrant workers throughout the world.<sup>3</sup> However, many migrant workers are employed as unskilled workers and, often more willing to work harder, work for less pay, for longer hours and perform unattractive tasks, often referred to as 3D-jobs; "Dirty, Dangerous and Demanding". Many of the jobs are in the category of precarious

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work; often temporary, part-time, with changing employers and a high degree of uncertainty in the job.<sup>1,4–8</sup> Most importantly, these precarious workers may take greater risks on the job, and do not complain about unsafe working conditions for the threat or fear of wage or job loss. These conditions put migrant workers at increased risk for occupational injuries and fatalities, although some results are conflicting.<sup>1,9–14</sup>

Migrant and seasonal farmworkers also face many occupational hazards as a result of heavy lifting and carrying; excessive heat exposure, unsecured machinery, prolonged, whole-body vibration (eg, tractor driving); and rapid repetitive motions.<sup>9,14–17</sup> Though migrant and seasonal farmworkers are vital to the nation's economy, they are marginalized and underserved populations with many unmet socioeconomic and health-care needs.<sup>9</sup>

It is estimated that almost half of the deaths associated with 1.2 million annual occupational accidents worldwide occur in the agricultural sector.<sup>17</sup> Moreover, 6629 injuries occurred between 2000 and 2005 among migrant workers in Italy.<sup>11</sup> Nearly one-fifth of the migrant and seasonal agriculture workers in Turkey experienced a health problem and more than half of them (55.7%) suffered from muscle pain in 2017.<sup>17</sup>

Furthermore, a higher risk of mental health problems,<sup>9,13</sup> acute and chronic pesticide poisoning<sup>9,18</sup> and heat-related illness<sup>5,7,19–22</sup> were reported among migrant and seasonal farmworkers. However, underreporting of medical conditions is significant due to limited access to health services, and fear of lost wages or jobs.<sup>23</sup> The occupational health and safety (OHS) of these migrant workers remains a fraught and neglected issue.<sup>24</sup>

Factors that can impact the health and safety of migrant and seasonal farmworkers include low income, extreme temperatures, exposure to old and unsafe machinery, high workloads, long working hours, exposure to biting insects and animals, and allergies.<sup>17,25,26</sup>

However, very little is known in Ethiopia about the risk of occupational health problems in those who move within the country to take up work, often far from home, although in recent years such employment-related geographical mobility is receiving increasing attention.

Therefore, this study aimed to assess the prevalence of heat-related illness, work-related injury and stress among seasonal and migrant farmworkers in northwest Ethiopia.

## Methods

### Study Design, Setting and Study Participants

Community-based cross-sectional study design was employed from October to December 2019 among seasonal and migrant farmworkers. The study was carried out in two sites of Amhara regional state, Northwest Ethiopia (West Armachiho and Metema), and bordered by Sudan, where migrant and seasonal farmworkers profoundly exist. The first site was West Armachiho, which is found 930 km from Addis Ababa, the capital city of Ethiopia. The average temperature is 38°C and humidity of the district is 78%, and the daytime temperature is very high from March to May reaching up to 43°C. The second study setting was the Metema district. Metema is found Northwest of Ethiopia, which is located in the West Gondar zone at 897 km from Addis Ababa. West Armacho and Metema districts are fertile agricultural areas with a large scale of farming of cash crops like sesame, maize, cotton, and sorghum. In consequence, these seasonal agriculture works attract a hundred thousand of migrants and seasonal farmworkers from highlands of Amhara and neighboring regions to these areas to work particularly in the weeding (May to August) and harvesting (September to November) seasons.

### Sample Size Determination and Sampling Procedure

The sample size was determined by using a single population proportion formula, assuming a 4% margin of error and a 95% confidence interval. Also, a pilot study was conducted among 50 seasonal and migrant farmworkers in another setting, namely, Quara district, to estimate the expected proportions of work-related injury and found to be 25%. Since the two-stage cluster sampling technique was used, the design effect of 2 and 10% of possible non-response rate during the data collection period were considered. Finally, a total of 990 study participants were included in the study. Study subjects were selected using a cluster sampling technique.

### Data Collection Tool, Procedures, and Data Quality Control

The data was collected through interviewer-administered structured questionnaire adopted from different literatures. The questionnaire was originally prepared in the English

version, and it was translated to Amharic (local language) to make the questions easily understandable by the study participants and back to English by another translator to check the consistency of the message from the question. The translation was then reviewed by professional experts. A structured questionnaire was developed from different literatures to assess heat-related illness symptoms, work-related injuries, and stress. The questionnaire also includes socio-demographic, behavioral characteristics of workers and work environment issues. The questionnaire was pre-tested ( $n = 50$ ) to check the validity and consistency of the Amharic translated version of the questionnaire.

The training was given for data collectors and supervisors for two days on procedures, techniques, and ways of collecting the data. Moreover, the filled questionnaires were checked for completeness and consistency daily by the supervisors. Throughout the data collection, data collectors were supervised at each site, regular meetings were held between the data collectors and the principal investigator. Ten percent of data was double entered to check errors during data entry.

## Operational Definitions

A work-related injury is defined as any functional disorder sustained by a worker as a result of any cause extraneous to the injured worker or any effort, he/she makes during or in connection with the performance of his/her work during the 12 months preceding the interview.

Work-related stress also measured by the Perceived Stress Scale (PSS) questionnaire and those study participants who score  $\geq 27$  to 10 Likert scale items were considered as having stress. The Perceived Stress Scale (PSS-10) is a 10-item likert scale questionnaire originally developed by Cohen et al to measure stress among adults. Composite-level scores were computed by summation of the items within the composite scales and dividing by the number of items. Negatively worded items were reversed when computing percent positive response.<sup>27</sup>

Heat-related illness (HRI) is defined for the purpose of this study as experiencing three or more HRI symptoms in the preceding week to data collection was considered as having HRI.<sup>28</sup>

## Data Management and Analysis

The data was checked, edited, coded, and entered into Epi-Data 3.1 and exported to SPSS version 20.0 for further analysis. Descriptive statistics such as frequency, mean, percentage and standard deviations were calculated to

describe the characteristics of the study population in relation to different variables. A binary logistic regression model was fitted to identify factors associated with a work-related injury. The Work-related injury was regressed against the demographic, socio-economic, behavioral, and work environment factors. Before fitting the binary logistic regression model, first, the goodness of model fit test was checked by Hosmer and Lemeshow test and the value suggests the model is a good fit ( $p$ -value = 0.52). Also, multi-collinearity was also checked using variance inflation factor (VIF) and the value was  $VIF < 5$  for each. Hence, there is no evidence of multi-collinearity.

Variable with  $p$ -value  $< 0.20$  at bivariable binary logistic regression analysis was exported to the multivariable binary logistic regression analysis. Enter method was used in multivariable analysis for the selection of variables. The significance level was obtained at 95% CI and  $p$ -value  $\leq 0.05$ . The adjusted odds ratio was used to determine the strength of association.

## Results

Of the total of 990, 950 of them were fully participated, which gives a response rate of 96%.

## Socio-Demographic Characteristics and Working Condition of the Study Participants

The majority 943 (99.3%) of the study participants were male. The mean ( $\pm$  SD) age of the respondents was  $26 \pm 7.8$  years and the age of the respondents ranged from 13 to 67. Among the study participants, 103 (10.8%) of the respondents were unemployed before their departure from their hometown. The majority 832 (87.6%) of the study participants came from a rural area. Of the participants, 178 (18.7%) of them have come to the farm site for the first time. The majority 697 (73.4%) of the study participants were working for  $\geq 8$  hours per day (Table 1).

## Prevalence of Self-Reported Work-Related Injuries

The finding of this study revealed that the period prevalence of self-reported work-related injury among seasonal and migrant farmworkers was 32.5% (95% CI: 29.7, 35.9). However, none of injured employees have got compensation for the work-related injuries sustained. Of the total 309 injured respondents, 100 (32.4%) of them hospitalized

**Table 1** Socio-Demographic and Personal Characteristics of the Study Participants, Northwest Ethiopia, 2019(n = 950)

| Variables                                       | Frequency (n) | Percent (%) |
|---|---------------|-------------|
| Gender  |               |             |
| Female  | 7             | 0.7         |
| Male  | 943           | 99.3        |
| Total   | 950           | 100         |
| Age in years                                    |               |             |
| 13–17   | 43            | 4.5         |
| 18–29   | 686           | 72.2        |
| 30–39   | 151           | 15.9        |
| >40   | 70            | 7.4         |
| Total   | 950           | 100         |
| Educational status                              |               |             |
| Unable to read and write                        | 374           | 39.4        |
| Able to read and write without formal education | 73            | 7.7         |
| Primary school                                  | 406           | 42.7        |
| Secondary school and above                      | 97            | 10.2        |
| Total   | 950           | 100         |
| Main job/occupation before migrating            |               |             |
| Student   | 177           | 18.6        |
| Farmer  | 670           | 70.5        |
| Unemployed                                      | 103           | 10.8        |
| Total   | 950           | 100         |
| Family size                                     |               |             |
| ≤ 2   | 88            | 9.3         |
| 3–5   | 536           | 56.4        |
| ≥ 6   | 326           | 34.3        |
| Total   | 950           | 100         |
| Residence                                       |               |             |
| Rural   | 832           | 87.6        |
| Urban   | 118           | 12.4        |
| Total   | 950           | 100         |
| Religion  |               |             |
| Orthodox  | 932           | 98.1        |
| Muslim  | 15            | 1.6         |
| Catholic/Protestant                             | 3             | 0.3         |
| Total   | 950           | 100         |
| Marital status                                  |               |             |
| Single  | 649           | 68.3        |
| Married   | 243           | 25.6        |
| Divorced/Widowed                                | 58            | 6.1         |
| Total   | 950           | 100         |
| Salary per day in ETB                           |               |             |
| ≤ 100   | 405           | 42.6        |
| > 100   | 545           | 57.4        |
| Total   | 950           | 100         |

(Continued)

**Table 1** (Continued).

| Variables                       | Frequency (n) | Percent (%) |
|---------------------------------|---------------|-------------|
| Frequency of visits to the farm |               |             |
| First time                      | 178           | 18.7        |
| 2–4 times                       | 293           | 30.8        |
| ≥ 5 times                       | 479           | 50.4        |
| Total                           | 950           | 100         |
| Length of stays in week         |               |             |
| ≤ 2 weeks                       | 197           | 20.7        |
| 3–4 weeks                       | 343           | 36.1        |
| 5–12 weeks                      | 171           | 18          |
| >12 weeks                       | 239           | 25.2        |
| Total                           | 950           | 100         |
| Average hours worked per day    |               |             |
| ≤ 8 hours                       | 253           | 26.6        |
| > 8 hours                       | 697           | 73.4        |
| Total                           | 950           | 100         |
| Average hours worked per week   |               |             |
| ≤ 48 hours                      | 96            | 10.1        |
| > 48 hours                      | 854           | 89.9        |
| Total                           | 950           | 100         |

for more than 24 hours. The majority 205 (66.3%) of the injured respondents reported they have injured during harvesting period (Table 2).

## Part of the Body Affected and Types of Injury

Among the total of injured respondents, 207 (66.9%) of them reported hand as the main part of the body injured. Moreover, of the injured respondents, 133 (43%) reported lower leg and 132 (42.7%) head as part of the body injured. Regarding the types of injury, 132 (42.7%) were hit by objects and fall injuries and 109 (35.3%) were cut. In addition, 64 (20.7%) were fracture injuries.

Among the seasonal and migrant farmworkers who had contact with chemicals, 16 (23.4%) of them experienced chemical poisoning.

## Heat Exposure and Heat-Related Illnesses

Among the total respondents, the majority, 813 (85.6%) of the study participants perceived a thermal discomfort. This study revealed that 60.9% (95% CI: 57.8, 64.3) of the study participants had reported three or more heat-related illness symptom. Extreme weakness 540 (56.8%), skin

**Table 2** Prevalence of Work-Related Injury Among the Study Participants, Northwest Ethiopia, 2019 (n = 950)

| Variables   | Frequency | Percent |
|---|-----------|---------|
| Injury in the past two weeks                      |           |         |
| No  | 839       | 88.3    |
| Yes   | 111       | 11.7    |
| Injury in the past 3 months                       |           |         |
| No  | 743       | 78.2    |
| Yes   | 207       | 21.8    |
| One year Injury prevalence                        |           |         |
| No  | 641       | 67.5    |
| Yes   | 309       | 32.5    |
| Hospitalized for more than 24 hours due to injury |           |         |
| No  | 209       | 67.6    |
| Yes   | 100       | 32.4    |
| Period where injury occurred                      |           |         |
| Preparation                                       | 104       | 33.7    |
| Harvesting  | 205       | 66.3    |
| Employer pay your salary at the time of injury    |           |         |
| No  | 293       | 94.8    |
| Yes   | 16        | 5.2     |

rash 428 (45.1%), headache 384 (40.4%), profuse sweating 408 (42.9%) and fatigue 425 (45.1%) were the commonest heat-related symptoms reported by the seasonal and migrant farmworkers (Table 3).

## Work-Related Stress Prevalence

According to this study, the prevalence of work-related stress among seasonal and migrant farmworkers was 67.6% (95% CI: 64.6, 70.7).

## Factors Associated with Work-Related Injuries

The multivariable binary logistic regression showed that types of occupation before migration, average hours worked per day, stress and thermal discomfort were had a statistically significant association with work-related injuries (p-value  $\leq 0.05$ ) (Table 4).

This study showed that unemployed seasonal and migrant farmworkers at their hometown before departure had a higher risk of experiencing work-related injuries. Seasonal and migrant farmworkers who were unemployed at their hometown before migration had 2.2 times higher

**Table 3** Frequency of Heat-Related Illness Experienced Among Study Participants, Ethiopian, 2019 (n = 950)

| HRI Symptoms Experienced   | Frequency (%) |
|----------------------------|---------------|
| Skin rash                  | 428 (45.1)    |
| Painful muscle cramp/spasm | 203 (21.4)    |
| Irritability               | 245 (25.8)    |
| Headache                   | 384 (40.4)    |
| Profuse sweating           | 408 (42.9)    |
| Fatigue                    | 425 (45.1)    |
| Dizziness                  | 430 (45.3)    |
| Extreme weakness           | 540 (56.8)    |
| Blurred vision             | 296 (31.2)    |
| Fainting /unconscious/     | 143 (15.1)    |
| Confusion /restlessness/   | 451 (47.5)    |

odds of experiencing work-related injuries when compared to respondents who were students at their hometown before their departure (AOR = 2.2, 95% CI: 1.3, 3.9). Working >8 hours per day was associated with a high likelihood of experiencing work-related injuries. Workers who work for more than 8 working hours per day were had more likely of sustaining work-related injuries than those seasonal and migrant workers who work for less than 8 hours (AOR = 1.6, 95% CI: 1.2, 2.3). Work-related stress was associated with a high likelihood of work-related injuries. Respondents who had developed work-related stress had 1.4 times higher odds of experiencing work-related injuries than their counterparts (AOR = 1.4, 95% CI: 1.02, 1.9).

According to this study, thermal discomfort was a risk factor for experiencing work-related injuries. Respondents who were perceived a thermal discomfort had 1.5 times higher likely of experiencing work-related injuries when compared to those who were not perceived a thermal discomfort (AOR = 1.5, 95% CI: 1.1, 1.9).

## Discussion

This study shows that seasonal and migrant farmworkers are at higher risk of occupational health problem. The study participants reported a high prevalence of work-related injury. A high proportion of study participants have shown heat-related illness symptoms. Extreme weakness, headache, profuse sweating, and fatigue were the commonest heat-related symptoms reported by the seasonal and migrant farmworkers. Moreover, the prevalence of work-related stress among seasonal and migrant farmworkers was very high. Being unemployed before migration,

**Table 4** Bivariate and Multivariable Binary Logistic Regression Analysis of Factors Associated with Injury Among Seasonal and Migrant Farmworkers in Ethiopia, 2019(n = 950)

| Variables                                       | Injury (Frequency) |     | COR (95% CI)       | AOR (95% CI)       |
|---|--------------------|-----|--------------------|--------------------|
|   | No                 | Yes |                    |                    |
| Age in years                                    |                    |     |                    |                    |
| 13–17   | 27                 | 16  | 1.00               | 1.00               |
| 18–29   | 469                | 217 | 0.78 (0.41, 1.48)  | 0.66 (0.33, 1.32)  |
| 30–39   | 98                 | 53  | 0.91 (0.45, 1.84)  | 0.85 (0.38, 1.9)   |
| >40   | 47                 | 23  | 0.83 (0.37, 1.83)  | 0.78 (0.32, 1.92)  |
| Educational status                              |                    |     |                    |                    |
| Unable to read and write                        | 250                | 124 | 1.00               | 1.00               |
| Able to read and write without formal education | 53                 | 20  | 0.76 (0.44, 1.33)  | 0.81 (0.45, 1.46)  |
| Primary school                                  | 267                | 139 | 1.05 (0.78, 1.41)  | 1.19 (0.85, 1.66)  |
| Secondary school and above                      | 71                 | 26  | 0.74 (0.45, 1.22)  | 0.93 (0.52, 1.65)  |
| Main job/occupation before migrating            |                    |     |                    |                    |
| Student   | 130                | 47  | 1.00               | 1.00               |
| Farmer  | 451                | 219 | 1.34 (0.93, 1.95)  | 1.42 (0.90, 2.206) |
| Unemployed                                      | 60                 | 43  | 1.98 (1.19, 3.32)* | 2.22 (1.26, 3.91)* |
| Family size                                     |                    |     |                    |                    |
| ≤ 2   | 62                 | 26  | 1.00               | 1.00               |
| 3–5   | 369                | 167 | 1.08 (0.66, 1.77)  | 1.15 (0.68, 1.95)  |
| ≥ 6   | 210                | 116 | 1.32 (0.79, 2.19)  | 1.39 (0.81, 2.42)  |
| Residence                                       |                    |     |                    |                    |
| Rural   | 565                | 267 | 1.00               | 1.00               |
| Urban   | 76                 | 42  | 1.17 (0.78, 1.75)  | 1.04 (0.66, 1.64)  |
| Marital status                                  |                    |     |                    |                    |
| Single  | 435                | 214 | 1.00               | 1.00               |
| Married   | 164                | 79  | 0.98 (0.72, 1.34)  | 0.93 (0.63, 1.37)  |
| Divorced/Widowed                                | 42                 | 16  | 0.77 (0.43, 1.41)  | 0.69 (0.36, 1.32)  |
| Salary per day (ETB)                            |                    |     |                    |                    |
| ≤100 ETB  | 276                | 129 | 1.00               | 1.00               |
| > 100 ETB                                       | 365                | 180 | 1.06 (0.80, 1.39)  | 1.05 (0.79, 1.39)  |
| Frequency of visits to the farm                 |                    |     |                    |                    |
| First time                                      | 132                | 46  | 1.00               | 1.00               |
| 2–4 times                                       | 199                | 94  | 1.36 (0.89, 2.0)   | 1.27 (0.82, 1.97)  |
| ≥ 5 times                                       | 310                | 169 | 1.56 (1.07, 2.29)* | 1.48 (0.98, 2.24)  |
| Length of stays in week                         |                    |     |                    |                    |
| ≤ 2   | 124                | 73  | 1.00               | 1.00               |
| 3–4   | 249                | 94  | 0.64 (0.44, 0.93)* | 0.69 (0.46, 1.01)  |
| 5–12  | 109                | 62  | 0.97 (0.63, 1.48)  | 1.01 (0.65, 1.58)  |
| >12   | 159                | 80  | 0.86 (0.58, 1.27)  | 0.77 (0.51, 1.16)  |
| Average hours worked per day                    |                    |     |                    |                    |
| ≤ 8 hours                                       | 183                | 70  | 1.00               | 1.00               |
| >8 hours  | 458                | 239 | 1.36 (0.99, 1.87)  | 1.62 (1.16, 2.27)* |
| Stress  |                    |     |                    |                    |
| No  | 222                | 86  | 1.00               | 1.00               |
| Yes   | 419                | 223 | 1.37 (1.02, 1.85)* | 1.38 (1.02, 1.88)* |

(Continued)



**Table 4** (Continued).

| Variables   | Injury (Frequency) |     | COR (95% CI)       | AOR (95% CI)       |
|-------------|--------------------|-----|--------------------|--------------------|
|             | No                 | Yes |                    |                    |
| Heat stress |                    |     |                    |                    |
| No          | 270                | 101 | 1.00               | 1.00               |
| Yes         | 371                | 208 | 1.49 (1.13, 1.99)* | 1.48 (1.09, 1.98)* |

**Notes:** 1:00 = reference; \*P-value < 0.05; \*\*p-value ≤ 0.001.

working for >8 h/day, stress and thermal discomfort were the significant predictors for the work-related injury.

The finding of this study revealed that the prevalence of self-reported work-related injury among seasonal and migrant workers in Ethiopia was 32.5% (95% CI: 29.7, 35.9). Among the total of injured respondents, two-third 207 (66.9%) of them reported hand as the main part of the body affected. Moreover, 133 (43%) and 132 (42.7%) of injured respondents reported lower leg and head as part of the body affected, respectively. This finding suggests that seasonal and migrant farmworkers are at high risk of work-related injuries and illnesses. This might be attributed to adverse occupational exposure to hazardous conditions and unsafe working environments.<sup>13,29</sup> This result is supported by a study conducted across countries that stated that lack of provision of safety training and protective equipment and poor health-care access among seasonal and migrant farmworkers poses a significant risk for work-related injuries and fatalities.<sup>7,17,30–32</sup> Moreover, seasonal, and migrant farmworkers may take a greater risk on the job including working for longer hours and not complaining about unsafe working conditions fearing loss of jobs. These conditions put seasonal and migrant workers at increased risk of work-related injuries and fatalities.<sup>1,7,29</sup>

Furthermore, the prevalence of injury in this study was higher than the study reported the prevalence of work-related injury among seasonal and migrant workers 3.3% in Turkey,<sup>17</sup> 27% in binational health survey (USA, California)<sup>33</sup> and 23% in Hangzhou China.<sup>34</sup> The possible reason might be a substantial number of migrants in this study work without adequate training and using protective equipment. Furthermore, they work in more hazardous, worse conditions and exploitive environments, where they might be at considerable risk of work-related injury than those countries.

However, it was lower than the study that reported 73% of work-related injury among migrant farmworkers,<sup>35</sup> 38.3% in China districts<sup>36</sup> and 47% among international

migrants.<sup>29</sup> This might be due to the higher use of heavy agricultural machinery and major language/cultural barriers among migrants in those study areas compared to this study. Besides, poor access to health care, a high rate of adverse occupational exposures and working condition might attribute to the higher prevalence of work-related injury.<sup>7</sup> The other possible reason might be migrant workers work in unsafe working conditions without complaining fearing loss of jobs or being deported. In addition, migrant farmworkers might consider not reporting injury or illness due to fear of loss of employment.

This study also showed that the majority of seasonal and migrant farmworkers suffered heat-related illnesses (HRI). This finding is also supported by a study conducted across countries. Which stated that uninterrupted strenuous job in a hot environment with a very few rest periods and lack of potable water contributes to a high incidence of heatstroke, heat exhaustion and heat cramps among farmworkers.<sup>5,9,20,21,37,38</sup> Another study also reported that farmworkers are four times more likely to experience HRI than other industries workers as a result of high ambient temperatures.<sup>9</sup> According to a systematic review conducted, agriculture industry has a mortality rate from HRI that is 20 times that of all other occupations.<sup>29</sup> Lack of training, regular breaks, shade, and medical attention were reported as a risk factors for the high prevalence of HRI among seasonal and migrant workers.<sup>28</sup>

Furthermore, in this study, more than two-thirds of the study participants have experienced work-related stress. This result is supported by a study that reported migrant workers may experience high levels of stress that is attributed to a fast-paced work environment, precarious or insecure jobs and loss of protective socio-cultural factors such as social support, family ties, language and group identity.<sup>39–42</sup>

This study showed that the employment status of migrants before departure from their hometown was a significant predictor of the work-related injury. Seasonal and migrant farmworkers who were unemployed at their

hometown before migrating had higher odds of experiencing work-related injuries. This result is also supported by a study done in Shanghai, which states that occupational injury was associated with less job experience.<sup>43</sup> This might be explained by the concept of job-relevant knowledge gained over time. The more experienced workers had more constructive perspectives regarding safety practices than their inexperienced counterparts. Other possible reasons might be as they work longer years they become familiar and aware of hazards related to specific jobs.<sup>44</sup>

In this study, working for more than 8 hours per day was associated with a high likelihood of experiencing work-related injuries. This study is in line with the study that reported long daily hours of work, which give rise to fatigue, increased the risk of work-related injuries.<sup>17,24,34,45</sup> The possible reason for this might be long working hours may lead to fatigue, physical and mental stress which can possibly cause weariness, sleepiness, irritability, reduced alertness and impair judgment/decision-making that increase the risk of physical injuries and susceptibility to accidents.<sup>46</sup> Moreover, extended working hours may also involve prolonged exposure to potential health hazards.

According to this study, work-related stress was associated with high likelihood of sustaining work-related injuries. Respondents who had developed work-related stress had 1.38 times higher odds of experiencing work-related injuries than their counterparts. This finding was in line with the study that reported the demand for quick work often results in an increased risk of injury from psychological stress.<sup>47,48</sup> The possible reason might be those stressed workers might be distracted, less focused, inattentive and in consequence lead to accidents and injuries. On the contrary, less stressed workers can manage the job demand and control imbalance in a better way and this could lessen the likelihood of experiencing a work-related injury.

Furthermore, thermal discomfort was significantly associated with sustaining work-related injury. Respondents who perceived a thermal discomfort had 1.48 times higher likelihood of experiencing work-related injuries. This result is supported by a study that reported workplace heat exposure can increase the risk of occupational injury.<sup>45,49</sup> This might be due to the fact that elevation of core body temperature and dehydration have had negative behavioral effects in addition to physical impacts like fatigue, irritability, impaired judgment and vigilant

decrement which could lead to an increased risk of accidents and injuries.

This study is significant as it is the first study to investigate the occupational health problems and associated factors among seasonal and migrant farmworkers in Ethiopia. The findings of this study provide an insight into work-related health problems faced by seasonal and migrant farmworkers in Ethiopia and help to design a tailored occupational injuries and disorders prevention and control strategies. It may also help for a deep understanding of the nature of the problem and beneficial to develop a sustainable strategy to promote health and safety for migrant farmworkers.

Moreover, this study will have policy implication. It helps for the design and implementation of best occupational health and safety policy for seasonal and migrant farmworkers in Ethiopia.

## Limitations

Though this study was able to provide important data on work-related injury and illnesses among seasonal and migrant farmworkers, few limitations are noted. For instance, the possibility of recall bias could not be ruled out since more serious and recent injuries or troubles remembered better than a less serious and older one. But we have tried to minimize the effect by using structured questionnaire for assessing work-related injury and illnesses and engaging well-trained data collectors. Despite this limitation, we feel the study provides a reasonably accurate assessment of heat-related illness, stress, work-related injury and associated risk factors among seasonal and migrant farmworkers.

## Conclusion

In conclusion, this study showed that heat-related illness, work-related injury, and stress among seasonal and migrant farmworkers in northwest Ethiopia remains a major public health problem.

Employment history, average working hours, stress and thermal discomfort were significantly associated factors to work-related injury. Hence, implementing tailored occupational health and safety measures would be supremely important. Provision of ongoing safety training, personal protective equipment, improving working hours and stress management could be given attention to minimize the problem.



## Abbreviations

AOR, adjusted odds ratio; HRI, heat-related illness; CI, confidence interval; COR, crude odds ratio; OHS, occupational health and safety; SPSS, Statistical Package for Social Science.

## Data Sharing Statement

All data generated or analyzed during this study are included in this article. The data that support the findings of this study are also available from the corresponding author upon reasonable request.

## Ethics Approval and Consent to Participate

Ethical clearance was obtained from Ethical Review Board of University of Gondar. Permission letter was also obtained from each district administrator and farm owner/employers. Those seasonal and migrant workers, who were selected to participate, were informed about the purpose of the study, the importance of their participation and withdraw at any time. Informed written consent was obtained prior to data collection. Moreover, parental consent was obtained for study participants under the age of 18 years. We confirm that our study complies with all the ethical principles of the Helsinki declaration.

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## Author Contributions

All authors contributed to the study design, data collection, data analysis, drafting, or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no conflicts of interest for this work.

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