EFFECTS OF A HEALTHY UNIT GUIDANCE (HUG) PROGRAM ON WORK ENVIRONMENTS AND HEALTH OUTCOMES AMONG NURSING PERSONNEL

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ABSTRACT: The propose of this quasi-experimental study was to evaluate effects of the Healthy Unit Guidance (HUG) program, a tailored participatory ergonomics intervention, on work environments and health outcomes among nursing personnel. The study was conducted at two tertiary care hospitals during May 2010 to June 2011. There were 90 nursing personnel participated in this study. Data collection was carried out by self-reported questionnaire. The result illustrated the marginal changes trend in work environments and health outcomes among the intervention group at post intervention. During short follow up (3 months), the positive outcome of the HUG program within the intervention group had proven by the number of work improvement achievements carried out by nursing personnel themselves. The finding suggests that further studies are needed to clarify the obvious effect of the participatory ergonomic intervention.

Keywords: HUG program, Participatory ergonomic intervention, Work environment, Health outcome, Nursing personnel

INTRODUCTION

Work related musculoskeletal disorders (MSD) are a major source of illness throughout the nursing world [1, 2] that often resulting in pain, sickness-related absenteeism and disability leaves [3, 4]. In hospital setting, MSDs among nursing staff are caused by ergonomic risk factors such as transferring, repositioning and lifting patients, working in awkward positions and prolonged standing while working in a work environment that has not been suitably adapted to these conditions [5]. Moreover, psychosocial factors such as job demand and social support were associated with MSDs occurrence [6].

The successful interventions, wherein MSDs have been notably reduced among these groups, have been reported in several studies. These have been particularly observed in developed countries, where emphasis is placed on organizing policies and implementing mechanical lifts or patient transfer equipments [7, 8] In developing countries, due to the absence of ergonomic regulations and limited financial support, practical ergonomic approaches that are built on local achievements and focus on participatory training methods have proven useful in facilitating concrete workplace improvements within the existing conditions [9]. Direct participation of workers and employers has been promoted in ergonomic training, aimed at immediate solutions and continuous improvements [10]. Therefore, participatory ergonomics is crucial for MSD prevention.

From a preventative perspective, participatory ergonomics appears to be the most effective method of applying ergonomics in the workplace, in terms of focusing on multi-faceted building of human-centered work environments and practical measures. It is anticipated that with an improvement of work environments in the hospital setting, there will be a resulting positive effect on the health of the nursing personnel, particularly relating to musculoskeletal health, sick leave, and work ability [11].

In Thailand, there have been a few studies describing the best practices for successful participatory ergonomic interventions on work environments and their outcomes in the industrial workforces [12, 13]. However, such evidence among nursing personnel is still limited. Therefore, this study directly focused on assessing the effects of the Healthy Unit Guidance (HUG) program, a tailored participatory ergonomic intervention, on work environments and health outcomes among nursing personnel.

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MATERIALS AND METHODS

Study design and population

The before and after quasi-experimental study with a control group was carried out at two tertiary care hospitals during May 2010 to June 2011. The participants consisted of registered nurses (RNs), practical nurses (PNs) and nurse aides (NAs), who were employed and providing direct patient care at targeted hospitals. Maharaj Nakorn Chiang Mai hospital performed as the intervention group (receiving the HUG program) and Lampang hospital performed as the control group (maintaining usual practice, without the HUG program). The sample size was determined based on a result from the previous participatory ergonomics intervention study [12], which indicated that 73% of the subjects had a successful outcome on reducing musculoskeletal symptoms. If we observe a 30% (effect size) absolute improvement for those on this study intervention, with power (1-β) of 0.80 and $\alpha = 0.05$ at two-tailed test, a 39 samples per group were needed for test the effects of the HUG program. Consequently, the total of 91 voluntary participants who met inclusion criteria was recruited for this study. One participant of the intervention group was excluded before completing the study due to working abroad, which makes 45 participants per group (90 participants) at the end of the study. To control the threat to internal validity, only female nursing personnel working in the orthopedic ward were selected. This contributed to a similarity of participants' work task characteristics and environments.

Materials

The HUG program was based on the concept of participatory ergonomics. It was comprised of a series of workshops that focused on establishing management support, strengthening the capacities of participants and evaluating work improvement achievements. The first workshop on establishing management support aimed to set up and train facilitators. Ten volunteer nurses from the targeted orthopedic ward were recruited as a facilitator team. They were trained on the basic principles of ergonomic risk factor assessment and management in a hospital setting, the structure of and how to use an action checklist, simple and practical low-cost improvements, and the roles of facilitators. Then, the second 6-hour workshop was conducted on strengthening the capacity of the participants. The method of identifying and managing environmental risk factors at work, for musculoskeletal disorders, was introduced to the participants. Eventually, the nursing personnel were able to conduct workplace exposure assessments themselves, using the HUG checklist as a guideline for work improvements. The last workshop was a follow up and evaluation of work improvement achievements. Participants provided a presentation of short-term innovative achievements, show casing work improvement activities which occurred within 3 months subsequent to the completion of the workshop, to all stakeholders (e.g. facilitators and the hospital management team). The whole process of the HUG program intervention took 3 months.

The study protocol and ethics were approved by the Research Ethic Committee of the Faculty of Medicine, Chiang Mai University (ref: no. 285/2010). All participants completed consent forms and gave their permission to be used for the study.

Data collection

Data on all outcome measures were assessed by self-reported questionnaires. A panel of experts confirmed the questionnaire's content validity, showing a content validity index of 0.99. The reliability was tested and found to be acceptable. The Cronbach's alpha coefficient of the questionnaire was 0.80. The before and after intervention measures were done with the same validated questionnaire (at baseline, 3 and 6 months after the HUG program intervention is completed).

Work environments refer to work-related factors that influence the occurrence of musculoskeletal symptoms among nursing personnel. This includes physical and psychosocial environments. The physical work environment was defined as factors associated with the use of force in terms of pull, push, moving or transferring materials or patient and working position of the nursing personnel. It was measured by questionnaire developed based on physical workload index, modified by Hollmann et al. [14]. The index was presented as pictograms and calculated as the weighted sum of the 15-item scores describing the frequency of different work positions combined with the lifting of objects. The total yield score is between 0 (the best physical work environment) and 56.16 (the worst physical work environment). The psychosocial work environment questionnaire was developed based on the Copenhagen Psychosocial Questionnaire (COPSOQ) modified by Aust et al. [15]. The 57-item questionnaire, cover three main areas of the psychosocial work environment: 1) demands at work, 2) work organization, and 3) interpersonal relations at work. The scale was built on 1–5 items (questions). All items had 5 response categories. Directions of the scores follow the label of the

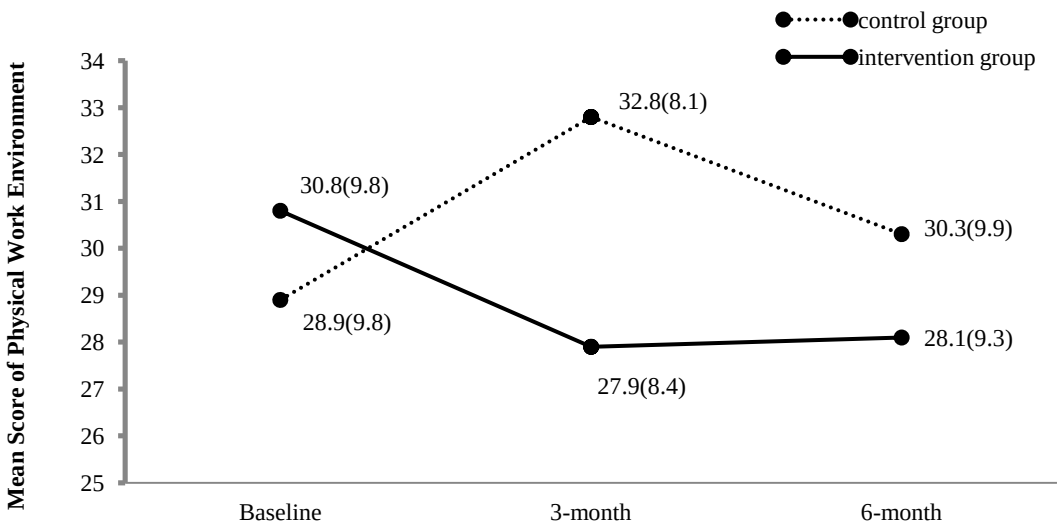


Figure 1 The mean score of physical work environment among the intervention and the control groups at baseline, 3-month and 6-month of follow up

scale; i.e. a high score on the emotional demand scale indicates high emotional demands, a high score on the predictability scale indicates high predictability.

Health outcomes include musculoskeletal symptoms, sick leave and work ability of the nursing personnel. Musculoskeletal symptoms were measured by questionnaire modified from the Nordic Musculoskeletal Questionnaire [16]. This questionnaire requires the nursing personnel to identify nine areas of the body causing musculoskeletal problems. Respondents are asked if they have had any musculoskeletal trouble (such as ache, pain, discomfort and numbness) in the last 3 and 6 months. Sick leave refers to the amount of days that the nursing personnel are away from work, resulting from musculoskeletal symptoms. Work ability is defined as the balance between the demands of work and the resources of each individual nursing personnel. It is measured using the Work Ability Index (WAI) [17]. The WAI questionnaire entails seven dimensions. The result of the work ability level ranges from a score of 7-49 (the worst rating is 7 and the best rating is 49).

Statistical analysis

Demographic characteristics of the study's participants were attained using the mean and standard deviation of continuous variables and using the frequency and percentage of categorical variables. The mean difference of work environment and health outcomes score within groups at the baseline, 3-month and 6-month after the intervention were tested using the repeated measure ANOVA with *Bonferroni* pair wise comparisons. The different of those mean scores among the intervention and control groups at each point of measurement were tested using the one-way ANOVA with a level of significance that was set at $p < 0.05$.

RESULTS

Demographic Characteristics

A comparison of the demographic characteristics (e.g. age, educational level, height, body mass index, job title, years of employment, and working hours) between the intervention and control group, at the baseline assessment, indicated that there were no statistical differences between these groups.

Work improvement achievements

After 3 months of participants' training, a total of 29 work improvement achievements from 8 inpatient orthopaedic wards of the intervention group were carried out by nursing personnel themselves in various types of nursing tasks. The highest changes were emphasized on the physical work environment. For instance, patient care and treatment (e.g. apply lifting team to move and transfer a patient to or from the bed; use the rubber draw sheet as an assistant device for repositioning patient in the bed; and organize sufficient space for work in properly position) workstation design (e.g. clear transport way and reorganize the stuffs for easy access) and medical equipment storage and handling (e.g. use a step to address height difficulties and reduce a resistance of the rolling wheels of the medical equipment). We found

Table 1 The mean difference of physical work environment score between and within groups

Source of variation	df	MS	SS	F	*p-value*
Between subjects					
Group	1	204.33	204.33	1.45	.232
Error	88	141.03	12410.78		
Within subjects					
Time	2	27.58	55.17	0.52	.598
Time*Group	2	270.20	540.41	5.05	.007**
Error	176	53.49	9413.89		

SS = Sum Square; df = degree of freedom; MS = Mean Square
** *p-value* < .01

Table 2 The mean score of psychosocial work environment among the intervention and the control groups at baseline, 3-month and 6-month post intervention

Psychosocial work environment	baseline		3-month		6-month	
	Control Mean(SD)	Intervention Mean(SD)	Control Mean(SD)	Intervention Mean(SD)	Control Mean(SD)	Intervention Mean(SD)
Demand at work						
Quantitative demands	39.1(17.4)	40.6(15.8)	32.6(16.6)	38.5(15.7)	38.3(13.4)	39.3(11.6)
Work pace	68.3(18.8)	62.7(18.3)	63.3(20.4)	61.1(24.7)	63.3(20.3)	61.1(24.7)
Cognitive demands	59.4(11.8)	60.3(16.5)	58.2(15.2)	59.0(16.5)	61.4(14.8)	60.4(12.3)
Emotional demands	52.6(15.1)	52.9(16.6)	54.3(14.6)	53.6(19.3)	52.6(13.2)	53.2(16.6)
Demands for hiding emotions	58.1(18.0)	57.0(17.7)	56.5(17.8)	55.5(20.0)	56.5(13.5)	56.1(17.9)
Work organization						
Influence at work	33.2(9.3)	39.4(16.1)	35.2(15.1)	43.2(14.8)	35.6(11.5)	43.9(16.5)
Possibilities for development	64.2(12.2)	62.9(12.2)	63.2(12.8)	63.5(13.7)	69.2(11.9)	66.5(14.9)
Meaning of work	77.4(14.8)	75.9(17.9)	79.8(14.7)	76.3(15.6)	78.7(8.6)	78.7(15.4)
Commitment to the workplace	59.3(14.3)	58.8(14.7)	58.2(15.9)	58.1(13.4)	61.0(11.4)	59.6(13.8)
Interpersonal relations at work						
Predictability	60.3(14.4)	65.6(12.6)	59.2(12.8)	60.8(14.3)	62.5(13.8)	61.4(14.1)
Rewards	50.3(11.4)	56.1(11.2)	51.2(10.9)	56.7(14.2)	53.3(13.4)	56.2(13.1)
Role clarity	70.0(15.0)	71.7(14.4)	69.4(14.0)	70.0(11.9)	72.6(17.2)	71.7(16.7)
Role conflicts	41.3(14.1)	42.4(14.1)	39.0(14.8)	42.1(13.7)	39.6(14.6)	41.8(13.8)
Quality of leadership	58.1(16.3)	62.1(15.3)	55.7(16.3)	61.8(18.3)	57.9(11.0)	63.2(13.9)
Social support from supervisor	59.4(17.1)	65.0(15.1)	59.4(18.7)	65.7(17.6)	58.7(11.4)	65.5(15.6)
Social support from colleagues	60.7(15.1)	65.9(12.5)	63.7(13.5)	69.4(12.2)	64.4(10.4)	68.9(11.4)
Social community at work	79.6(11.0)	79.6(14.3)	79.6(13.0)	82.2(14.0)	81.5(10.8)	82.0(11.9)

negligible changes on psychosocial work improvement in terms of time planning and management, social support at work, and welfare facilities (e.g. organize short-informal letter for urgent situation and promote the healthier climate where nursing staff can encourage each other).

Work environments

Work environments were categorized into two parts, physical and psychosocial work environment. We found that the mean score of physical work environment among the intervention group at 3-month and 6-month of follow up declined dramatically, in contrast with those among the control group (Figure 1). The repeated measure ANOVA was used to test the mean differences of physical work environment score between and within groups. The finding revealed the interaction of the group and time on physical work environment between the two groups ($F = 5.05$, $p = .007$). There were no statistically significant differences between the physical work environment scores by group ($F = 1.45$, $p = .232$) (Table 1). A significant difference between the three times of physical work environment was not found in the intervention group ($F = 2.17$, $p = .120$), but was found in the control group ($F = 3.39$, $p = .038$). *The Bonferroni* pair wise comparisons were computed to identify specific mean difference at each point of time measurement among the control group. There was found the significant difference at 3-month follow up and baseline ($p = .034$), but was not found at 6-month follow up and baseline ($p = .990$).

Considering the psychosocial work environment, the intervention group reported fewer demands at work (e.g. quantitative demands, work pace,

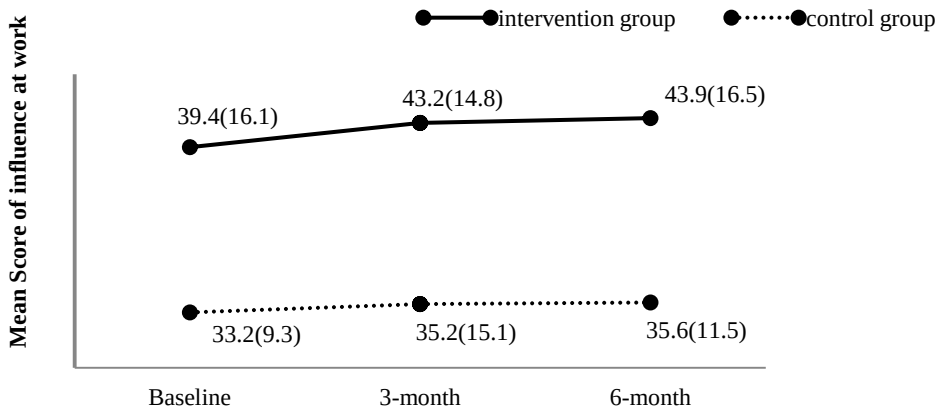


Figure 2 The mean score of influence at work between the intervention and the control groups at baseline, 3-month and 6-month of follow up

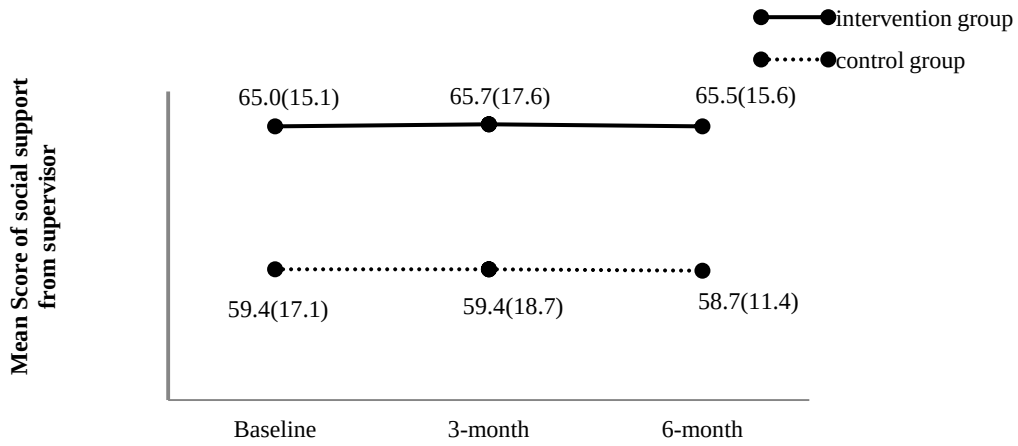


Figure 3 The mean score of social support from supervisor between the intervention and the control groups at baseline, 3-month and 6-month of follow up

Table 3 Baseline and Posttest Means and Standard Deviation for influence at work and social support from supervisor by Group

Variable/Group	Time of evaluation			Time effect		Group* Time effect		Group effect	
	baseline	3-month	6-month						
	Mean(SD)	Mean(SD)	Mean(SD)	F	p	F	p	F	p
Influence at work									
Intervention	39.4(16.1)	43.2(14.8)	43.9(16.5)	1.46	.237				
Control	33.2(9.3)	35.2(15.1)	35.6(11.5)	0.48	.625	0.18	.841	9.26	.003**
Social support from supervisor									
Intervention	65.0(15.1)	65.7(17.6)	65.5(15.6)	0.06	.946				
Control	59.4(17.1)	59.4(18.7)	58.7(11.4)	0.06	.942	.07	.929	5.06	.027*

*p-value < .05, **p-value < .01

cognitive demands, and demands for hiding emotions) at 3-month and 6-month follow up than at the baseline assessment. The positive items of the change in work organization, an increasing trend was found among the intervention group, with the exception of commitment in the workplace, which did not show a major increase. Regarding interpersonal relationships at work, there was an increase on four of seven positive items included rewards, social support from supervisor, social support from colleagues, and social community at work (Table 2). Of the psychosocial work environment items, influence at work (Figure 2) and social support from supervisor (Figure 3) among the

intervention group were minimal changed at post-intervention. The repeated measure ANOVA was used to test the mean differences of two variables within group and found no statistically significant differences. Nevertheless, we found the significant differences of influence at work and social support from supervisor scores by group, respectively ($F = 9.26$, $p = .003$; $F = 5.06$, $p = .027$). The finding revealed no interaction between group and time on both items between the two groups. There was no time effect on both the intervention and control group (Table 3).

Musculoskeletal symptoms

The 3-month prevalence rates of musculoskeletal symptoms, at the baseline measurement of the intervention and control groups, were 40.0% equally. Three months following the intervention, the prevalence rates of musculoskeletal symptoms were reported to be higher than before the intervention, among both groups (57.8% for the intervention group, 60.0% for the control group). Regards finding at month-6 post intervention, although the MSD rate among the intervention group was higher than those at baseline assessment, it was slightly deceased compared with month-3 post intervention. Nevertheless, there were no changes of MSD rate during month-3 and month-6 post intervention among the control group.

Sick leave and work ability

There were no days of sick leave reported in the intervention group, before and after the intervention. However, we found that 2.2 percent of the control group had taken 2-day sick leaves due to musculoskeletal problems during the study period. The mean scores of the work ability within the intervention and control groups, at the baseline assessment, were 40.3 and 42.1 (respectively). The mean score of work ability among the intervention group appears to have slightly increased at month-3 (+0.8) and month-6 (+0.7) post intervention. In contrast, the mean score of the work ability within the control group appears the same after a 3-month follow up and slightly increased (+0.1) at a 6-month post intervention.

DISCUSSION

In this study, the authors investigated the effects of the HUG program on working environments and health outcomes of the nursing personnel. The first aim was to replicate the existing findings on the effect of PE intervention on work environments. We expected that the nursing personnel who had received the HUG program showed an improvement in work environments in comparison to the nursing personnel who did not receive the HUG program. Prior research demonstrates that using the participatory approach can increase acuity within work environments [18]. Changes in ergonomics, among the workers within the PE program, showed a decrease in the physical loads [19]. The finding showed that work improvements among the intervention group were carried out and represented the initial concrete outcomes of the HUG program. Unfortunately, we did not see the obviously positive changes on their physical work environment perception. Concordance with the study among home-care personnel of Horneij et al. [20] indicated no significant differences of perceived physical demand at work between the intervention and the control group after 12-month and 18-month follow up.

The trend of declining of physical work environment score reflected that the HUG program might maintain a level of physical work environment degradation. In contrast with the control group, the score of physical work environment has raised at some point of time. Moreover, the finding showed an increase in perceived physical work environment among the control group at 3-month follow up was unexpected but of potential interest. A possible explanation may be the altered peak of nursing activities among the control hospital. There was some evidence indicate that it might be occurred from a period of extreme turbulence in the work environment within the setting studied themselves [20]. Thus, this phenomenon should be explored in further studies.

Regarding psychosocial work environment, the score of positive items among the intervention group was increased post-intervention but not significantly increased at any follow-up. Increasing of these items might be occurred because of the participatory training method. Performing work improvement by their own initiative ideas may be makes worker have much perception on influence at work. Moreover, some work improvement activity such as promote the healthier climate where nursing staff can encourage each other may be effective in many ways (e.g. increased familiarity between colleagues and supervisor, improved human relations) and can also raise social support at work. However, the significant difference at baseline and post-intervention among the intervention group was not found. A potential explanation might be related to the number of sample sizes in this study. We calculated sample size based on the effect size for reducing musculoskeletal symptoms of the previous participatory ergonomic study. Therefore, the sample size (45 participants per group) might not be

sufficient to makes a significant difference for the work environment outcomes. The results of this study was comparable with the study of Ikeda [21] indicates that 285 workers who engaged with the participatory approach program were statistically significant increase perception on psychosocial work environment in terms of social support from supervisor and colleagues. The study result indicate the significant differences of influence at work and social support from supervisor scores by group, but were not found time effect on both the intervention and control group. This may apparent due to the huge different of their mean score at baseline measurement though statistical testing shown no different. Consequently, slightly increasing of these mean score among the intervention group or decreasing of these mean score among the control group might be sufficient to makes the significant different for those outcomes at post-intervention. As a result, this finding cannot be claimed as a causal effect of the intervention.

The second aim of the study was to investigate the effects of the HUG program on the health outcomes of the nursing personnel. It was anticipated that an effective program would result in a reduction of the rate of musculoskeletal symptoms and sick leaves along with an increase in the score of work ability among nursing staffs. However it was found that the report on the rate of musculoskeletal symptoms among the intervention group, after a 3-month follow up, showed no decrease. A feasible explanation for this may concern the times of measurements. Our findings were in concordance with the study reviews of Bos et al. [22] indicating an uncertainty in the ability to measure a decrease in musculoskeletal symptoms, within one year subsequent to the ergonomic intervention. Although the PE intervention is an effective method to reduce musculoskeletal symptoms, it shows a small positive impact on musculoskeletal symptoms during a short-term post evaluation [23]. Prior study indicates that reducing in musculoskeletal disorders rate has been found evidently after two years follow up of participatory ergonomic intervention [24]. Thus, in this study, 3-month and 6-month follow up evaluation of the HUG program implementation may be not a sufficient amount of time to show concrete changes in musculoskeletal symptoms.

The rise in MSDs shown in the 3-month and 6-month follow-up evaluation reported by the nursing personnel in both intervention and control groups, is noteworthy. Prior study in regards to the definition of MSDs indicated that an increase is possible when workers pay more attention to their reports [25]. Furthermore, it may occur from the fluctuating, varying and seasonal workload experienced in the hospitals. Unfortunately, the researchers did not record the daily number of patient handling tasks, which was a probable risk factor contributing to the rise of MSDs, within both the intervention and control groups during the follow-up period. Hence, this factor should be considered in further studies.

A few studies indicated that the physical and psychosocial exposures impacted the increased risk of sick leave [22, 26]. In this study, the days of sick leave recorded among the intervention group showed no increase within the short follow-up evaluation period of 3 and 6 months. It might be described by the reducing of physical work environment and increasing of some positive items of psychosocial work environment, but not enough to see evidently changes within 6 months. Moreover, the relationship between an intervention and sickness absence is much more complicated. Many individual and organizational factors influence the decision of the employee to report sick leave [27].

According to previous research, some chronic diseases (particularly MSDs) can negatively impact work ability, as much as poor work environments [28, 29]. Therefore, as the work environments improve, the work ability score should increase as well. As a result, the increased score of work ability among nursing personnel in the intervention group after the implementation of the HUG program can be explained due to the improvement in the work environments. This is regardless of the insignificant difference when compared to the control group.

This study has some limitations, such as the use of only self-reported questionnaires as the form of measuring tools. This may have affected the results, due to measuring only perception of participants. The observation techniques for the work environments and the systemic recordings of health outcomes should be used for further studies. Although this intervention was design as similar as the study of previous study, it was not the same. Therefore, the calculated sample size might not be sufficient to make the difference for the desirable outcomes among the intervention group. Repeated intervention with large sample size should be conducted in the future to confirm more precise findings. This study indicates that further comprehensive studies in other hospitals, must be undertaken to confirm the robustness of the participatory ergonomic approach.

In summary, we cannot claim that changes in work environment and health outcomes among nursing personnel have been made as a result of the HUG program. However, the positive outcome of this

program within the intervention group had proven by the number of work improvement achievements carried out by nursing personnel themselves whether the follow-up period was short. Further studies with lager sample size and long-term period follow-up are needed to clarify the obvious effect of the participatory ergonomic intervention.

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