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I, Chunhui He , hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Occupational Safety and Ergonomics.

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Physical and Psychosocial Demands on Shift Work in Nursing Homes

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Physical and Psychosocial Demands on Shift Work in Nursing Homes

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By

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Abstract

There has been a plethora of research investigating the adverse health effects of shift work and to a lesser extent musculoskeletal disorders (MSDs). The health care industry, specifically nurses and nurse aides, is probably the most integrated profession with shift work. The high prevalence of the low back pain and injuries among nursing aides indicates the need of investigation on the physical and psychosoical demands for shiftwork. The objective of the current study was to determine the physical and psychosocial work demands for long-term nursing aides for different shifts (Day, Evening and Night) and shift lengths (8-hour versus 12-hour) and adverse musculoskeletal outcomes.

Fifty four female nursing aides who were permanent employee of five nursing homes in Cincinnati metropolitan area completed a psychosocial questionnaire developed from the Quality of worklife, Job Content and Dundee State Stress questionnaires. The nursing aides were also observed with a specially developed REBA checklist that quantified the postural demands. In addition, 2 nursing aides from each shift were monitored to quantifying the amount of time sitting, standing, and walking, as well as energy expenditure. Finally the nursing aides completed body discomfort symptom survey. One-way ANOVA, Kruskal-Wallis, and Fisher Exact Tests was used to identify significant differences among shifts.

The results indicated more severe postures for shoulders and elbows in night shifts and for neck in 8-hour day shift. Walking steps and energy expenditure on day shift were significantly greater than on night shift and posed a significant amount of

activity. Hourly energy expenditure on 8-hour shift was greater than 12-hour shift. The 8-hour shifts (especially evening and night) ranked lower when compared to the 12-hour shift for psychosocial factors: relationship with the coworkers and supervisor and had family interference with work, The 8-hour day shift nursing aides reported more hand-wrist pain while the 8-hour night shift workers had more knee pain and lost days due to ankle/foot pain than other shifts. The 12-hour day shift nursing aides had more current hip pain than the other shifts.

Both the time and the duration of the shifts have some effect on physical and psychosocial demands as well as musculoskeletal disorders. However, the results were not completely consistent with all variables. The relationship with the supervisor and coworkers may be a major underlying factor of MSDs and turn-over rates for night shifts. The bottom line was that the demands on the nursing aides were significant and complex with the different shifts having unique demands.

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CHAPTER 1

INTRODUCTION

There are approximately 20% of workers in the United States working non-standard schedules such as rotating and night shifts (Spratley, Johnson, Sochalski, Fritz, & Spencer, 2001; U.S.Congress, 1991). A plethora of studies have found negative impact of shift work on health and well-being (Costa, 1996; Drake, Roehrs, Richardson, Walsh, & Roth, 2004; Masri & Sassone-Corsi, 2013; van Drongelen, Boot, Merkus, Smid, & van der Beek, 2011). Nursing staff (nurse and nursing aides) have been one of the main professional groups driven by shift work in hospitals, home healthcare, and long-term care facilities. Caring for people is a very demanding job with many complex demands (Bakker, Verhagen, van Trijffel, Lucas, & Koes, 2009). National data compiled by the Bureau of Labor Statistics (BLS) showed that the rate of work-related injury or illness requiring medical treatment or lost work was 8.2 per 100 among long-term care facility workers in 2011(BLS, 2013). Among those injuries, musculoskeletal disorders (MSDs) have resulted in substantial costs, especially low back pain (Dunning et al., 2010; Fronteira & Ferrinho, 2011; B. P. Klein, Jensen, & Sanderson, 1984; Silverstein, Viikari-Juntura, & Kalat, 2000.). Further, Silverstein and associates (Silverstein, Viikari-Juntura, & Kalat, 2002) reported that nursing homes were the #1 facility in the number of MSDs and was #23 in costs with 5.14 per 100 FTE.

Within the nursing profession, nursing aides appear to be at highest risk of disabling back injuries with the injury rates being equal to or higher than those of workers in heavy industries (Bakker et al., 2009; Galinsky, Waters, & Malit, 2001; Jensen, 1987). Compared to nurses, reported back injuries for certified nursing assistants are 1.5 to 4 times that of registered nurses (Fuortes, Shi, Zhang, Zwerling, & Schootman, 1994; Pompeii, Lipscomb, Schoenfisch, & Dement, 2009; Siddharthan, Nelson, & Weisenborn, 2005; Violante et al., 2004). The MSD injury rate for nursing aides was double the rate of a patient nurse (8.8 vs. 4.1 per 100 FTE) (Pompeii et al., 2009). Randall and associates (Randall, Pories, Pearson, & Drake, 2009) found that nursing aides were more than 4 times more likely to be injured when lifting bariatric patients than registered nurses (62% to 15%). During the professional career of nursing aides, a lifetime low back pain prevalence of 35-90% has been reported (Knibbe & Friele, 1996). Bottom line, nursing aides suffer from one of the highest rates of low back injuries.

MSDs problems for nursing aides also include other body regions. In a review by Lorusso and associates (2007), it was found nurses and nursing aides had annual prevalence of low back pain of 12% to 86%, shoulder pain of 4% to 49%, neck pain of 28% to 63%, upper extremity pain of 31%, and low extremity pain of 54%. Others (Luime et al., 2004) have reported current pain in the shoulder to be around 35% and neck pain at 36% to 40%. Dulon and associates (2008) found that nursing aides and nurses had a prevalence of current low back and cervical back pain at 18% and 10% while the monthly prevalence increased to 43% and 21%, respectively.

Although data has shown that nursing personnel experience a high incident rate of musculoskeletal symptoms, the role the shift work in the development of these problems has yet to be fully understood (A. M. Trinkoff, Le, Geiger-Brown, Lipscomb, & Lang, 2006). Both physical and psychosocial stressors are commonly found in the complex work environments of nurses and nursing aides, whether that is in a hospital or long-term care facility. In long-term care facilities, nursing aides work with patients who have varying degrees of movement and mobility—typically, elderly who are limited due to illness or dying from serious ailments. Research has shown that both physical and psychosocial factors play a role in developing muscle pain either independently (Bongers, de Winter, Kompier, & Hildebrandt, 1993; Davis & Heaney, 2000; Hales & Bernard, 1996; Kelsey & Golden, 1988) or jointly (Davis & Heaney, 2000; Devereux, Buckle, & Vlachonikolis, 1999; Hales & Bernard, 1996; Schoenfisch & Lipscomb, 2009; Warming, Precht, Suadicani, & Ebbehøj, 2009). The high prevalence of low back pain among nursing aides and auxiliaries has traditionally been attributed to the high frequency of lifting high magnitudes of load (e.g. patients) (Alamgir, Yu, Gorman, Ngan, & Guzman, 2009; Bakker et al., 2009; Feng, Chen, & Mao, 2007; Knibbe & Friele, 1996; Lagerstrom, Hansson, & Hagberg, 1998; Owen, Garg, & Jensen, 1992; Smedley, Egger, Cooper, & Coggon, 1995). Cameron and associates (2008), and Warming et al.(2009), found that patient handling impact more than the low back, also including upper back, upper arm, hands, thigh/knee, lower leg, and ankle/foot.

Nursing aides are in direct contact with the patients, oftentimes requiring multiple handlings throughout the day whether it is shifting them in bed (repositioning) or transferring to and from the bed (Eriksen, 2006; Feng et al., 2007). In a study in 2006, Eriksen (2006) found that nursing aides repositioned, transferred and lifted patients more in long-term care facilities than in hospitals. Although extensive research has indicated high levels of biomechanical stress on caregivers when performing patient lifting and repositioning tasks (Garg, Owen, Beller, & Banaag, 1991; Marras, Davis, Kirking, & Bertsche, 1999; Nelson, Lloyd, Menzel, & Gross, 2003; Ulin et al., 1997; Zhuang, Stobbe, Hsiao, Collins, & Hobbs, 1999), these studies focused on biomechanical stressors of the worst case tasks (e.g. patient repositioning and transferring). Many other handling tasks are done by nursing aides in the treatment and caring of the residents. Other physical activities include moving medical equipment, delivering medicine, delivering meals, and assisting in the patient in getting dressed.

In addition to the high physical demands, the nursing aides have potential high psychosocial stressors such as dealing with life and death situations, pressure from management to perform and cut costs, less of social activities due to shift work and potential violent acts from residents (Gates, Fitzwater, & Deets, 2003; Sandvide, Astrom, Norberg, & Saveman, 2004; Schoenfisch & Lipscomb, 2009; Stubbs, 2009). These psychosocial demands may be directly related to the shift that the nursing aide works (McIntosh, 1990; Schoenfisch & Lipscomb, 2009) and maybe dramatically different for different shifts. For example, nursing aides who work on night shift have

less support from other staff (McIntosh, 1990), and working on weekends and night may affect nursing aides' personal life and social activity as well as health outcomes (Åkerstedt T, 1988; Drake et al., 2004; Fitzpatrick, While, & Roberts, 1999; Hossain et al., 2004; Piko, 2006). Furthermore, psychosocial stressors may be influenced by the length of the shift (8-hour vs. 12-hour) (Hossain et al., 2004; Josten, Ng-A-Tham, & Thierry, 2003a; Mills, Arnold, & Wood, 1983; L. Smith, Macdonald, Folkard, & Tucker, 1998; L. Smith, Folkard, Tucker, & Macdonald, 1998). Overall, there is a lack of understanding of the impact of both physical and psychosocial demands when working extended hours.

The current study was designed to fill this void by determining the physical and psychosocial work demands for long-term nursing aides for different shifts and shift lengths. Further, the impact of shift and shift length on musculoskeletal pain was also investigated. The results have the potential to provide guidance to long-care facilities in determining the proper work schedules and manpower requirements.

CHAPTER 2

BACKGROUND

2.1 Shift Work and Its Health Effect

Shift work usually means working outside the normal daylight hours (8 am—5pm) or more than 7 to 8 hours at a time. The need for 24-hour continuous service while meeting service requirements in health care facilities make shift work necessary. In the United States, there were approximately 25% of all employees working on shift work in 1990 (Verespej, 1990) and has only slightly decreased over the last 2 decades (McMenamin, 2007). The most recent statistics reported that about 15 million people worked a shift other than a daytime schedule (e.g. 9 to 5), who accounted for 14.8% of the full-time wage and salary workers population (Bureau of Labor Statistics, 2005). Hereafter, shift work will refer to those shifts that are not the traditional 8-hour day shift (e.g. night shift, evening shifts, and 12 hour shifts).

Research has shown that shift work can cause many adverse effects on health-related problems, in particular disturbed sleep and fatigue (Åkerstedt T, 1988; Akerstedt, 2003; Akerstedt & Wright, 2009; Axelsson, Akerstedt, Kecklund, & Lowden, 2004; Caruso & Waters, 2008; Geiger-Brown, Trinkoff, & Rogers, 2011; Keller, 2009). Lengthening the shift from 8 to 12 hours significantly reduces the hours available for sleep and drastically impacts sleep patterns (Geiger-Brown & Trinkoff, 2010; Geiger-Brown et al., 2011). Shift work also has been associated with more

severe accidents and decreased work performance (Åkerstedt T, 1988; Axelsson et al., 2004; Estabrooks et al., 2009; Folkard & Tucker, 2003; Hossain et al., 2004; Keller, 2009). Further, it appears that long-term effects of shift work is more associated with chronic diseases such as coronary heart disease (Knutsson & Boggild, 2000; Puttonen, Härmä, & Hublin, 2010) and metabolic disturbance (B. H. Karlsson, Knutsson, Lindahl, & Alfredsson, 2003; Szosland, 2010), although evidence currently is limited (Frost, Kolstad, & Bonde, 2009; Szosland, 2010; Tucker, Marquié, Folkard, Ansiau, & Esquirol, 2012). Little is known about the long-term ramifications of shift work on musculoskeletal disorders and pain. A recent review of the literature investigating shift work and musculoskeletal disorders concluded that few studies have adequately examined the adverse impact on the musculoskeletal system (Caruso & Waters, 2008).

The major problem in shift work disorders is that work hours force the individual to adopt temporal patterns of biological and social functioning that potential go against the biological clock. This biological clock generates and maintains chronobiological rhythms that control sleep and wakefulness and other physiological functions. Staying awake at night for work and sleeping during the day may lead to the acute symptoms, such as difficulty getting to sleep, shortened sleep and sleepiness during working hours (Åkerstedt T, 1988; Akerstedt, 1998; Akerstedt, 2003; Akerstedt & Wright, 2009; Keller, 2009; Sallinen & Kecklund, 2010). These effects have also been seen for rotating shifts for workers (Keller, 2009; Sallinen & Kecklund, 2010). In all, shift work can make workers feel sleepy while on the job as well as have increased sleep disturbance during days off (Akerstedt & Wright, 2009). Sleep

deprivation caused by sleep disturbance can have significant negative effects on job performance and social functioning, especially by generalizing fatigue, decreasing productivity, increasing injury risks, and lowering the quality of work and family life (Akerstedt, 2003; Akerstedt & Wright, 2009; Folkard & Tucker, 2003; Hossain et al., 2004; Keller, 2009; Scott, 2000). In a review completed by Åkerstedt and Torbjorn (2003), the complete detrimental impact of shift work and sleep disturbance among morning, afternoon and night shift workers is discussed.

2.2 Circadian Rhythm and Shift Work

One potential reason for the health problems for shift work is the conflict between mismatch between work hours and biological clock output. Daily biological rhythms, including sleep-wake cycles, rectal temperature and melatonin secretion, are called circadian rhythms, which are controlled by the internal clock (Masri & Sassone-Corsi, 2013). The internal clock (sometimes referred to as biological clock) resides in the suprachiasmatic nuclei of the hypothalamus, and generates a signal that results in a pronounced 24 hours oscillation in virtually all the physiological and psychological functions (Masri & Sassone-Corsi, 2013). For example, rectal temperature has a maximum at ~17:00 h and a minimum at ~5:00 h (Czeisler, Weitzman, Moore-Ede, Zimmerman, & Knauer, 1980), while melatonin has a maximum at ~4:00 h in the morning and a minimum at ~16:00 h. Melatonin is closely related to temperature and alertness. During daytime, human rhythms generate a drop of vigilance in the mid-afternoon and a very alert period towards the end of the afternoon (Lavie, 1986),

which is close to the change of temperature. This might have ramifications for a potential injury mechanism for musculoskeletal disorders.

The phase of the circadian pacemaker or master clock in mammals can be adjusted by external stimuli such as the daily cycle of light–dark (Berger & Hobbs, 2006), as well as by internal stimuli such as information related to the physiological and behavioral status of the organism. If no adjustment occurs, work at the bottom of the circadian rhythm will be carried out at low levels of physiological activation, subjective alertness or behavioral efficiency. Adjustment to a new circadian phase position will occur at the speed of 1 h per day under optimal conditions, probably through light exposure at the sensitive portions of the circadian phase (Akerstedt, Kecklund, & Knutsson, 1991). It appears that only very marginal circadian adjustment occurs in shift workers (Akerstedt, 1985; Akerstedt & Wright, 2009), because in shift workers, the adjustment is counteracted by a light pattern in opposition to night work hours (Berger & Hobbs, 2006; Cohen-Mansfield, 1997) .

Shift work has adverse effect on sleep in different ways according to the time of the shift (Åkerstedt T, 1988; Akerstedt, 1998; Akerstedt, 2003; Camerino et al., 2008). Therefore, injuries and accidents may occur when people work on alternative shifts when there less physiological activation and subjective alertness is present, especially at night (Akerstedt & Wright, 2009; Estabrooks et al., 2009). Further, working at night leads to sleep loss, which causes circadian rhythm disruption (Camerino et al., 2008). Research indicated that body temperature, hormone secretion, metabolism of fat as well as muscle strength have circadian rhythms (Drust, Waterhouse, Atkinson,

Edwards, & Reilly, 2005; Gauthier, Davenne, Martin, & Van Hoecke, 2001; Giacomoni, Edwards, & Bambaeichi, 2005). The circadian rhythm for muscle strength has been documented for maximal voluntary contraction and isokinetic peak torque with a trend that similar to the change of temperature (Atkinson, Coldwells, Reilly, & Waterhouse, 1993; Callard, Davenne, Gauthier, Lagarde, & Van Hoecke, 2000; Coldwells, Atkinson, & Reilly, 1994; Deschenes et al., 1998; Gauthier, Davenne, Gentil, & Van Hoecke, 1997; A. Nicolas, Gauthier, Trouillet, & Davenne, 2008; A. F. Nicolas, Gauthier, Trouillet, & Davenne, 0605; Zhang, Dube, & Esser, 2009).

When circadian rhythm is disrupted, it will interrupt the wake/sleep cycle as well as the metabolic demands that are coordinated with this cycle. On the other hand, in the sleep phase, the digestive process slows down and mental alertness decreases. This process will lead to two adverse effects. First, when the circadian rhythm is disrupted, the body becomes stressed through the endocrine system, potentially resulting changes in metabolism, loss of muscle tone and weight gain (van Drongelen et al., 2011). For example, the night shift workers have an irregular eating habit (Pasqua & Moreno, 2004; Waterhouse, Buckley, Edwards, & Reilly, 2003); at the same time, the lipid and carbohydrate metabolism were stimulated that resulted in insulin resistance (Al-Naimi, Hampton, Richard, Tzung, & Morgan, 2004; B. Karlsson, Knutsson, & Lindahl, 2001; Lund, Arendt, Hampton, English, & Morgan, 2001; L. Morgan, Hampton, Gibbs, & Arendt, 2003; Romon et al., 1992). These alterations of metabolism of fat and sugar result in weight gain (B. Karlsson et al., 2001; Scott, 2000) and other health problems.

Second, the motor system that controls and adjusts muscles for any body movement is loses accuracy when alertness drops. The decreased ability to control the muscles results from decreased brain activity and resulting deficits in the central nervous system. Moreover, working at night interrupts the circadian rhythm of muscle strength. If heavy workload such as patient lifting is performed at the lowest point of the rhythm, a result might be the damage to the muscles or other structures utilized during lifting.

2.3. Current Status of Musculoskeletal Disorders Among Nursing Aides and Nurses

The health care industry, specifically nurses and nurse aides, is one of the professions that is most integrated with shift work. However, healthcare workers who are employed on shift work are suffering musculoskeletal disorders such as pain or injury in back and shoulders. Meanwhile, the loss that caused by the musculoskeletal injuries is tremendous. Nursing aides had the highest incidence of musculoskeletal injuries, and had 5^{th} highest back injury incidence in the United States (Jensen, 1987; Silverstein et al., 2002; Washington State Department of Labor and Industries, 1996). Further, nursing aides accounted for 3.6 worker compensation claims due to back injuries per 100 workers that rate was higher than for material handlers (3.4) and construction workers (2.8)(B. P. Klein et al., 1984). Based on 1990–1998 accepted workers compensation claims data, the average incidence rate (IR) for lifting related back injuries was 3.8 times the overall industry rate (IR=7.2 per 100 FTE employees)

(Silverstein et al., 2000.) in the long-term care facility industry Washington State. Silverstein et al.(2002) also reported similar trends in more recent years for the state of Washington's worker compensation costs where nursing aides had higher numbers of claims and costs than many heavy industries. For another musculoskeletal disorder--rotator cuff syndrome, long-term care facilities had 2.4 times (IR=3.7 per 100 FTE employees) the overall industry rate (Myers, Silverstein, & Nelson, 2002). Thus, musculoskeletal disorders have a tremendous impact on nursing aides.

2.4. Complex Demands in Long-Term Care Facilities

2.4.1. Physical Workload

Research has found that nursing aides provide up to 90% of the direct care to residents (Banaszak-Holl & Hines, 1996) including assistance with eating, dressing, bathing, toileting, repositioning in bed, and transferring from bed to chair. In long-term care facilities, nursing aides are often working with residents who have serious medical conditions as well as physical and cognitive impairment, which requires them to lift, transfer, and reposition residents many times in a day. Oftentimes, the residents are not cooperative in the transferring process. As a result, patient/resident handling tasks are major contributors to low back injuries in these facilities (Eriksen, 2006; Feng et al., 2007; Garg & Owen, 1994; Knibbe & Friele, 1996; Pheasant & Stubbs, 1992; Sedlak, Doheny, Nelson, & Waters, 2009; Smedley et al., 1995; Stobbe, Plummer, Jensen, & Attfield, 1988; Yassi et al., 1995). It has been reported that among the more frequently reported tasks relating to low back injuries

were adjusting the patient in bed (31.7%), transferring the patient from bed to wheelchair or vice versa (21.6%), and chair to toilet (2.2%) (Knibbe & Friele, 1996; Pompeii et al., 2009). In another study by Vasiliadou and associates (1995), moving patients in bed and transferring patients out of bed were found responsible for 29% and 24% of the low-back injuries, respectively. Moreover, repositioning the patients in bed were the second most stressful tasks performed by nursing aides (Garg & Moore, 1992; Owen et al., 1992) and in the top three risky tasks by another research group (Pompeii et al., 2009). Nursing aides appear to be at more risk of low back injuries when performing these types of tasks than nurses: lifting patient (OR=1.7), transferring (OR=2.1), pulling up patient in bed (OR=2.7), and repositioning (OR=1.9) (Pompeii et al., 2009). Furthermore, these tasks were found to be more risky when handling bariatric patients (Randall et al., 2009).

The loads on the spine for these tasks have been found extremely high even under the best conditions (e.g. small patient that was compliant, adequate space to move). The compressive loads on the spine were examined when performing patient handling tasks in some studies (Garg et al., 1991; Garg & Owen, 1992; Garg & Owen, 1994; Owen et al., 1992), which found that the static estimations of the compressive force were about 3600 N to 4751 N for patient transfers. The repositioning of the patient in bed was found to be drastically lower, about 107 N (Owen et al., 1992). Other researchers (Jang et al., 2007) have reported higher compressive and shear spine loads for similar tasks: highest compression loads—total lift (13230 N), partial lift (9150 N), transport patient (8900 N), and assist patient to move (2910 N); highest shear

loads--total lift (1210 N), partial lift (850 N), transport patient (980 N), and assist patient to move (440 N). However, in a laboratory study of resident handling tasks (Marras et al., 1999) considering dynamic loading and muscle co-activation, different manual transfer and repositioning tasks can increase peak spinal compressive forces above the 6400 N tolerance limit, and result in a high probability of high risk group membership compared to industrial manual handling tasks. It is obvious that the repetitive excessive force posed on the low back and other joints will adversely damage the muscle and tendon tissues and further skeletal structures.

Besides the biomechanical stress, awkward postures are common in patient handling tasks due to limited space, equipment obstacles (Waters, Collins, Galinsky, & Caruso, 2006). Hodder and associates (2010) reported that repositioning patients in bed requires as tremendous amount of force while in a poor posture—severe trunk flexion in combination with lateral bending and twisting. Although many large long-term care facilities provide lifting equipment, the room space makes it difficult to maneuver therefore more repetitive pushing and pulling tasks are involved (Menzel, Brooks, Bernard, & Nelson, 2004). Further, lifting equipment has still not gained traction and oftentimes sits idle (more than 50% of lifts not done with assistive device)(de Castro, Cabrera, Gee, Fujishiro, & Tagalog, 2009; Simon et al., 2008).

2.4.2. Psychosocial Demands and Psychological Stress

Nursing is a profession that requires 24-hour delivery of skilled care, along with emotional input, which is referred to as “emotional labor” (Phillips, 1996). Therefore, the nursing staff is exposed to a wide range of psychosocial workplace stressors. Nine

sub-scales of workplace stressors were identified by French et al. (2000) that might impact on nurses (McVicar, 2003) including workload, conflict with physicians, inadequate preparation, problems with peers, problems with supervisor, discrimination, uncertainty concerning treatment, dealing with death, and dying patients, patients/their families. The psychological responses to the stressor are called stress (Selye, 1976).

Nurses' aides face high psychosocial and psychological stress because of the heavy work load, poor pay, inadequate staffing levels (and resulting time pressure), insufficient skills, lack of respect, and resident interactions (e.g. exposed threat and assaults, especially the nursing aides who care for individuals with dementia) (Eriksen, Tambs, & Knardahl, 2006; Gates, Fitzwater, & Meyer, 1999; Gunnarsdottir, Rafnsdottir, Helgadottir, & Tomasson, 2003; Lapane & Hughes, 2007; D. G. Morgan, Semchuk, Stewart, & D'Arcy, 2002; Muntaner et al., 2006; Schoenfisch & Lipscomb, 2009; Stubbs, 2009). In Morgan et al.'s study (2002) comparing the job strain of the registered nurses, nursing aides and activity workers, nursing aides had significantly higher psychological job demands and significantly less decision authority among the other long-term care facility staff. Patient care tasks (Lin, Yin, & Li, 2002) were found the most stressful in many studies investigating psychosocial demands among nursing aides (Dunn, Rout, Carson, & Ritter, 1994a; Lin et al., 2002; D. G. Morgan et al., 2002). These tasks were probably the most stressful since adverse interaction were unavoidable.

The negative consequences of lack of staffing not only increase the workload but also lessen the quality time of interacting with the residents (D. G. Morgan et al., 2002). In addition, fast pace working and inadequate of personal care time and emotional support from the nursing aides also make the residents feel ignored and unsatisfied, which leads to more verbal and physical incivility from the residents (Gates et al., 1999). Therefore, the nursing aides feel more pressure and stress (Eriksen et al., 2006) .

Furthermore, the residents who are under long-term care of the nursing aides are like family members to them. Facing the life and death situation of the residents every day as their own part of life can make the nursing aides emotional, stressed, and disturbed (Kayser-Jones et al., 2003; McVicar, 2003; Moss, Moss, Rubinstein, & Black, 2003). Lack of psychosocial support, inadequate staffing, nobody to talk about the grief will worsen this situation.

Additionally, lack of support from other staff including coworkers as well as supervisors (Lapane & Hughes, 2007; McGowan, 2001; Schoenfisch & Lipscomb, 2009), and role conflict(Bourbonnais, Comeau, & Vezina, 1999; Dunn, Rout, Carson, & Ritter, 1994b; Eriksen et al., 2006; McVicar, 2003; Piko, 2006) are also common stressors among the nursing staff. On one hand, a problem often occurs when switching of shifts where the staff working on the previous shift fails to provide adequate information to coworker on subsequent shift. On the other hand, nursing aides often suffer from less freedom for decision making and lack of recognition from

supervisors for good performance (Lapane & Hughes, 2007; McGowan, 2001), all of which contribute to a poor psychosocial work environment.

Besides the heavy physical workload and psychosocial distress for nursing aides in long-term care facilities, the functioning of the long-term care facilities itself can have a major impact on the cumulative load on the nursing aides. For example, staffing, training, equipment availability, and organization of work can have both direct and indirect impact on physical and psychosocial load (Garg & Owen, 1994; Myers et al., 2002). With the aging of the population, demand for nurse aides is expected to grow dramatically. There are approximately 1.5 million older people in the United States long-term care facilities that need 1.2 million employees as the care givers in these long-term care facilities (Myers et al., 2002). According to the Institute of Medicine (IOM), advocacy groups, and provider associations, a serious shortage of nurse aides already exists, and will worsen if steps are not taken immediately (US General Accounting Office, 2001).

With a shortage in people, turnover is high. A review of the literature investigating turnover in long-term care facilities estimates that annual turnover of aides ranged from 37 to 93% (Cohen-Mansfield, 1997) . Among the several factors contribute to providers' difficulty in both hiring and retaining nurse aides, the high job demands including physical and psychosocial demands of the work and relatively low wages and few benefits (US General Accounting Office, 2001). Therefore, the nursing staff experiences burnout, job dissatisfaction and other risks that related to organizational structures or work environment (Burisch, 2002; Kalliath & Morris,

2002; Piko, 2006). High staff turnover and shortness of staffing make nursing aides work more difficult and potentially increasing the risk of musculoskeletal disorders. However, the research on the physical and psychosocial demands with current staffing shortage among nursing aides with respect to MSDs is limited (Caruso & Waters, 2008).

2.5. Potential Impact of Shift Work in Developing Musculoskeletal Disorders in Nursing Aides

Research has indicated that both physical workload and psychosocial factors play an important role in developing musculoskeletal disorders (MSDs) (Bongers et al., 1993; Davis & Heaney, 2000; Devereux et al., 1999; Hales & Bernard, 1996; Kelsey & Golden, 1988). This may explain the high MSDs incident rate and injuries among nursing aides since they are exposed to high physical and psychosocial demands. As one of the organization factors that place cumulative load on nursing aides, working extended hours and/or working shift work are potential risk factors that developing musculoskeletal injuries (Caruso & Waters, 2008; Fredriksson et al., 1999; Lipscomb, Trinkoff, Geiger-Brown, & Brady, 2002; Waersted & Westgaard, 1991). Shift work is a complex term that can be described in many ways and each way may have different impact on the human body.

The shift work system can be classified as permanent/fixed or rotating shift. They also differ in relation to other important factors such as length of the shift cycles, duration of the shift, schedule on the shift, etc. (L. Smith, Hammond, Macdonald, &

Folkard, 1998). Because of the complexity of the shift work, the research on this topic varies tremendously. Most of the studies investigated fixed shift and rotation shift or comparing normal day worker with shift workers for performance, fatiguing, as well as physical health such as heart disease, and concluded that rotation shift places more risk on the shift workers (Akerstedt, 2003; Boggild & Knutsson, 1999; Puttonen et al., 2010; Szosland, 2010; Tucker et al., 2012; Wilson, 2002)

Although the physical and psychosocial demands have been found to be excessive, the research to quantify these complex workloads is limited. This is especially the case for physical and psychosocial demands among nursing aides working on different shift (morning, evening and night). Furthermore, most of the studies on nursing research used self-report questionnaire to assess not only psychosocial but also physical demands. Poor correlations with direct observation assessment and subjective questionnaire assessment have been reported in multiple studies (Hansson et al., 2001; Homan & Armstrong, 2003). In addition, having both subjective exposure and outcome data can lead to a systematic reporting bias (negative affect) (Andrews, Norman, Wells, & Neumann, 1998; Davis & Heaney, 2000). A comprehensive study using more objective approach that considers variables that indicate the overtime risks of manual handling tasks to fix the research gap is necessary.

Furthermore, research has shown that both shift work and long work hours are associated with several health and safety risks including musculoskeletal injuries (Fredriksson et al., 1999; Lipscomb et al., 2002; Waersted & Westgaard, 1991).

Twelve-hour shifts are extended in duration than 8-hour shift and also include a night shift. Lipscomb and associates (2002) reported that working above 8-hours per day; working on shift other than day shift were significantly related to musculoskeletal disorders in one or more body sites. However, this study only scratched the surface of understanding of extended shift hours and shift work.

2.6 Variation in Physical Workload between Shifts

For traditional 8-hour shift, the 24-hour day is divided by three distinct shifts: day, evening and night. Correspondingly, the 24-hour day is evenly divided in 12-hour shifts: day and night. The staffing levels are different among these shifts according to the nature of the operation in the long-term care facility. In general, day shifts are the most physically demanding for the nursing aides given that they are required to wake up of the patients, dress patients, conduct personal hygiene procedures, prepare meals, prepare for nap time and perform the most resident transfers. Therefore, the ratio of nursing aides to residents is highest as compared to afternoon and night shifts. Night shift is the quietest shift with a slowest pace (Pigors. P & Pigors, 1944) and less time pressure (Boggild, Burr, Tuchsen, & Jeppesen, 2001). Thus, the night shift typically has the lowest nursing aide-to-resident ratio, which means one nursing aide on night shift takes care of more residents than the aides on day shifts. Meanwhile, the work activity levels on evening and night shifts are lessened due to less caring giving activities when residents are sleeping (Blau & Lunz, 1999). The duty of the nursing aides on night shift is basically answering calls; checking and changing dirty briefs by

certain intervals, for example, every two hours a round. Depending on the requirement of the facilities, they will also get some of residents up in the morning.

While many states have regulations, the reality is understaffing in many facilities due to lack of available employees. Time pressure, which is an indicator of insufficient staffing resources, has been found associated with musculoskeletal injuries (Bongers et al., 1993). It has also been reported that the higher nurse-to-patient ratio, the fewer back pain and injuries occur among the nurses (Larese & Fiorito, 1994). It can be explained that lacking of staff will increase the physical workload since each nurse aide has to perform more manual handling work. Furthermore, the physical workload varies for each shift will vary depending on the staffing level for that given day. While the general rule is that night shifts are less demanding, this is not always the case. Sometimes night shifts may become difficult when the residents wander at night or in the early morning or have an emergency due to a fall of a patient. This situation will worsen when there is not enough of nursing resources to adequately account for all residents.

The studies that investigate the workload variation by shift work are limited. In a Japanese study by Wakui (2000), the workload of nursing aide for different shifts in a long-term care facility was examined. Among the six nursing aides observed, walking steps, heart rate, estimated energy expenditure, caring time and posture data were compared when they worked on day (7:30-16:30/9:00-16:00) and night (16:30-8:30) shifts. The results showed that most of the variables were similar between day and night shifts, such as, the percentage of working and recess time and the heart rate

variables were similar in each shift work. The time spent on working and recess was significantly longer on night shift than day shift because the night shift was longer than day shift, and the same trend was found for total walking steps and energy expenditure between the day and night shifts due to the longer duration of night shift. Nevertheless, when actual duration effects were eliminated, there was no difference on steps walked per hour between day and night shift but the work intensity (kal/kg/min) was significantly larger on day shift than night shift. The differences that were found between day and night shift on work intensity were probably also due to the longer night shift span since the same subjects were accustomed to both day and night shifts. While this study has provided some interesting results about the differences between day and night shifts, there is much to be understood about the nuances of shift work in the United States as well as more traditional shift lengths.

2.7 Variation in psychosocial workload

Nursing aides who work on the night shift typically have less psychosocial support than day shift workers. The nature of the night shift results in less staff working as well as less supervisor interaction, which results in different social support levels than during the day shift. Above all, nursing aides who work on the night shift are isolated from daytime social activities, taking less domestic duties, and have inadequate social time with family and friends due to working at the time usually when families spend time together (Fitzpatrick et al., 1999). In addition, some studies have shown that permanent evening shift workers suffer the most with regard to

family/spousal issues (Blau & Lunz, 1999; Scott, 2000). Similarly, working weekend shifts was also identified with social isolation.

Furthermore, mental stress level is different across the shifts. A study that assessed the shift work effects on work performance and job-related stress among nurses from day, afternoon, night and rotating shifts, has shown that both the nurses' job performance and their job-related stress were related to the type of shift they worked. It has indicated that rotating shift nurses experienced the most job-related stress, followed in turn by the afternoon, day, and night shift nurses (Coffey, Skipper, & Jung, 1988). The mental stress is at another level for nursing aides working in mental impaired patients units (Hamaideh, 2011; Lautizi, Laschinger, & Ravazzolo, 2009). In Novak et al.'s study (1996), the nursing aides who care for cognitively impaired patients on the day shift show significantly higher scores on specific stress measures than other shifts. In contrast, another study that performed in a United Kingdom hospital reported that the psychiatric night nurses had significant higher stress levels than the day shift nurses (Barton & Folkard, 1991).

Long-term care facilities are places with an elder population who often suffer from dementia and other mental impairment. The nursing staffs, especially nursing aides who make direct contact with these people are also facing different levels of mental stress when dealing with these individuals. The true effect of this stress has yet to be understood with respect to shift work and nursing aides.

2.8 Length of the Shift and Its Impact on Health

Among the different shift types, the 12-hour shift and 8-hour shift are most common with each type having potentially different intensities in workload. Basically, the 24-hours in a day can comprise three 8-hour shifts or two 12-hour shifts. Overall, the workers on 8-hour shifts and 12-hour shifts work *approximately* equal amount of time a week. For example, a full-time worker enrolled in 8-hour shifts works five days a week, which will be 40 hours a week of work period. A full-time 12-hour shift workers work three days a week, which is 36 hours a week. On some levels, although 12-hour shift workers have extended working hours a day than 8-hour shift workers, their workload is less than 8-hour shift workers. In addition, the 12-hour shift workers have longer time off than 8-hour shift workers. The similarity of these two shift systems is that no matter 12- or 8-hour shifts, nursing aides in a long-term care facility perform the same tasks. Nevertheless, other factors make the difference between these two types of shifts beyond the daily working hours.

The nursing aides are hourly paid with a low salary rate that makes them work more to earn more money for their living. Therefore, the term of "overtime" has been introduced in many studies and has been shown to be detrimental to health (Grosch, Caruso, Rosa, & Sauter, 2006). As mentioned in previous section, the shortage of health care personnel is a current trend and adds to the extended hours issue. Working overtime becomes one coping strategy in hospitals with a shortage of nurses (Rogers, Hwang, Scott, Aiken, & Dinges, 2004). Moreover, there are occasions that some nursing aides cannot come to work, for example, family emergency, or paid-time-off.

Other nursing aides pick up the hours and work additional hours beyond their normal shift. Twelve-hour shift workers usually work a couple of hours more to make 40-hour a week on other days than their three-day work duty. As a result, to examine the positive and negative effects of shift duration between 12-hour shift and 8-hour shift, one has to think about whether the focus is on extended working hours per day or working hours per week, or both. In present study, the relationship of shift work and musculoskeletal disorders was investigated.

Many researchers have pointed out the health and safety risks of extended working hours (e.g. 12-hour shifts) compared to traditional shift hours (e.g. 8-hours). However, the conclusions were not consistent among these studies on the health effects of the extended working hours (Knauth, 2007; Portela, Rotenberg, & Waissmann, 2004; L. Smith et al., 1998; Stone et al., 2006; Tucker, Smith, Macdonald, & Folkard, 1998). Research on health effects of shift work among health care workers mainly focus on cardiovascular, gastrointestinal and mental disorders (Costa, 1996; B. Karlsson et al., 2001; Scott, 2000; Tucker et al., 2012). Research on nursing shift work on musculoskeletal disorders is limited and has largely focused on shift work with less extent on shift duration (Horwitz & McCall, 2004; Myers et al., 2002).

The main reasons to consider 12-hour shift having adverse effects on health are longer exposure to physical demands, raised concerns of fatigue, and reduced recovery time between work days, which potentially results in increased musculoskeletal disorders (Rosa, Bonnet, & Cole, 1998; L. Smith et al., 1998; Waersted & Westgaard, 1991). However, a study done in Poland showed that nurses

working 12-hour shifts had lower physical workload (measured in kilocalories per hour) compared with those working 8-hour shifts, and better mood states as measured by fatigue, hostility, and friendliness (Makowiec-Dabrowska, Krawczyk-Adamus, Sprusinska, & Józwiak, 2000). On the other hand, in other studies, nurses of 12-hour shifts were shown to be exhausted and dissatisfied staff (Fitzpatrick et al., 1999; Gowell YM & Boverie PE, 1992; Todd, Robinson, & Reid, 1993). Ugrovics and associates (1990) reported that the last hour of the first 12-hour shift was associated with an increase in fatigue and drop in concentration. This conclusion was supported by Mills and associates (1983) that 12-hour shift was associated with increased fatigue over the shift. Chen and associates (2011) also found that even though the working pace was slow in the extended four hours for nurses on 12-hour shift, the heart rate and energy expenditure were not significantly lower than the 8-hour shift, which indicated adverse physiological effect may continuous act on their health. Twelve-hour shifts were also reported to have higher risk of accidents and injuries (Akerstedt, 1995; Folkard & Tucker, 2003). Conversely, the research done by Tucker *et al*. in a chemical plant found no difference between 8-hour shift and 12-hour shift on chronic fatigue (Tucker, Barton, & Folkard, 1996) but the 12-hour night shift workers had shorter sleep time than 8-hour shifts on their working days.

In an experimental field study ((Dahlgren, Kecklund, & Akerstedt, 2006), the effects of working 8- or 12-hour shifts in the absence of additional stress was determined for 16 white-collar workers who worked one week of 8-hours and one week of 12-hours. Actigraphs, rated sleepiness (Karolinska Sleepiness Scale) and

stress throughout the day were used. The results revealed that the longer working hours were associated with higher levels of exhaustion as well as increased the sleepiness with higher levels when approaching the end of the workweek. In addition, total sleep time was shorter in the 12-hour working week. However, no significant differences between ratings of stress and workload were found. It may indicate that a longitudinal study is needed to assess the effects of extended working hours and one week is too short to show the difference. Additionally, the workload of white-collar workers is much less than blue collar or nursing aides.

In addition, Gillespie and associates (Gillespie & Curzio, 1996) did a study to compare two medical wards that had been operating a 12-hour shift for more than one year with two medical wards that had continued with a conventional shift system over the same period and identified that most of the eight-hours shifts staff felt tired as a problem whereas this dropped to 20% for those working 12-hour shifts. The number of consecutive shifts as the reason for tiredness was reported by the majority of 8-hour shift workers. The results from this study showed that the 12-hour shifts produced more favorable responses from the staff since less fatigue was reported by those working the 12-hour shift.

Although the results from various studies showed different conclusions, majority of them indicated an unfavorable fatiguing effect of 12-hour shifts. Compared to the 8-hour shifts, 12-hour shifts make the working hours longer but the work days fewer, which provide longer periods of time off (e.g. longer time of leisure for the workers). This trade-off between extended exposures and additional time off for 12-hour shifts

may explain the inconsistency of the results. Most studies looking at the traditional 8-hour system exclude the impact of the long night shift (12-hour). For example, the Poland study that investigated physical workload among hospital nurses only compared the 12-hour day and 8-hour day shift nurses (Makowiec-Dabrowska et al., 2000). On the other hand, the inconsistency of these studies indicate that different occupations may have had different responses when comparing these two shift types due to varied workload, staffing levels, nature of the job tasks, and working environment.

Even though the effects of the 12-hour shifts are not conclusive, many hospitals and long-term care facilities have implemented 12-hour shifts for nurses. The decision to adopt the 12-hour shift needs to be based on two competing factors: additional burden of longer exposure to risk factors, which might be associated with fatigue, accidents, alertness (J. M. Harrington, 1994; Knauth, 2007), and benefit of other factors that related to improved care of patients and management (Stone et al., 2006; Tucker et al., 1996; Tucker et al., 1998). Additionally, the nursing staff's psychosocial and mental health is also essential for the physical wellbeing and better work performance. Therefore, the psychosocial and mental stress levels have also been inspected in various studies in which the 12-hour and 8-hour shifts were compared. In Smith and associates' review article (1998), they concluded that 12-hour shifts may be advantages in terms of lower stress levels, better physical and psychological wellbeing, improved durations and quality of off duty sleep as well as improvements in family relations. In this comprehensive systematic review, the inconsistent

conclusions for the 12- and 8-hour shifts were listed and the conclusion was based on the results of the majority of the studies. Another recommendations was that employees working a compressed work week (e.g. three days of 12-hour), are more motivated so that the detrimental effects are reduced (L. Smith et al., 1998).

There have been several research studies that have investigated shift work in nursing. First, in a recent nursing study, Hoffman et al. (2003) examined the variation in role stress and career satisfaction among hospital-based registered nurses by shift length in order to find out the effects of 12-hour shifts using a descriptive cross-sectional research design. Twelve-hour shifts were found more stressful than 8-hour shifts but no difference in job satisfaction or salary were found among the randomly selected nurses. Although the study sampled 500 nurses, the response rate was only 50% and with 42% usable. Second, a more recent study (McGettrick & O'Neill, 2006) compared 8- and 12-hour shifts among hospital nurses, in which the fifty-four nurses from three critical care areas completed a self-administered questionnaire. The results of the study indicated that 12-hour shifts were positive for patient care, job satisfaction, off duty and family life but negative for communication, fatigue and education (McGettrick & O'Neill, 2006). Third, a research article published recently by Stone et al. (2006)using large sample size compared the effects of 8- and 12-hour shifts on nurses, systems, and quality patient care outcomes. Surveys from different sources showed that nurses working on the 12-hour shifts were on average more satisfied with their jobs, experienced less emotional exhaustion and less likely to report missing shifts. In all, 12-hour shifts nurses were more satisfied.

In a recent literature review (Knauth, 2007) that included 105 articles examining extended working hours found that working long hours has multiple negative effects such as more accidents, reduced alertness, fatigue, and increased absenteeism. Moreover, after the long breaks from work, the 12-hour shift workers needed more time to communicate with management, which might make the relationship between employees and management worse and pose stress to the both parties. The positive effects of 12-hour shifts included more time for family, social life and domestic duties, and increased satisfaction with working hours. However, no definitive conclusion has been drawn from the review, especially the adverse health effects of extended working hours are not clear. From the literature that was reviewed, earlier studies demonstrated more favorable responses on 12-hour shifts while later studies more often found negative effects. Thus, results have been inconclusive at best. Further, the effects of the two shifts systems on mental stress and psychosocial factors have yet to be explored.

Patient care and performance were also areas that many studies investigated. Twelve-hour shifts were reported by Todd et al. (1989) to decrease the quality of patient care on the wards. In Smith and associates' review article (1998), few differences were found between 8- and 12-hour shifts with respect to impact on the patients. Bloodworth and associates (2001) found 12-hour shifts have potential benefit for patient care, as well as for staff job satisfaction and efficient management of the ward. Australian researchers (Campolo, Pugh, Thompson, & Wallace, 1998) investigated the implementation process involved in introducing 12-hour shifts in a

hospital intensive care unit in order to examine the effects of 12-hour shifts on staff retention, sick leave and in service education. The results indicated that working longer shifts did not have adverse effects on self-reported wellbeing and performance (Campolo et al., 1998). On the other hand, other researchers have specified competing opinions about 12-hour shift. For example, Fitzpatrick et al. (1999) observed nurses working longer shifts had less effective total performance scores (Fitzpatrick et al., 1999). The results indicated that nurses working on 12-hour shifts were more stressed than colleagues working 8-hour shifts. However, in Stone et al' study (2006), no differences were found in patient outcomes between 8- and 12-hour shifts workers. Although limited in scope and with methodology problems, these studies suggest that nurses may experience greater professional fulfillment unless the appropriate strategies are implemented.

2.9 Impact of Overtime

Overtime work means the work hours exceed scheduled work times. For example, overtime hours include working more than 8-hours or 12-hours in a given day or more than 40 hours in a specific week. This may include mandatory overtime and on-call activities, working on days designated as time off, staying on extended shifts, and working while sick to maintain staff complements (A. M. Trinkoff et al., 2006). Trinkoff and associates (2006) reported extended work schedules occurred with more than 25% of nurses worked more than 12-hours in a day and about 33% worked more than 40 hours a week. Further, more than a third of nurses worked six or more days in

a row at least once in the preceding six months. To go even further, almost one-quarter of nurses worked more than 50 hours per week which meant they were likely to work several days consecutively, without sufficient rest between shifts, and scheduled time off (A. Trinkoff, Geiger-Brown, Brady, Lipscomb, & Muntaner, 2006). In addition, the U.S. government statistics reported that 50% of all full-time nurses worked more than 42 hours per week for the year 2000 (Spratley et al., 2001).

Increased hours in a work environment with high physical and psychosocial demands can adversely affect nurses' health, because the extended work hours increase exposure to job demands especially increase exposure to physical demands, and therefore increased the risk of musculoskeletal disorders. Adverse schedules that increase risk of musculoskeletal disorders included working more than 13 hour/day, overtime, and other schedules such as working on weekend (A. M. Trinkoff et al., 2006). Moreover, increased hours besides scheduled work hours will limit rest and recovery time, and may result in increased MSDs (Jansen, Kant, van Amelsvoort, Nijhuis, & van den Brandt, 2003; Raediker, Janssen, Schomann, & Nachreiner, 2006; Spurgeon, Harrington, & Cooper, 1997). For example, Engels and associates (1996) found that back and leg symptoms were positively associated with hours worked per week by long-term care facility staff. Raediker et al. (2006) also reported that there was a significant correlation between the number of working hours per week and the frequencies of health complaints, which applied to both of musculoskeletal disorders and psychological complains. Compared to non-shift workers, shift workers showed

higher level of complains than non-shift workers although both of them there was a increase in complaints with the increase in working hours (Raediker et al., 2006).

When nurses work overtime, especially mandatory overtime, it will not only interfere with rest and recovery, but also affects their social lives and family responsibilities. Therefore, the psychosocial stress is exaggerated with such pressure that may create conflicts between job and family (Jacobs & Gerson, 2001). In Spurgeon et al.' review on health and safety problems associated with long working hours, mental health and psychological well-being were found significantly related to long working hours/week. It has been suggested that weekly hours that exceed fifty were associated with increased occupational stress (Spurgeon et al., 1997). Overtime working needs to be paid further attention in the modern society and within the shift work population. Due to the shortage of nursing recourses and cost efficiencies, overtime (specifically mandatory overtime) have increased in recent years. For nursing aides with low work payment, working more hours means earning more money which means eagerness to comply with these demands. In some conditions, nursing aides have to pick up the hours out of their work schedules to meet the requirement of patient-to-nurse ratio. It is evident that the overtime and extended work schedules may be harmful to health. When overtime is combined with shift work, the adverse responses to physical and psychosocial demands may be even higher (Fredriksson et al., 1999; Lipscomb et al., 2002; Waersted & Westgaard, 1991).

2.10 Current Study

The previous literature review has shown there are significant voids into understanding how nurses develop musculoskeletal disorders. First, the investigation on physical workload on shifts and between 8- and 12-hour shifts systems is limited. Most studies used subjective questionnaire to evaluate the physical workload and neglected attention to overtime exposures. Second, while rates of musculoskeletal disorders among nursing aides are high, there has been little understanding about the linkage between shift work and these outcomes. Third, nursing aides are at the lowest level of nursing professionals who perform most of the physical work and experiencing high mental, emotional and psychosocial workload. A comprehensive study is needed to document more thoroughly the complex stresses and demands on these individuals. Therefore, the current study was designed to investigate the comprehensive working environment, demographical differences, and complex physical and psychosocial factors among nursing aides working on shift works in long-term care facilities. In complex working environments such as long-term care facilities, how shift work is related to physical and psychosocial factors and the subsequent relationships to adverse outcomes is a must to give a perspective to the management and to reduce the injury rate.

The comprehensive research was designed to examine the physical workload applying direct observation method for the entire work shift as well as objective activity monitor for energy expenditure and physical activities. The psychosocial demands were analyzed by multiple well-validated questionnaires. In all, the current

study was to examine the difference of physical and psychosocial demands between shift work and musculoskeletal disorders among nursing aides.

Therefore, the *objective* of the proposed study was to quantify the physical and psychosocial demands among nurse assistants working on different shift work schedule and to determine any significant difference on musculoskeletal discomfort and injuries among nursing aides working on shift work in long-term care facilities as a function of shift type. In this study, the shift work in lone-term care facility was classified by its duration—8-hour or 12-hour and by time as day, evening and night for 8-hour shift or day and night for 12-hour shift. Majority of the nursing aides in long-term care facilities are fixed shift workers (e.g. they work on certain time and duration each time).

In this study, the following hypotheses were tested:

Hypothesis 1: There are significant differences among nursing aides for physical and psychosocial demands for different types of shifts including 12-hour shifts (day and night) and 8-hour shifts (morning, afternoon and night).

The Hypothesis 1 investigated whether the workplace demands placed on the nurses differ among different types of shifts including a comparison between night and day shifts as well as regular (8-hour) and extended shifts (12-hour). The study measured the physical (biomechanical) and psychosocial demands throughout the specific shift. The following specific aims were completed to test the hypothesis:

Specific Aim 1: Quantify the level of physical demands required for nurse aides

on day/night and morning/afternoon/night shifts using observational techniques.

Specific Aim 2: Quantify the level of psychosocial workplace stressors for nurse aides on day /night shifts, and morning/afternoon /night shifts utilizing self-reported questionnaires**.**

Hypothesis 2: There are significant difference on musculoskeletal discomfort and injuries among nursing aides working on shift work.

The Hypothesis 2 determined the relationship between the physical and psychosocial stressors that occur during the different shifts and the reported body discomfort. Furthermore, this hypothesis determined whether day shifts were more or less prone to discomfort and injuries than night shifts and whether the extended shifts were more or less prone to discomfort than regular 8-hour shifts. The following specific aims were completed to test the hypothesis:

Specific Aim 3: Assess the level of current discomfort in multiple body regions that will include: low back, hips, legs/feet, shoulders, hands/wrists, and neck.

Specific Aim 4: Identify injuries in the previous month in multiple body regions that will include: low back, hips, legs/feet, shoulders, hands/wrists, and neck.

CHAPTER 3

METHODS

3.1 Study Design

The study was a cross-sectional study. All the data were obtained at the same time (a single shift). The study was a field study where the researcher observed nursing aides in long-term care facilities performing their daily tasks throughout the whole shifts. The physical demands, psychosocial work demands, and musculoskeletal discomfort and injury was documented for nursing aides who worked on 8-hour and 12-hour shifts.

3.2 Subjects

Fifty-four female nursing aides who were certified and working work in one of the five long-term care facilities of similar size (80-100 beds). These facilities were geographically located in the Cincinnati metropolitan area, and represented typical long-term facilities found in the Midwest. The subjects were permanent employee without physical restriction and had worked on current shift with current employer for at least 3 months. Further, almost all of the nursing aides had previous experience as healthcare giver at another facility. The sample population worked one of the following shifts: 8-hour day shift (7:00 am to 3:00 pm), 8-hour evening shift (3:00 pm to 11:00 pm), 8-hour night shift (11:00 pm to 7:00 am), 12-hour day shift (7:00 am to 7:00 pm) as well as 12-hour night shift (7:00 pm to 7:00 am).

Originally, the plan was to observe 12 nursing aides on each of the shifts. However, sampling on the night shifts was slightly more difficult due to fewer nursing actually working these shifts and a greater tendency to be apprehensive about being a participant. Thus, slightly lower numbers were observed. As a result, 12 nursing aides were observed on 8-hr day and evening shifts while 10 nursing aides were observed on the 8-hr night and both 120hr shifts. The anthropometric measurements for the observed subjects are shown in Table 3.1. The demographic and work characteristics of the nursing aides are shown in Table 3.2.

3.3 Measurements

3.3.1 Direct Measurement of Physical Demands

Physical demands are typically assessed through the analysis of posture, movement, and peak or cumulative force (Burdorf & van der Beek, A J, 1999; Burdorf & van der Beek, 1999a; Burdorf & van der Beek, 1999b; Marras et al., 1999). In this study, the physical demands were classified by direct observation using checklist developed based on the Rapid Entire Body Assessment (REBA) (Hignett & McAtamney, 2000), which has been utilized by many researchers to evaluate postural demands in the workplace (Coyle, 2005; Gentzler & Stader, 2010; Jones & Kumar, 2010; Motamedzade, Ashuri, Golmohammadi, & Mahjub, 2011; Mukhopadhyay & Srivastava, 2010; Pascual & Naqvi, 2008; Torres & Viña, 2012). The REBA program used in the current study is designed by Janowitz and associates (Janowitz et al., 2006) for field study and has been validated in hospital settings. The program calculated an

upper body index that identified the postural demands on the arms, shoulders, hand and wrists, and neck and lower body index that identified the postural demands on the low back, upper leg, lower leg, and ankle/foot.

In addition, two nursing aides were randomly selected from each shift to be evaluated for physical activity on two working days. A small activity monitor (ActivPAL^{TM}) was attached to their thigh of the nursing aide. The use of a physical

Table 3.1: Summary of anthropometric measurements for the subjects who participated in the study as a function of shift (8-hr day, 8-hr evening, 8-hr night, 12-hr day, and 12-hr night).

Anthropometric Measurements	Shift									
	8-hr Day (12)		8-hr Evening (12)		8-hr Night (10)		12-hr Day (10)		12-hr Night (10)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	34.5	13.5	27.0	4.3	32.5	12.5	34.7	11.3	42.1	10.2
Standing Height (cm)	165.4	13.0	162.8	6.4	165.6	5.3	164.8	3.8	167.1	5.1
Body Weight (kg)	76.1	17.2	79.2	18.9	88.1	20.3	70.2	11.1	86.2	17.9
Waist Circumference (cm)	96.3	14.5	96.0	16.8	110.0	20.1	87.6	12.7	104.6	20.3
Hip Circumference (cm)	114.3	13.0	113.8	16.3	126.0	19.8	107.7	9.7	122.2	15.0
Shoulder Height (cm)	134.4	5.8	134.6	6.1	136.9	4.8	135.9	3.6	137.4	5.8
Elbow Height (cm)	104.1	3.8	104.4	6.1	106.2	4.3	104.9	3.8	107.2	3.6
Hip Height (cm)	85.9	4.6	87.1	4.1	90.4	6.1	88.1	3.6	90.2	3.3
Knee Height (cm)	46.5	3.6	46.5	4.3	47.5	4.6	46.0	2.5	46.2	3.3
Upper Arm Length (cm)	30.5	2.0	31.2	2.3	33.8	3.8	31.2	2.5	31.2	2.8
Lower Arm length (cm)	41.4	2.5	42.2	2.3	43.7	2.5	42.4	1.0	42.7	2.3
Torso Length (cm)	44.5	2.5	42.4	6.4	43.2	2.8	42.9	2.3	42.7	2.3
Shoulder Breadth (cm)	37.6	2.3	38.9	2.5	41.9	2.3	39.6	3.0	40.1	2.5
Iliac Breadth (cm)	38.9	4.1	39.1	4.1	40.4	5.6	36.8	3.8	38.9	3.6

Table 3.2: Demographic information and work characteristics of nursing aides for each of the shifts who completed all observations.

Shift		Total (54)	8-hr Day (12)	8-hr- Evening (12)	8-hr Night (10)	12-hr Day (10)	12-hr Night (10)
Age (years)		33.9(11.5)	34.5(13.5)	27.0(4.3)	32.5(12.5)	34.7(11.3)	42.1(10.2)
Race and Ethnicity	**Caucasian**	75.0%	58.3%	30.0%	20.0%	40.0%	40.0%
	African American	25.0%	33.3%	60.0%	70.0%	60.0%	60.0%
	Hispanic	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%
	Asian	0.0%	0.0%	10.0%	10.0%	0.0%	0.0%
Education	**Junior High**	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%
	High	83.3%	50.0%	60.0%	70.0%	50.0%	50.0%
	Junior College	8.3%	41.7%	20.0%	30.0%	40.0%	40.0%
	College	0.0%	0.0%	20.0%	0.0%	10.0%	10.0%
	Graduate	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%
Martial Status	**Single**	41.7%	75.0%	70.0%	50.0%	30.0%	30.0%
	Married/Partner	41.7%	16.7%	20.0%	40.0%	30.0%	30.0%
	Divorced/Separated	16.7%	8.3%	10.0%	10.0%	30.0%	30.0%
	Widowed	0.0%	0.0%	0.0%	0.0%	10.0%	10.0%
Have Children Less Than 3 Years Old (%)		25.9%	16.7%	58.3%	40.0%	10.0%	0.0%
Smoking (%)		42.6%	25.0%	75.0%	40.0%	30.0%	40.0%
Time with Current Employer (months)		45.5(57.3)	90.3(88.0)	15.2(14.3)	48.2(61.9)	25.9(23.6)	45.2(30.2)
Time at Current Job (months)		78.1(80.2)	90.7(97.5)	34.8(29.3)	101.1(113.1)	78.4(67.5)	91.9(66.1)
Full Time (%)		90.7%	91.7%	83.3%	90.0%	100.0%	90.0%
Time on Current Shift (months)		35.0(45.3)	56.2(68.9)	19.1(17.0)	43.8(53.4)	18.6(21.1)	36.2(35.8)
Typical Hours Worked/Week (hours)		42.4(9.2)	43.5(7.3)	37.5(7.4)	40.1(10.0)	46.7(11.3)	45.1(10.0)
Number of Overtime Hours/Week (hours)		25.9%	16.7%	58.3%	40.0%	10.0%	0.0%
Currently Working Another Job (%)		42.6%	25.0%	75.0%	40.0%	30.0%	40.0%

activity monitors to quantify sitting, standing, and walking has been found to be accurate and repeatable (Aminian & Hinckson, 2012; Dowd, Harrington, & Donnelly, 2012; Dowd, Harrington, Bourke, Nelson, & Donnelly, 2012; Grant, Ryan, Tigbe, & Granat, 2006; Grant, Dall, Mitchell, & Granat, 2008; D. M. Harrington, Welk, & Donnelly, 2011; Hinckson, Hopkins, Aminian, & Ross, 2013; Ryan, Grant, Tigbe, & Granat, 2006) and widely utilized for quantification (Dowd et al., 2012; Hart, Ainsworth, & Tudor-Locke, 2011; Hinckson et al., 2013). The monitor records the number of steps; time spent on sitting, standing and walking, and estimated the energy expenditure. One assumption made was that the exposures of the randomly selected nursing aides would be similar with the other nursing aides from the same facility and shift. While this was not ideal, it was a necessity given methodological limitations and limited equipment. The two day evaluation should provide a reasonable estimation for a typical shift.

Each participant was instructed to perform their daily routine and work assignment without interruption or modification. One researcher (He) observed their postures throughout the whole shift using a work sampling strategy. The observations were taken randomly with a 5-minute interval average. In other words, the sampling was done, on average, every 5 minutes but due to the random sampling, observations may have been between 1 and 20 minutes apart. Thus, there was at least one observation every 20 minutes. The random sampling strategy allowed for quantification of activities without bias due time of day and routine events. Random sampling captures a more representative sample than a regular interval sample such as

1 every 5 minutes.

3.3.2 Subjective Assessment of Psychosocial Demands

Psychosocial demands were measured through a single self-reported questionnaire (Psychosocial Survey) that assessed the social relationships and psychological demands of the work environment (Davis & Heaney, 2000; Karasek et al., 1998). The psychosocial survey was administered at the same time as symptom survey (discomfort and pain). The Psychosocial Survey combined three widely used and validated questionnaires: 1) National Institute for Occupational Health and Safety (NIOSH) Quality of Worklife questionnaire; 2) Karasek's Job Content Questionnaire (JCQ) (Karasek et al., 1998); and 3) part of the Dundee Stress State Questionnaire (DSSQ) that assesses mood and feelings (Matthews et al., 1999; Matthews et al., 2002).

3.3.2.1. Quality of Worklife Questionnaire

The Quality of Worklife Questionnaire was developed in 2000 by NIOSH to study national patterns of working conditions and health outcomes (Golden & Wiens-Tuers, 2005; Grosch et al., 2006). The QWL questionnaire has also been widely utilized to quantify work organization characteristics (Cherniack et al., 2011; Ikuma, Babski-Reeves, & Nussbaum, 2009; T. D. Smith & DeJoy, 2012). The portion of the questionnaire that was applied in the current study focused on the effects of work and job organization characteristics on nursing aides' health and well-being. Work life and work experience was examined through 76 questions dealing dealt with a wide

assortment of work organization issues and characteristics such as: hours of work, workload, worker autonomy, job security, job satisfaction, job stress, and worker well-being. The specific content includes: job level (41 items), work culture and climate (11 items), health outcomes (9 items), other outcomes (6 items), hours of work (6 items), work/family balance (4 items), relationships with supervision and co-workers (3 items), job benefits (1 item) and union (1 item). Five constructs are defined as following: ***Job Level*** questions assess a wide variety of job characteristics that include workload, job future, repetitive work, supervisory behavior, safety and health, stress management, and other measures. ***Culture and Climate*** questions assessed the safety climate, discrimination, harassment, respect, trust, and relationship with management. ***Health Outcomes*** look at physical health, mental health, injuries, and sleep problems. ***Other Outcomes*** that are measured in the assessment include job performance, satisfaction, and employees' intent to leave, job commitment, overtime, and flexibility. ***Work hours and balance*** measure hours of work, work/family split, supervision, benefits, and union participation (Centers for Disease Control and Prevention, 2006). The questionnaire measured the relationship between job and organizational characteristics and worker health and safety. Furthermore, questions on assaults by residents in the long-term care facilities were added to evaluate the frequency of the assaults and the frequency of the nursing aides reporting the assaults to the supervisor (Gates et al., 1999; Gates et al., 2003).

3.3.2.2. Job Content Questionnaire

This part of the questionnaire examined the individual's reaction to job demands,

job control levels, and personal moods and feelings. The bases of this part of the questionnaire were Karasek's Job Content Questionnaire (Karasek et al., 1998) and Matthews' Dundee Stress State Questionnaire (Matthews et al., 2002). These questions were concerned with various aspects of the work activities, especially job control and social relationships with the people that you interact with at work (e.g. supervisor and co-workers). In addition, a set of the questions investigated the mental concentration and job satisfaction. Other questions evaluated the moods and feelings of the nursing aides while they performed their job with summary scores being calculated for energetic arousal, tense arousal, hedonic tone and anger/frustration. Each set of the questions were measured with Likert scale with scores being summed to give an overall measure or index. Both the JCQ and DSSQ have been utilized by researchers to document the psychosocial demands and personality characteristics (B. Choi et al., 2012; J. Choi & Johantgen, 2012; Horner, Szaflarski, Jacobson et al., 2011; Horner, Szaflarski, Ying et al., 2011; M. I. Klein et al., 2012; Schernhammer et al., 2004; Seago & Faucett, 1997).

3.3.2.3 Subjective Assessment of Body Discomfort Symptoms

Body discomfort was documented current pain in the different body regions: low back, hips, legs/feet, shoulders, hands/wrists, and neck. The levels of pain were classified as none, mild, moderate and severe. This type of discomfort survey has been widely used by other researchers with good reliability (Abd Rahman, Aziz, & Yusuff, 2010; Kolstrup, 2012; Liao & Drury, 2000; Sauter, Schleifer, & Knutson, 1991). Further, the number of lost days for injuries was also asked on the questionnaire.

Injuries such as ruptured or herniated disk, carpal tunnel syndrome and other severe health outcomes that were diagnosed by physician were also asked about in the survey. Additional questions inquired about pain, injuries and lost day injuries (e.g. how many lost days) in the past 12 months in the same body regions. The subjects filled out the survey prior to the observation.

3.3.2.4. Demographics

One additional section of the questionnaire recorded demographic information such as general health status, job characteristics, work schedule, and personal information (e.g. age, gender, and race)

3.4 Apparatus

A handheld computer (personal digital assistant, PDA) was used in the study for observational data collection of the body postures. The REBA checklist (Hignett & McAtamney, 2000) was installed as a database on the PDA so that the researcher observed and recorded instantaneously. The PDA checklist was specially designed for field studies and has been previously utilized in hospital settings (Janowitz et al., 2006). In the current study, the researcher observed one nursing aide at a time for the whole shift by recording her postures of all the joints different joints (e.g. whole body joints such as neck, back, shoulders, elbows, wrists, knees as well as the weight she handled, sitting position etc. when performing each task) with the random 5-minute sampling technique (See Figure 3.1). The observed data was stored on the memory card and downloaded after the shift onto desktop computer for analysis.

A small activity monitor (activPAL™) was used to collect total body physical activity of selected nursing aides over the 2 full shifts. The monitor was attached to the mid-line of thigh of the subjects using wrap and surgical tape. The activPAL™ classified the individual's activity into periods of time spent sitting, standing and walking. This method of physical activity quantification has been validated by several researchers and used in different industrial settings (Alkhajah et al., 2012; Grant et al., 2006; Ryan et al., 2006; Ryan, Gray, Newton, & Granat, 2010; Ryde, Gilson, Suppini, & Brown, 2012). The monitor also estimated the energy expenditure based on the nursing aides' activity level throughout the shift. A sample of a subject's activity data is shown in Figure 3.2.

3.5 Procedure

Prior to the study, the researcher met with the nursing aides in the long-term care facility where the study objectives, procedures, and methods were explained to the potential subjects. All of the nursing aides decided to participate in the study read and signed a consent form, approved by the University of Cincinnati's Institutional Review board (protocol number: 06-02-09-06). Next, the observation dates were scheduled according to the subjects' working schedule. The questionnaires were given to the subjects within one week before the observation then collected by the researcher on the day of observation.

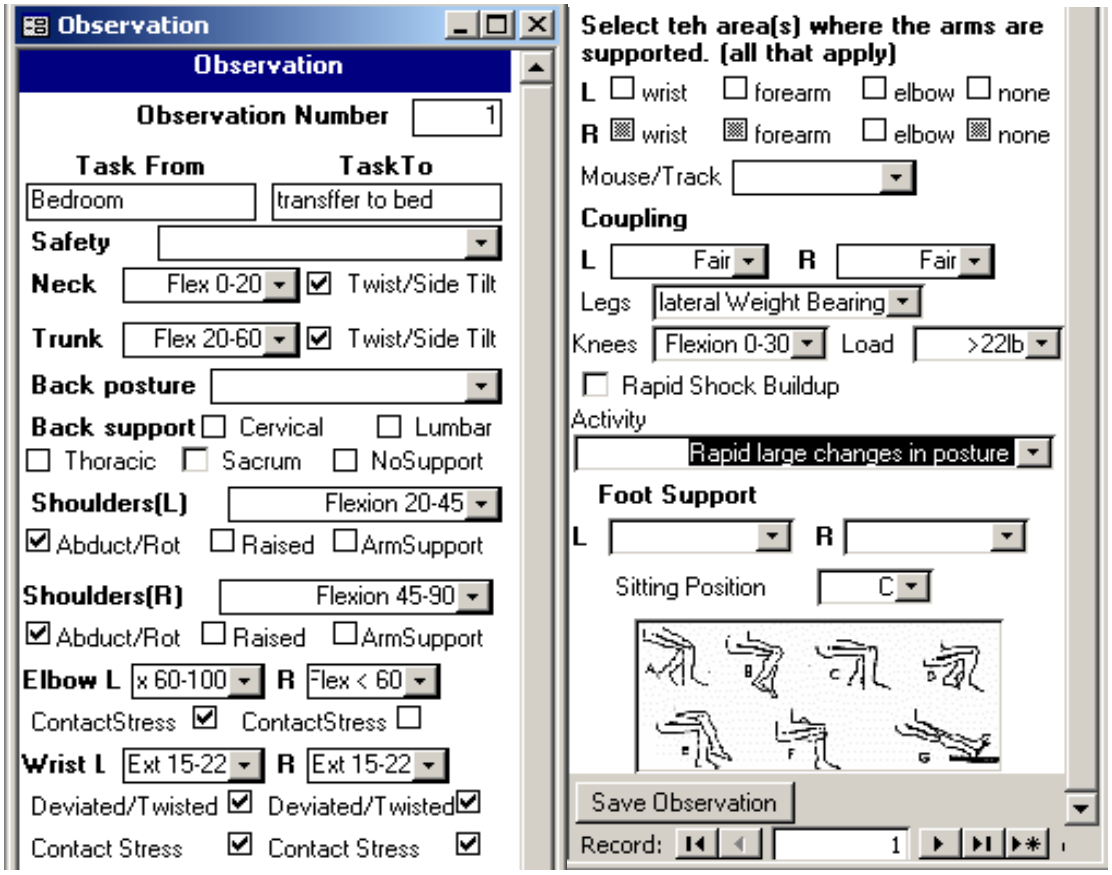

Figure 3.1: Screen caption of the PDA REBA checklist designed for field study.

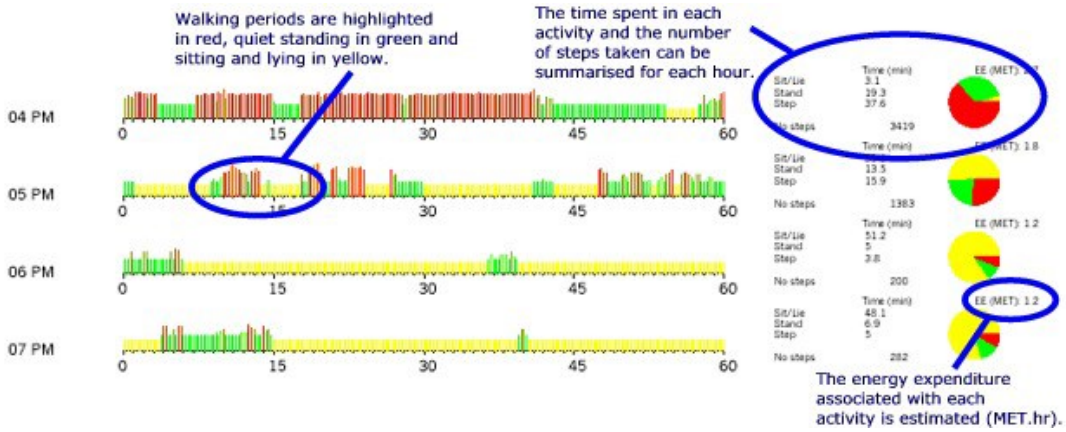

Figure 3.2: An example of the output data from the ActivPAL™ showing hourly readings and an overall summary in pie graph.

On the day of observation, researchers observed the nursing aides while they performed their daily work activities. The observations were recorded on a PDA checklist and included 1) documentation of body postures and 2) recording of the tasks being performed. A random sampling strategy that recorded observations on average of 5 minutes was utilized across the entire shift. The researcher made the observation at a distance within 10 feet. When a nursing aide entered a room, verbal consent was confirmed by the residents, indicating whether they were willing to allow the researcher to observe the nurse in their room. The nursing aides would inform the residents about the study and then ask if they would mind the researcher standing by them. The researcher would not come into the residents' room if the residents did not consent, which happened very rarely.

For the nursing aides that were randomly selected to have physical activity monitored, an activity monitor (ActivPAL™) was attached to the subject's thigh at the start of the shift and worn for the entire shift. The total walking steps, energy expenditure and time spent on walking, standing and sitting for the shift were recorded. The monitor was positioned on the thigh at the start of the shift and monitored for slippage throughout the shift.

Finally, anthropometric measurements were completed by the researcher (He) at the end of the shift. The measurements included body weight, standing height, waist circumference, hip circumference, shoulder height, elbow height, hip height, knee height, upper arm length, lower arm length, torso length, shoulder breadth, and iliac breadth. At the end of the data collection, the participants were paid $50.

3.6 Data and Statistical Analyses

3.6.1 Physical Demands

In order to eliminate the duration effects, the data collected by ActivPAL was calculated by an hourly rate or percentage of the shift duration. The data from the REBA checklist were transferred from the PDA to a desktop computer into an excel data sheet. Each posture category was coded and set-up as an event. Hourly frequencies were then calculated by summing up the events for specific postures. In addition, the two ergonomic indices for the upper (UB) and lower body (LB) were computed from the events. A one-way analysis of variance (ANOVA) was used to assess whether statistical differences exist on the posture scores with post hoc testing in the form of studentized Tukey test determined the source of the differences.

3.6.2 Psychosocial demands

The answers to the questions about psychosocial demands were input into excel data sheets. The items in the questionnaires were either rated on 4- or 5-point Likert scale (e.g., often, sometimes, rarely, never etc.) with a few "yes" or "no" questions. The analyses of quality of worklife module of NIOSH used two statistical analyses: 1) questions with 4- or 5-point Likert scales were analyzed with a Kruskal-Wallis Test and 2) dichotomized answers were analyzed with a fisher exact test. The questions on entire shift work environment and individual feelings were calculated into the specific scores and analyzed with one-way ANOVA.

3.6.3 Body Discomfort Symptom Survey

The severity to the discomfort was represented by the 4-point Likert scale: no

pain, mild, moderate and severe. The response was further simplified by dichotomizing into “low level pain” or “high level pain” for Pain Level and “no pain” or “Pain” for frequency of the pain in past year and current muscle pain. Fisher exact test was used to test the difference of the response for each shift.

3.6.4 Hypotheses Testing

The following provides a summary of how each hypothesis was tested. A summary of the independent variables, dependent variables, and statistical analyses are shown in Table 3.3.

3.6.4.1 Hypothesis 1

Hypothesis 1 was to compare the physical and psychosocial demands between the different shifts. The independent variables were shift parameters: shift schedule and shift duration (8-hr day, 8-hr evening, 8-hr night, 12-hr day, and 12-hr night). To quantify the level of physical demands required for nurses on day/night and morning/afternoon/night shifts, the direct observation data obtained from the entire shift were used (specific aim 1). The dependent variables for physical demands were postures data: (UB and LB indices and frequency of different joints angles) and physical activity level (total steps walked, energy expenditure, and time spent on walking, standing and sitting). The dependent variables for psychosocial workplace demands were assessed with a comprehensive questionnaire (specific aim 2) and included social relationships, organizational characteristics, personal mood and feeling, and psychosocial working conditions.

3.6.4.2 Hypothesis 2

To assess the relationship between shift work and discomfort, level of current discomfort in multiple body regions were utilized as the dependent variables, which included: low back, hips, legs/feet, shoulders, hands/wrists, and neck. These data were obtained from the symptom survey. The independent variable was again the shift of the nursing aides.

Table 3.3: Summary of the dependent variables, measurements, and statistical analysis methods

Dependent Variable Category	Measurement or Instrument	Dependent Variables	Statistic Analysis
Physical Demands	ActivPAL	Energy Expenditure	Descriptive Analysis
		Time spent on Standing, Sitting, Walking	
		Total Steps/Hour	
	Rapid Entire Body Assessment (REBA Checklist)	Upper Body and Lower Body REBA Score	One-Way ANOVA
		Hourly Awkward Posture Frequencies	Kruskal-Wallis Test
Psychosocial Demands	Quality of Worklife Questionnaire	Job Level, Culture/Climate, Health Outcome, Other Outcomes, Work and Balance	Kruskal-Wallis Test
			Fisher Exact Test
	Dundee State Stress Questionnaire	Motivation, Energetic Arousal, Tense Arousal, Hedonic Tone, Anger/Frustration	One-Way ANOVA
	Job Content Questionnaire	Job Satisfaction, Job Control, Mental Concentration, Social Relationship with Co-workers, Supervisors, and family	
Body Discomfort	Body Discomfort Survey	Current Pain Levels, Pain, Injuries, and Lost Days n the Past Year for the Following Body Regions: Low Back, Hips, Legs/Feet, Shoulders, Hands/Wrists, and Neck	Fisher Exact Test
			KrusKal-Wallis Test

CHAPTER 4

RESULTS

4.1 Introduction

Shift work has many complex factors that affect musculoskeletal symptoms. Physical and psychosocial factors appeared to be associated with the shift work in which nursing aides worked. In other words, the physical and psychosocial demands were found to be different for the different shifts. The physical demands were found to be significantly associated with routine awkward postures and patient lifting as well as walking and standing. In addition, the psychosocial factors were also elevated such as lack of social support and increased stress. These demands appeared to adversely impact the well-being of the nursing aides as musculoskeletal pain was elevated at the end of the shift. The following sections summarize the results.

4.2 Physical Demand

4.2.1 Physical Activity

The results from ActivPAL on physical activities among the nursing aides (See Table 4.1) indicated that day shift had more energy consumption than night shift with the 8-hour day shift having the highest physical workload. The nursing aides on the 8-hour day shift were on their feet more than 90% of the time. In addition, 12-hour night shift had the lowest energy expenditure due to the least amount of walking, but had the highest prolonged standing.

Table 4.1: Physical activity level by shift on energy expenditure, total steps and time spent on standing, sitting and walking.

	Shift	Measurement
Energy Expenditure (MET)	8-hr day	2.07
	8-hr evening	1.94
	8-hr night	1.76
	12-hr day	1.84
	12-hr night	1.62
Total Steps Taken (steps/hr)	8-hr day	1704
	8-hr evening	1356
	8-hr night	1101
	12-hr day	1388
	12-hr night	763
Total Time Standing (% of shift)	8-hr day	41.7%
	8-hr evening	45.1%
	8-hr night	34.6%
	12-hr day	42.4%
	12-hr night	45.8%
Total Time Sitting (% of shift)	8-hr day	9.8%
	8-hr evening	17.6%
	8-hr night	34.6%
	12-hr day	21.6%
	12-hr night	31.3%
Total Time Walking (% of shift)	8-hr day	48.5%
	8-hr evening	37.3%
	8-hr night	30.8%
	12-hr day	36.0%
	12-hr night	23.1%

4.2.2 Body posture

The REBA checklist results indicated that there was significant difference ($p<0.05$) for upper extremities among the shift workers. The REBA score for upper and lower extremities was calculated with postures of both body sides and estimated forces exerted. The awkward posture appeared to be the driving factor for the higher score. As seen in Figure 4.1, the upper body score for nurses working the 8-hour evening

shift was 37.4% greater than 8-hour night shift and 24.8% greater than 12-hour night shift. Also, the 8-hour evening shift was 15.9% greater than 8-hour day shift and 3.8% greater than 12-hour day shift, which had the lowest upper extremity score among the shifts. However, the lower body score, which included trunk and lower extremities, showed no significant difference among the participants but the trend was the 8-hour evening shift having the highest score.

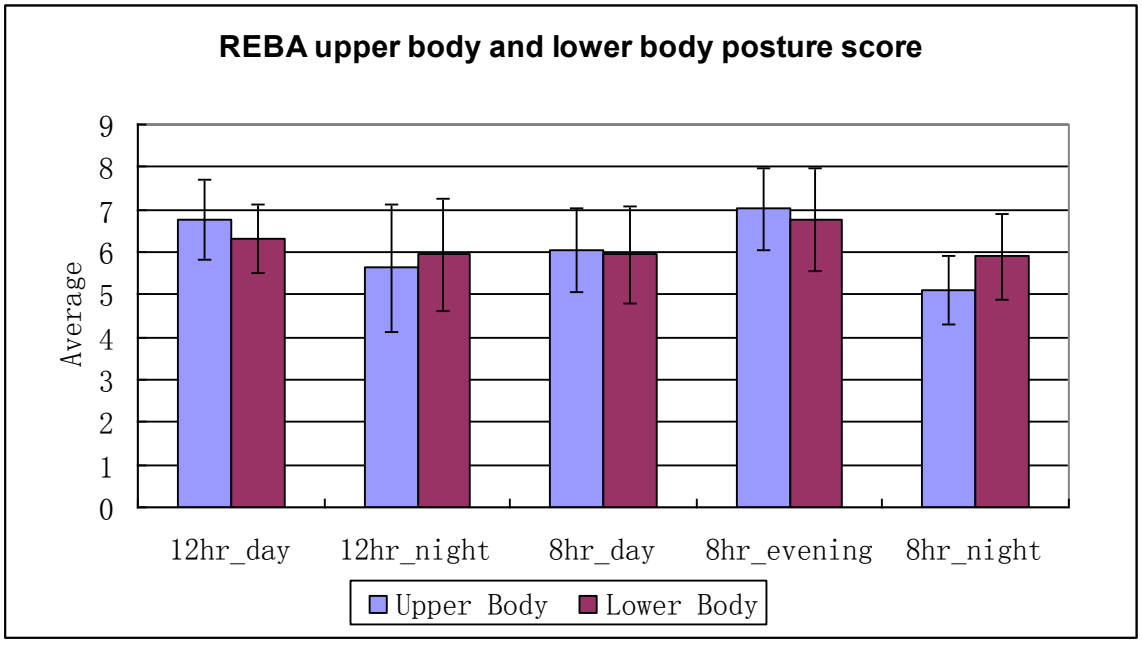

Figure 4.1: Average REBA score for upper and lower body posture scores of nursing aides for each of the shifts (REBA scores range from 1—low risk to 12—high risk).

The body postures had multiple significant differences ($P<0.05$) as a function of shift category (as shown in table 4.2). It was found that the knee angles were oftentimes in postures between 0^o and 30^o for the nurses in the 8-hour day shift (8.86 counts/hour), which was 66.2% and 31.0% more than 8-evening and 8-night shifts also was 113.0% and 183.1% more than 12-day and 12-night shifts, respectively. Day

shift knee angles were driven by nursing personnel working on 8- and 12-hour day shifts having more time spent on walking and standing. The night shifts of 8- and 12-hour shifts had the higher counts/hour for knee angle ranges between 30^{o} to 60^{o}. The results for knee posture indicated that aides on 8- and 12-hour night shifts had more predominantly between 30^{o} to 60^{o}, which indicated that sitting position was dominant for the night work.

Both elbow angles (right and left) for 8-hour day shift mostly fell into 60^{o} to 100^{o} flexion. There was no significant difference among 8-hour evening (5.42 times/hr); 8-hour night (5.90 times/hr) and 12-hour night shifts (5.01 times/hr) for left elbow flexion between 60^{o} to 100^{o}. However, there was significant difference among 8-hour day shift and other shifts (highest counts/hour for 8-hour day), followed by 8-hour night and evening shifts; 12-hour day shift was the last, which was 37% less than 8-hour day shift. Right elbow flexion of 60^{o} to 100^{o} had shown the similar trend as left elbow. The 8-hour day shift had more flexion activity within 20 degrees than other shifts and the 8-hour night ranked second for both left and right shoulder. Although left shoulder had less rate of joint activity than right shoulder, 8-hour night shift had more shoulder flexion activity between 45^{o} to 90^{o} than other shifts. The 12-hour day and night shifts had similar observations as 8-hour night shifts on elbows and wrists.

The night shift (8-hour and 12-hour) had more time in the above 100^{o} flexion for left elbow angle. Most of the time, the left and right shoulders fell into 0-20 degree flexion for nursing aides on 8-hour day shift. However, nursing aides working on night shifts had more times with 45^{o} to 90^{o} flexion for both shoulders, especially

8-hour night shift. For example, the 8-hour night shift was nearly 2.5 times the number of poor shoulder flexion postures than the 8-hour day shift and 1.8 times of 8-hour evening shift; as well as 1.5 and 1.3 times of the 12-hour day and night shifts, respectively.

Table 4.2: Average counts/hour of different joint angles range by shifts

Joint	Angles	8-day	8-evening	8-night	12-day	12-night	P Value
Knees	flex 0-30	8.86	5.33	2.16	4.16	3.13	P<0.001
Knees	flex 30-60	0.92	1.32	3.08	0.87	2.63	P<0.001
Legs	walk	2.57	2.09	1.09	2.28	0.92	P<0.001
Legs	sit	1.00	1.53	3.84	1.21	3.28	P<0.001
LElbow	flex 60-100	7.68	5.42	5.90	4.84	5.01	0.033
LElbow	flex > 100	1.82	2.82	3.53	2.96	3.15	0.041
LShoulder	flex 0-20	7.08	4.59	5.73	5.01	4.96	0.004
LShoulder	flex 45-90	0.86	1.60	2.00	1.32	1.73	0.008
LWrist	flex/ext 0-15	8.04	5.24	7.36	5.18	5.86	0.001
LWrist	flex 15-22	2.35	3.72	2.85	3.78	3.33	0.018
RElbow	flex 60-100	7.89	5.68	5.58	4.76	5.14	0.019
RShoulder	flex 0-20	6.93	4.98	5.46	4.13	4.57	0.001
RShoulder	ext 0-20	0.69	0.26	0.30	0.33	0.24	0.036
RShoulder	flex 45-90	1.01	1.36	2.40	1.62	1.85	0.004
RWrist	flex/ext 0-15	8.26	5.69	6.84	5.00	5.75	0.001
RWrist	flex 15-22	2.49	3.31	3.39	4.25	3.78	0.027
Trunk	upright	4.01	2.91	1.76	2.73	1.68	P<0.001
Trunk	flex 0-20	2.65	2.38	1.50	2.47	1.59	0.008
Trunk	ext 0-20	0.20	0.125	0.125	0.08	0.08	0.045
Trunk	sitting	1.00	1.54	3.84	1.11	3.27	P<0.001

When comparing wrist postures, 8-hour day shift fell into 0^o to 15^o flexion/extension often and had significantly greater counts ($P<0.001$) in that category than the other shifts with 45.2% higher than 8-hour evening shift; 20.8% more than 8-hour night shift; 65.2% and 43.7% more than 12-hour day and night shift, respectively. In 15^o to 22^o category, the wrist posture of 12-hour day shift ranked highest, which was 70.7% more than 8-hour day shift; 28.4% more than 8-hour evening shift; 25.3% more than 8-hour night shift and 12.4% more than 12-hour night shift ($P<0.03$).

Trunk postures further support more walking and standing for the day shift and more sitting for the night shift. Relatively, poor trunk postures were observed infrequent (less than 3 times per hour), indicating good body mechanics while performing their tasks. The trunk position showed 8-hour day shift workers performed tasks with trunk upright more than other shifts as well as trunk extension and flexion. The difference found was due to the 8-hour and 12-hour night shifts had less trunk flexion and extension around 0^o to 20^o. In addition, 8- and 12-hour night shifts nursing aides sat more than day workers.

No difference was found for some very severe posture such as trunk flexion above 60^o. However, when combined with the severe posture in the categories for each joints (as in Table 4.3), shift differences were identified for neck, elbows and wrists. The 8-hour day shift had a greater rate of awkward postures for the neck, which was higher than 8-hour evening shift by 60.9%; 8-hour night shift by 77.9%; and 12-hour day and night shifts by 79.6% and 25.0%, respectively. In addition,

8-hour night shift had more severe postures for shoulders and elbows. Compared with other shifts, 8-hour night shift had more elbow flexion less than 60^{o}, and extension more than 100^{o} on right side than 8-hour day and evening shifts as well as the 12-hour day and night shifts 70.4%, 38.0% 12.1% and 10.9%, respectively. Similarly, for the right shoulder flexion more than 45^{o} and extension more than 20^{o}, the 8-hour night shift had a higher rate than the 8-hour day and evening, as well as 12-hour day and night shifts: 122.7%, 61.0%, 41.1%, and 33.8%, respectively. The 12-hour day and night shifts had similar to the 8-hour night shifts on elbows and wrists. In comparison, the 8-hour day shift was the least one with awkward postures. The severe postures for trunk showed no significant difference. However, the trend had shown that 8-hour night shift was the worst among the shifts.

Table 4.3: Average counts/hour of different joint angles range for severe posture by shifts

Joints	Angles	8-day	8-evening	8-night	12-day	12-night	P Value
Neck	flex>20,ext	1.85	1.15	1.04	1.03	1.48	0.023
LShoulder	flex>45,ext>20	1.22	2.15	2.39	1.58	2.03	0.025
LWrist	flex15-22,flex/ext >22	2.85	4.23	3.49	4.19	3.72	0.023
RElbow	flex<60,ext>100	3.11	3.84	5.30	4.73	4.78	0.028
RShoulder	flex>45,ext>20	1.28	1.77	2.85	2.02	2.13	0.022
RWrist	flex15-22,flex/ext >22	2.71	3.80	3.90	4.17	4.13	0.018
Trunk	flex>60 ext>20	1.29	1.63	2.09	1.51	1.48	0.520*

4.3 Psychosocial Demands

4.3.1 Quality of Worklife Questionnaire

For the response on the Quality of Worklife Questionnaire, significant differences were found for concerns about family demands interference and relationship with supervisor and coworkers among the nursing aides on different shifts. The response on "how often do the demands of your family interfere with your work on the job" indicated that 20% of 8-hour night shift nurse aides felt the family demands often interfere with their work on the job and 30% felt it happened sometimes; 46.2% of 8-hour evening shift, 38.9% of 8-hour day shift and 10% of 12-hour day shift felt the interference happened sometimes (Figure 4.2). Among the nursing aides who answered "whether it is true that my supervisor is concerned about the welfare of those under him or her", 40% of 8-hour night shift didn't consider that was true as well as 33% of 8-hour day shift and 30% 12-hour night shift had showed the same response (Figure 4.3). About 23% of the nursing aides on 8-hour evening shift thought they could not rely on the people they worked with when they need help. Approximately 20% of 12-hour day shift and 8-hour night shift had negative impressions of their co-workers. Most of 12-hour night and 8-hour day shifts indicated that it was somewhat true or very true that the people they worked could be relied on when they need help (Figure 4.4). Two marginal significant differences were found that related with coworker and supervisor relationships (Figure 4.5 and 4.6). The response of nursing aides feeling of coworkers taking personal interest in them showed a staircase trend with 40% of 12-hour day shift, 30% of 12-hour night shift,

22% of 8-hour day shift, 7.7% of 8-hour evening shift and 0% of 8-hour night shift felt it was very true. When asked "are you likely to be praised by your supervisor or employer when your job was well done", 40% of 12-hour day shift gave positive response, and the rest of the shifts all had about 10% having positive responses.

The rest of the questions had dichotomized answers resulted in only one other significant shift effect: "assaults from the residents" (P<0.02). The self-reported residents' assaulting behavior by shifts indicated that 8-hour day shift nursing aides experienced more assaults from residents than other shifts (56% of them reported adverse verbal or physical event). In contrast, only 30% of nursing aides working on 12-hour night shift experienced residents' assault. On the other hand, 70% of nursing aides on 12-hour night shift reported no assault experience. The rest of the shifts had almost even response rate: 50% to 50%.

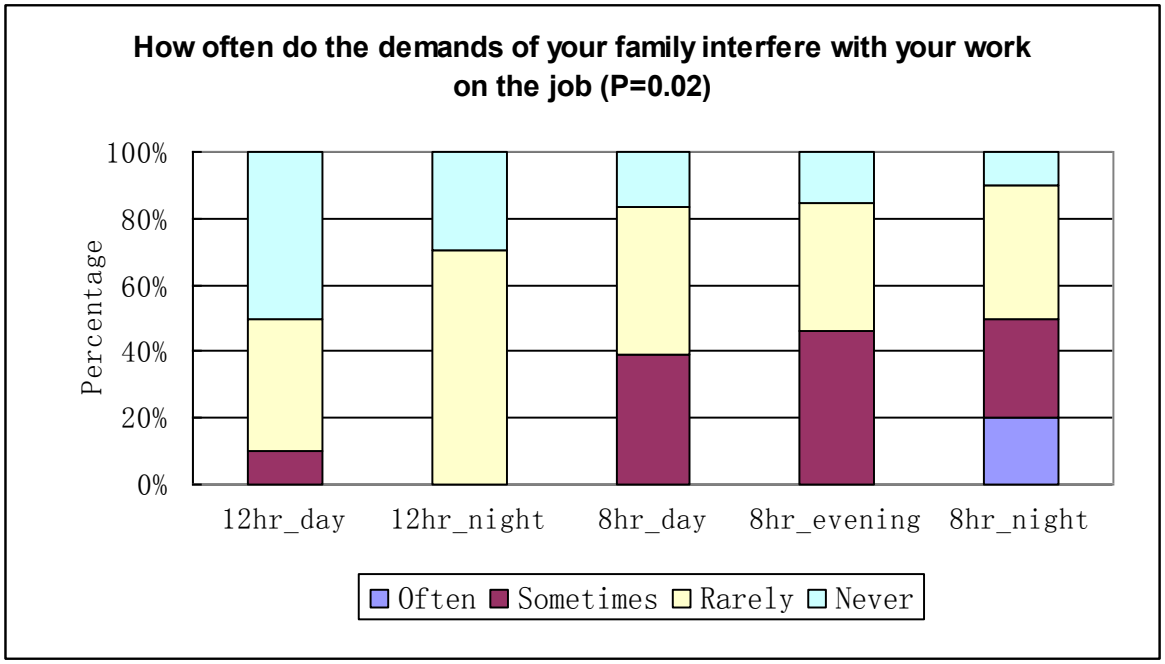

Figure 4.2: Percentage of nursing aides who felt family demands interfere with work for each of the shifts.

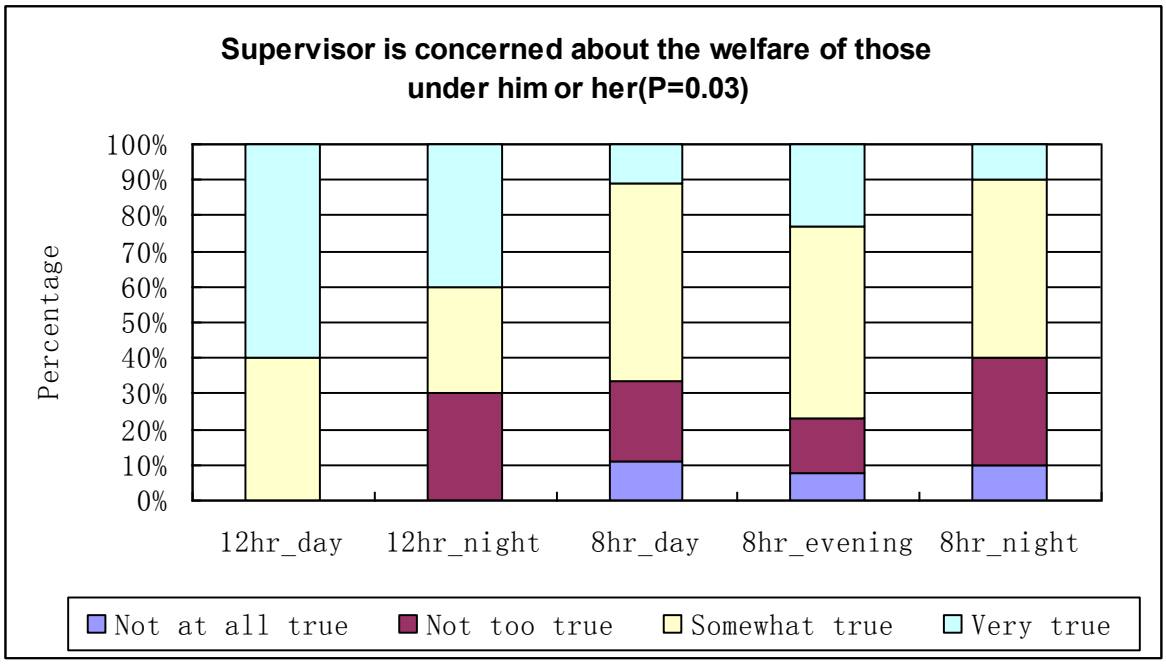

Figure 4.3: Percentage of nursing aides who had concern about whether supervisor cared about welfare of those under him or her for each of shifts.

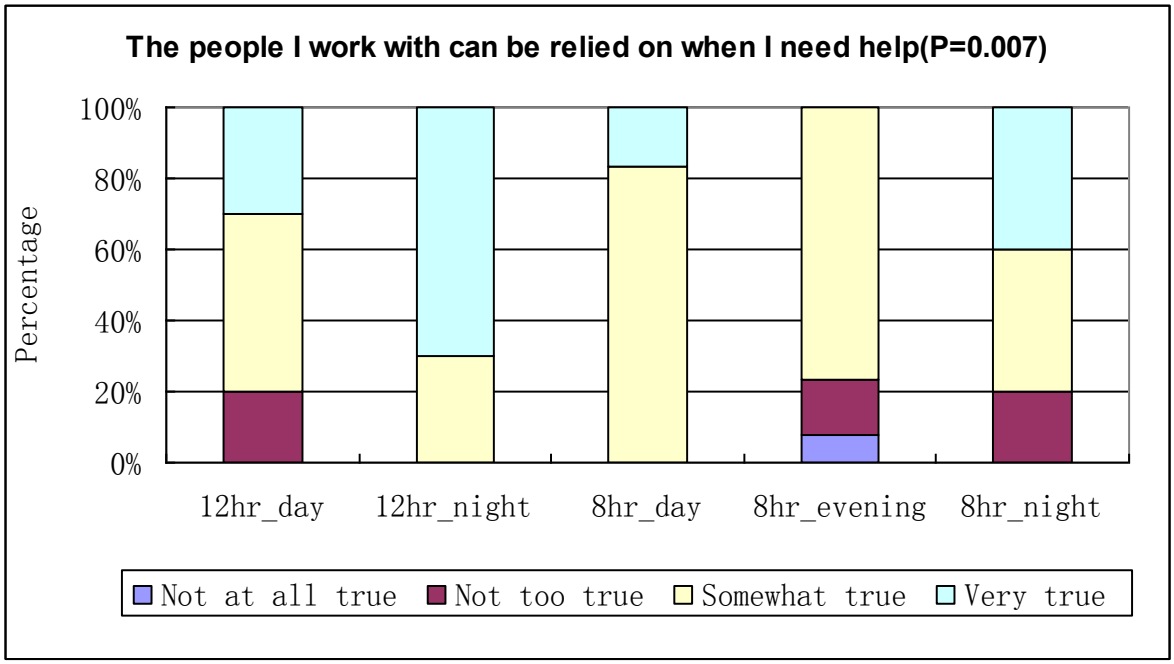

Figure 4.4: Percentage of nursing aides who felt their co-workers were not able to be relied upon when they needed help for each of the shifts.

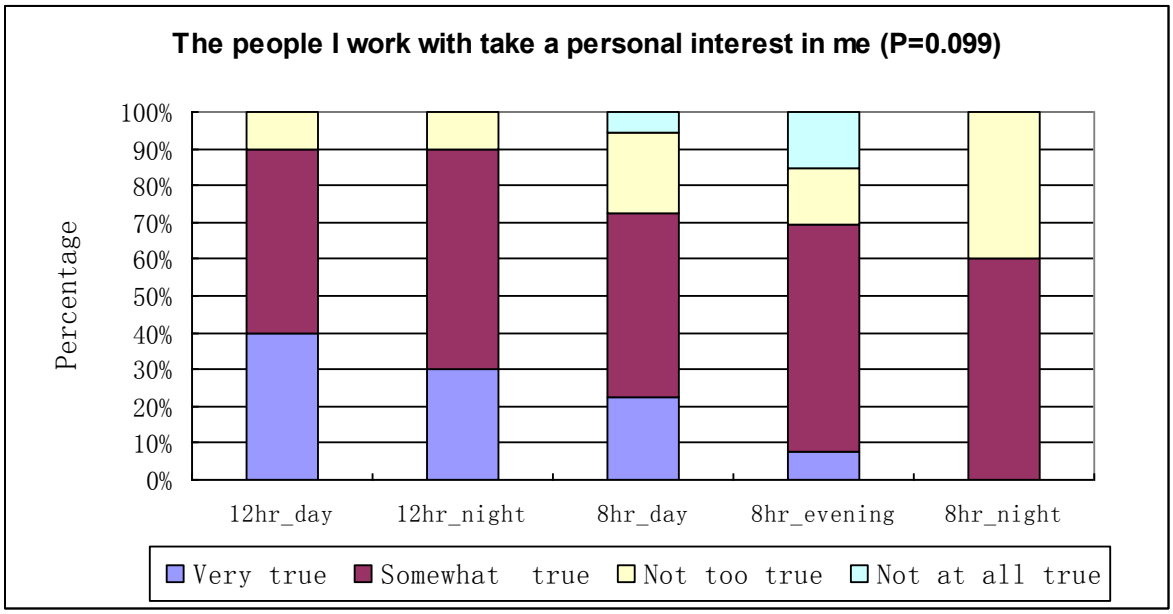

Figure 4.5: Percentage of nursing aides who felt their co-worker did not take a personal interest in them for each of the shifts.

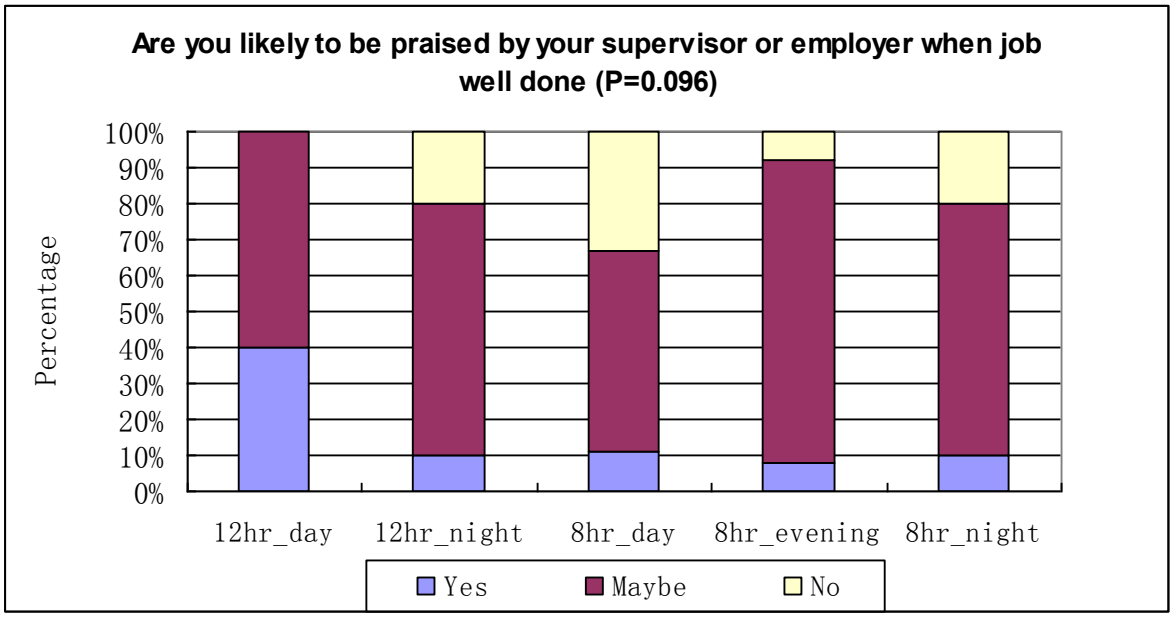

Figure 4.6: Percentage of nursing aides who felt not likely to be praised by their supervisor or employer when their job was well done for each of the shifts.

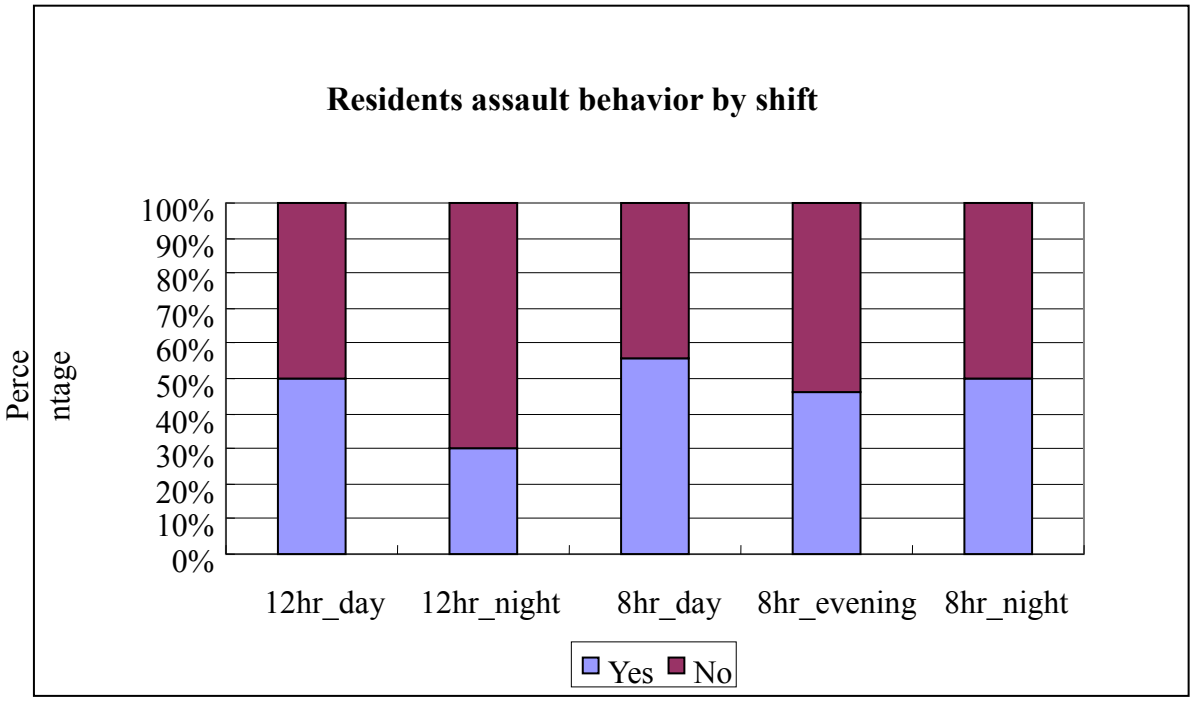

Figure 4.7: Percentage responses reported by nursing aides on residents' assault behavior for each of the shifts.

4.3.2 Shift Work Questionnaires

The answers about the nursing aides' responses to the shift work and other psychosocial demands had interesting trends with several significant differences found across the shifts (see Figure 4.8 to 4.20). The social relationships with coworkers and supervisors were marginally significant with 12-hour shift having better relationships with coworker and supervisor than 8-hour shift. Nursing aides from 8-hour evening shift were not satisfied with the social relationship with coworker or supervisor. The job satisfaction among the nursing aides across the shifts was not significant (P=0.3), but the result indicated that day shifts, including 12-hour and 8-hour were slightly more satisfied with the job than other shifts.

For the social relationship with coworkers, the nursing aides on 12-hour day shift reported to have the best relationship with their coworkers. The average score of the

response was 27.0% higher than the lowest score, which was 8-evening shift; 21.9% higher than 8-hour day shift; 20.6% higher than 8-hour night shift, respectively. Between 12-hour shifts, 12-hour day shift only 3.2% higher than 12-hour night shift. In addition, the average score for 8-hour evening shift on social relationship with supervisor, which was 9.62 (SD=2.10) was the lowest compared with other shift. It was 25.5% lower than the highest score 12.9 (SD=2.47), the 12-hour day shift.

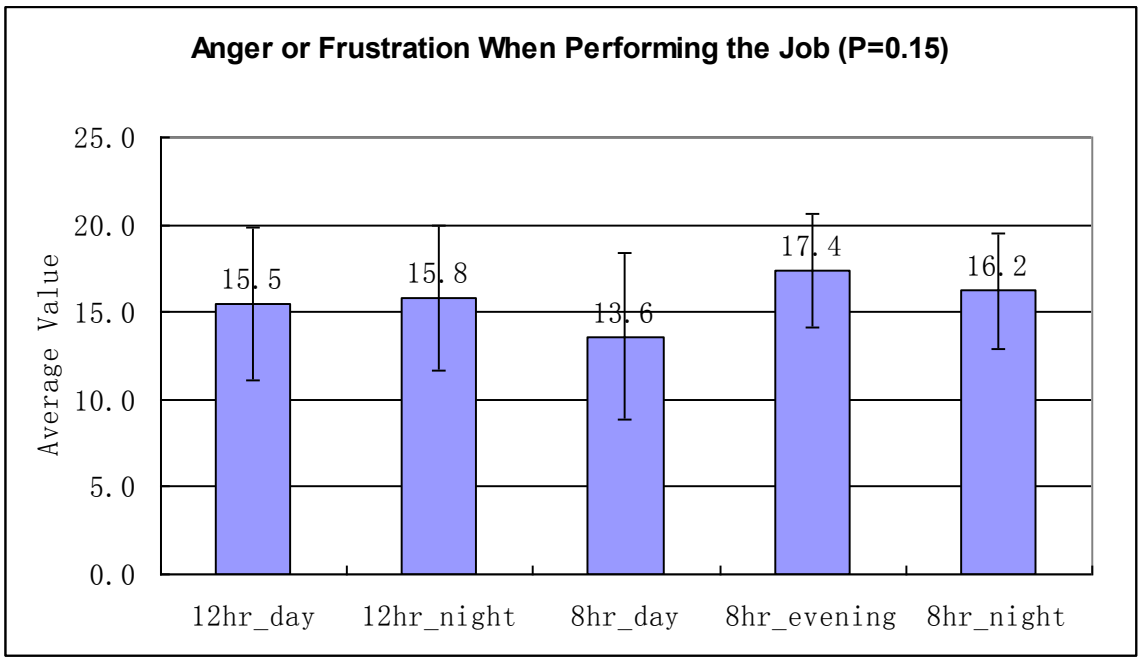

Figure 4.8: Average value of the feeling anger or frustration when performing the job for nursing aides on each of the shifts.

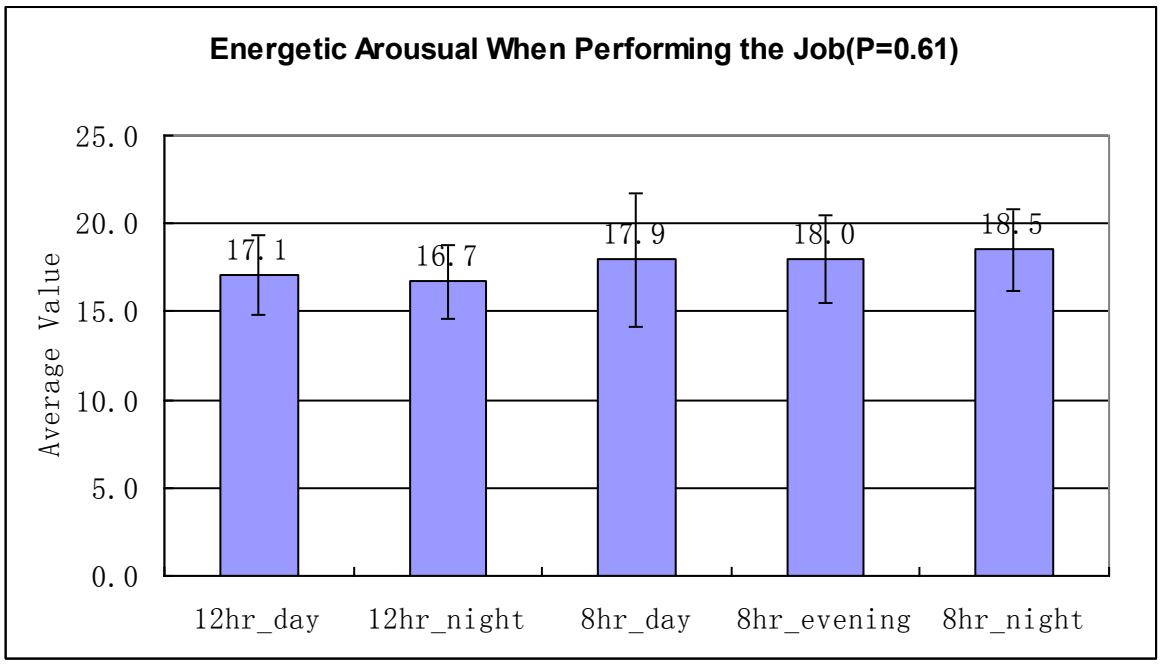

Figure 4.9: Average score of nursing aides feeling energetic arousal when performing the job for each of the shifts.

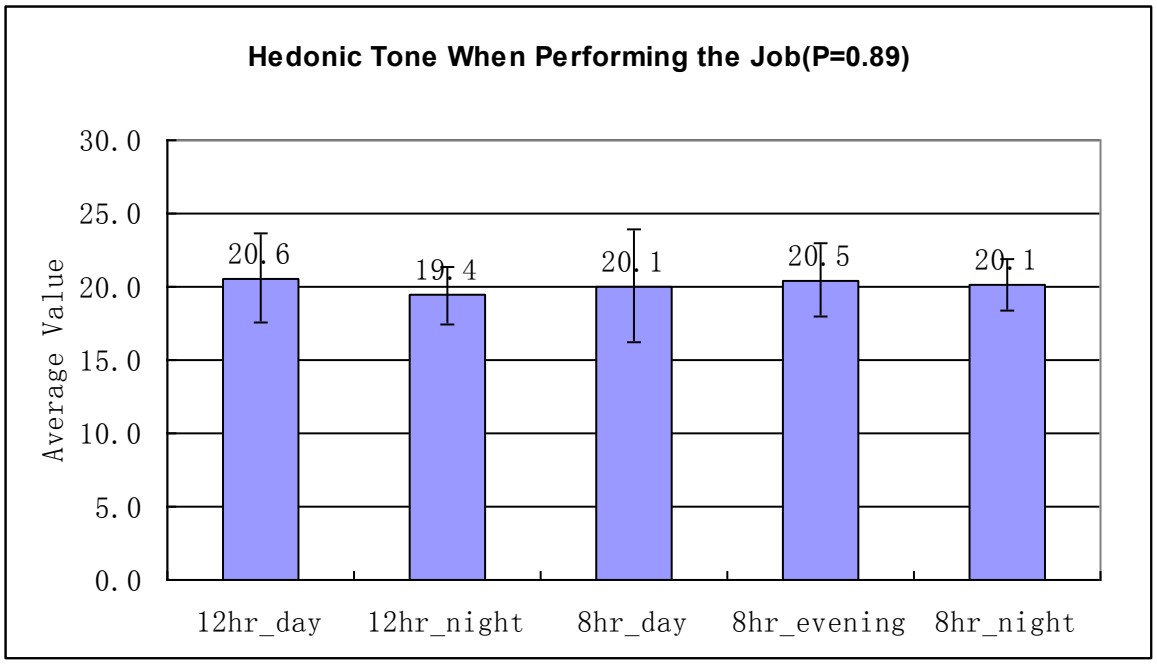

Figure 4.10: Average score for feeling hedonic tone when performing the job for nursing aides on each of the shifts.

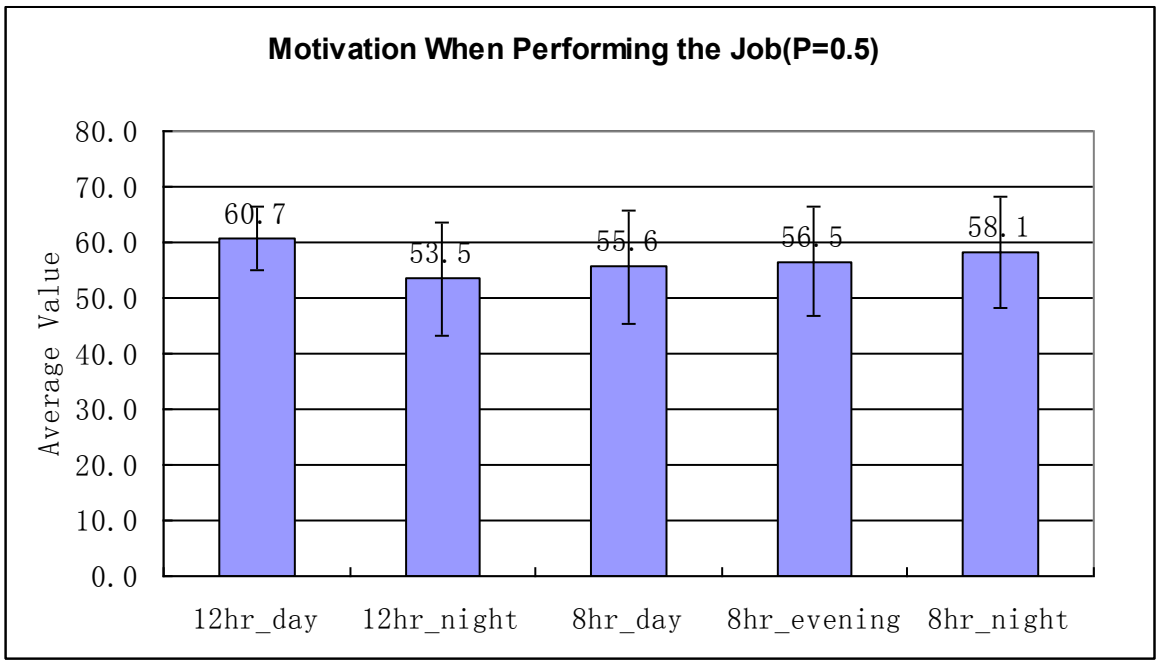

Figure 4.11: Average score value for feeling of motivation when performing the job for nursing aides on each of the shifts.

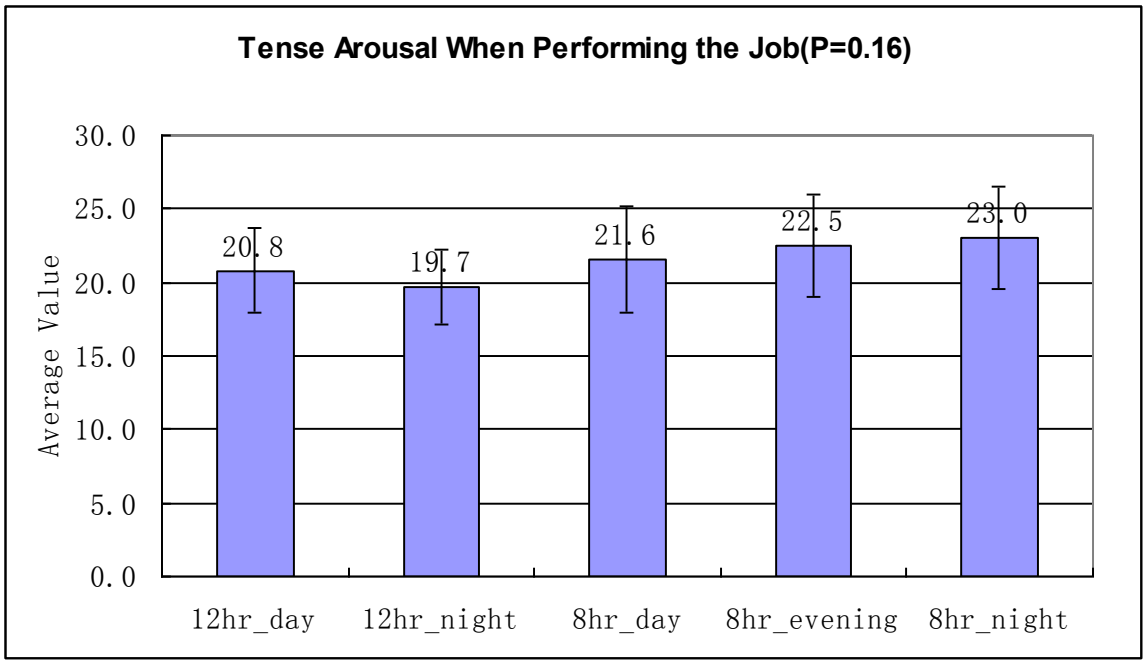

Figure 4.12: Average score for feeling of tense arousal when performing the job for nursing aides on each of the shifts.

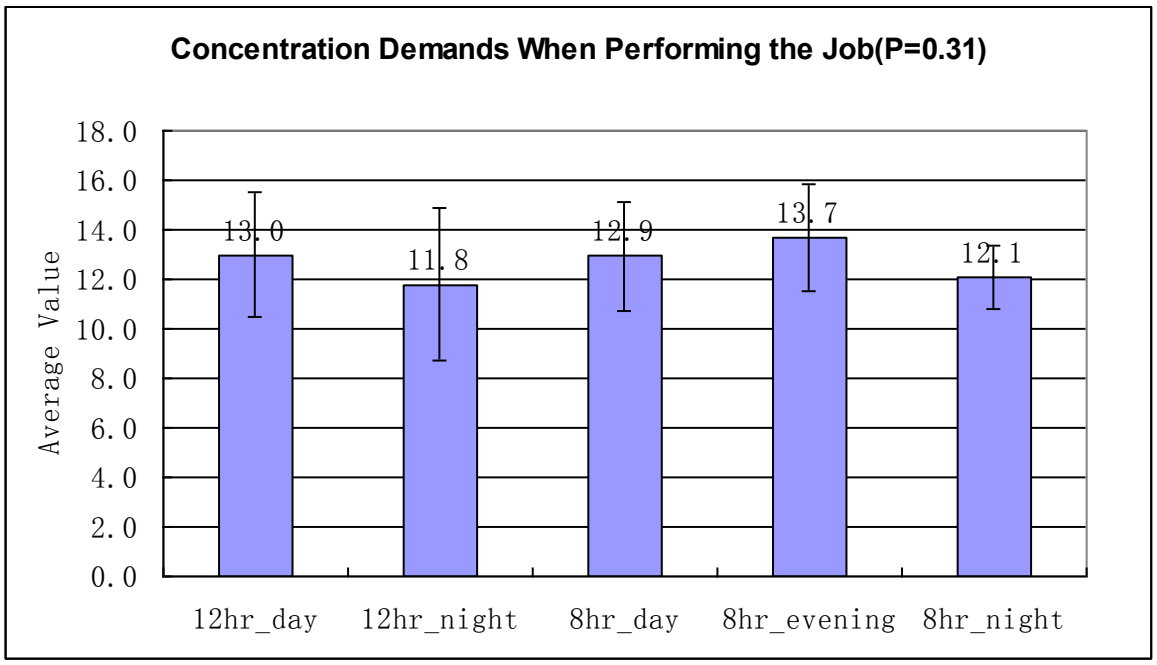

Figure 4.13: Average score for the concentration demands when performing the job for nursing aides on each of the shifts.

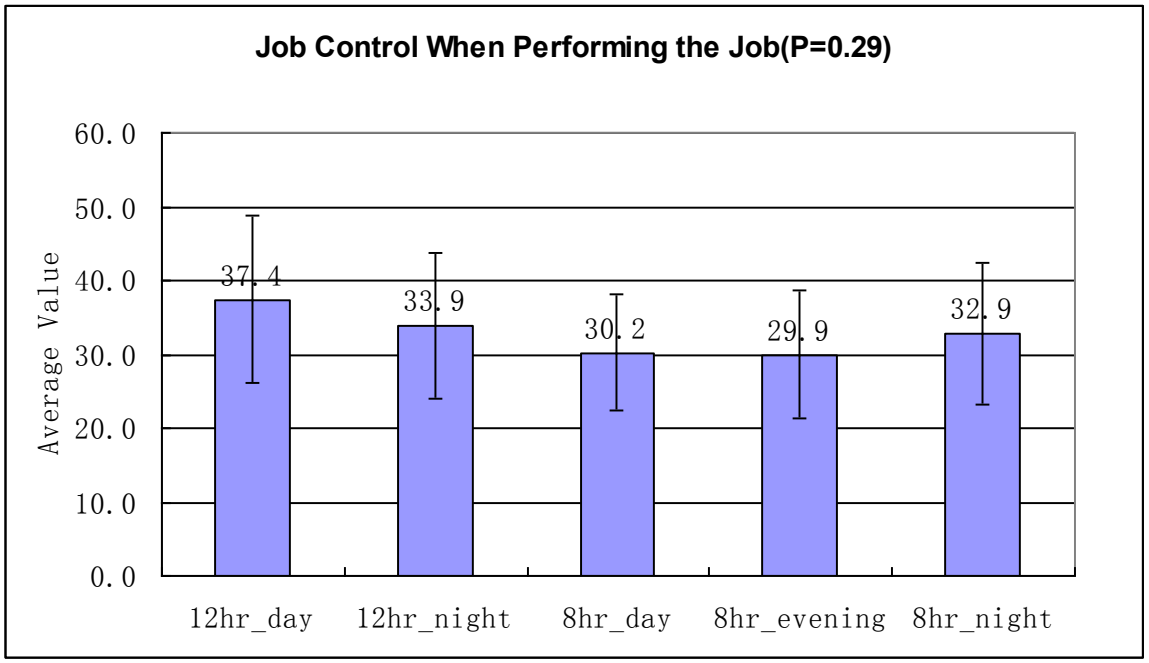

Figure 4.14: Average score for job control on the job for nursing aides on each of the shifts.

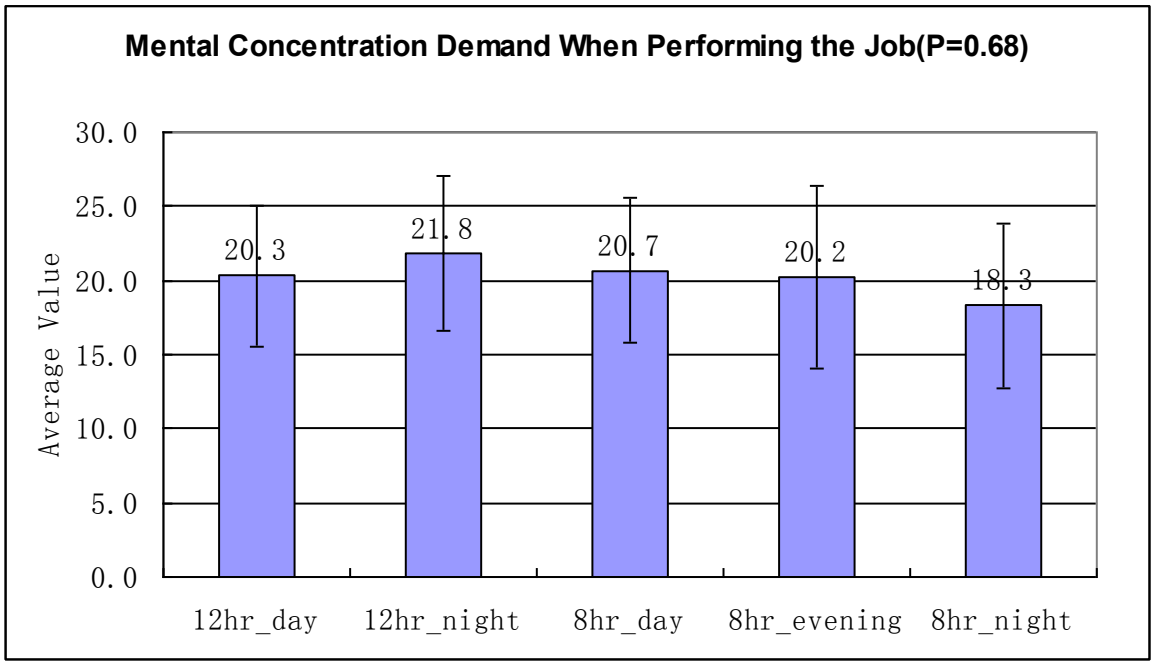

Figure 4.15: Average score for mental concentration demand while performing the job for nursing aides on each of the shifts.

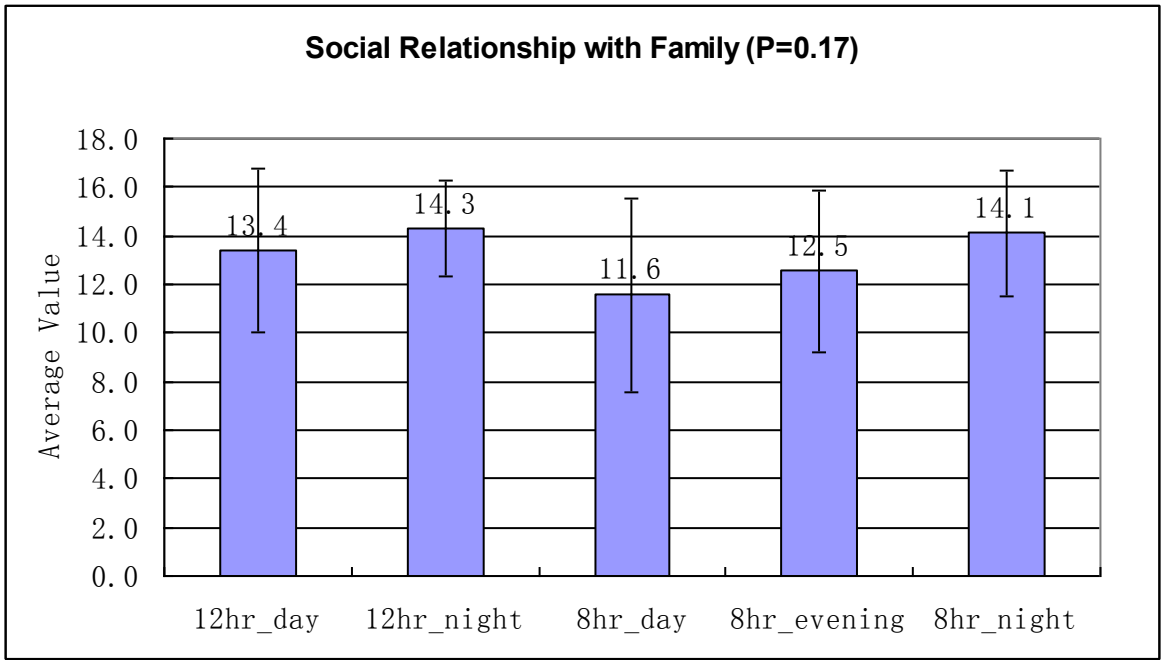

Figure 4.16: Average score for social relationship with family for nursing aides of each of the shifts.

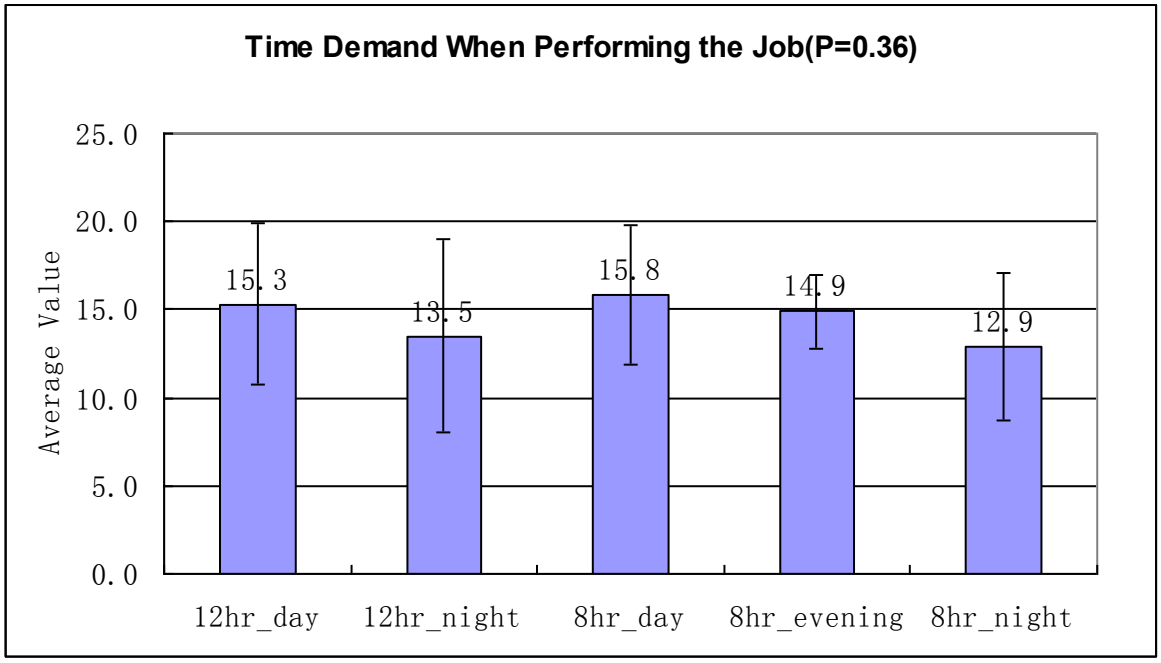

Figure 4.17: Average score for time demands while performing the job for nursing aides of each of the shifts.

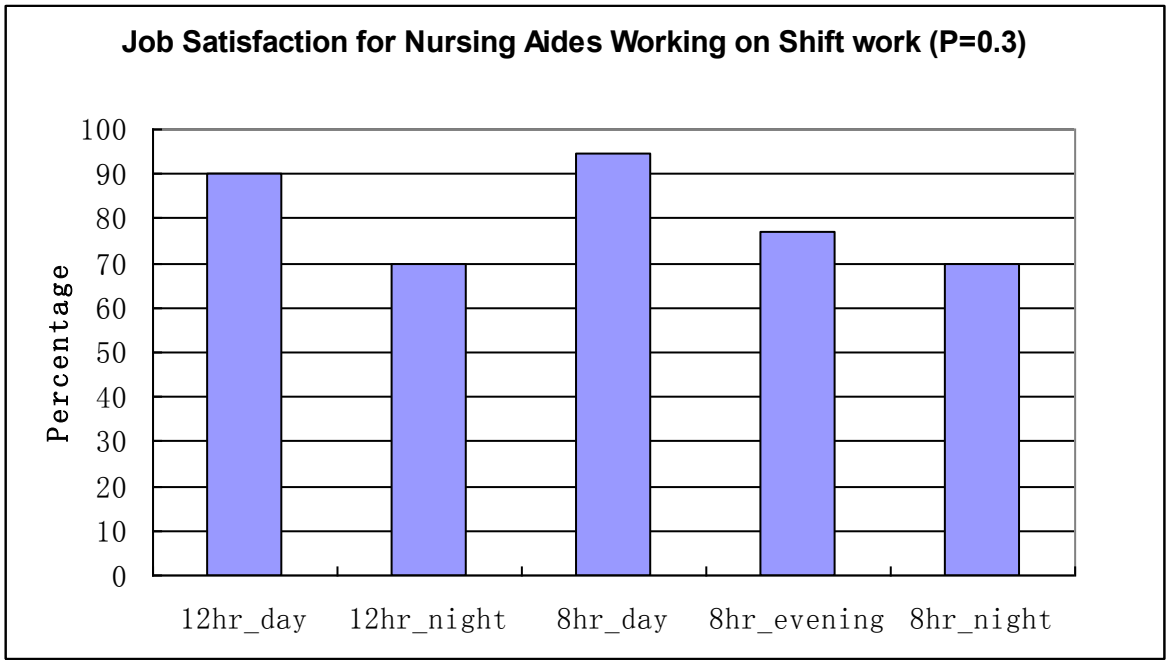

Figure 4.18: Percentage of for satisfaction with their job for nursing aides working on each of the shifts.

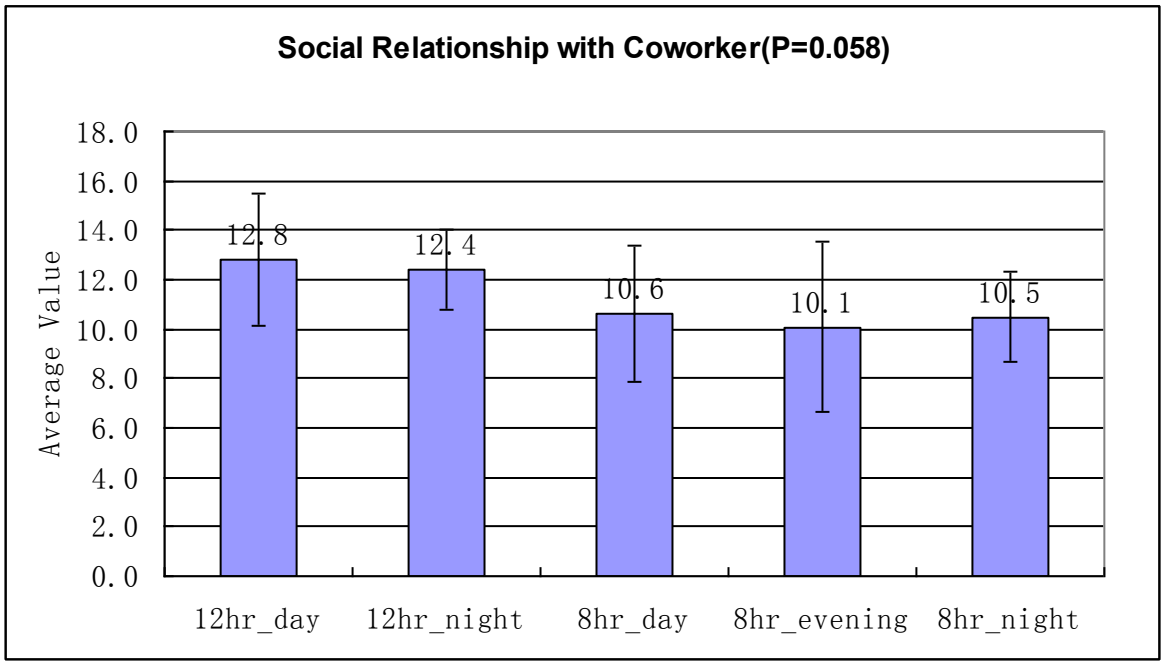

Figure 4.19: Average score for social relationship with coworker for nursing aides on each of the shifts.

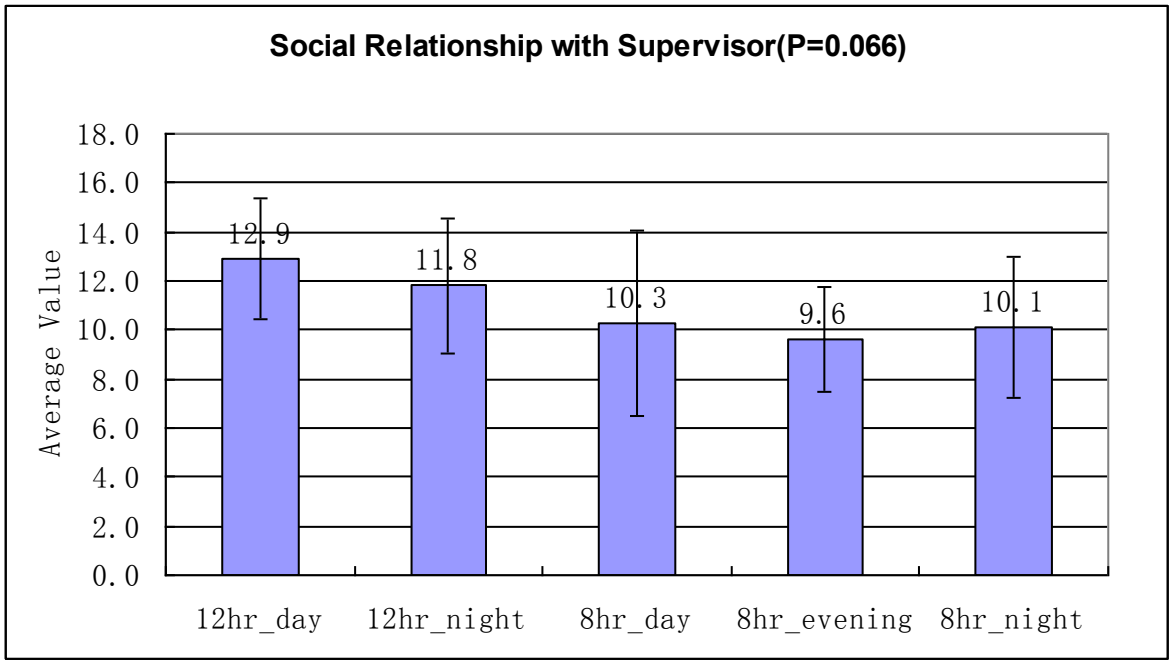

Figure 4.20: Average score on social relationship with supervisor for nursing aides on each of shifts.

4.4 Musculoskeletal Symptoms

4.4.1 Pain in Previous Year

According to the symptom survey, the nursing aides all experienced some pain at different body regions and at different pain levels in the past year (see Figure 4.21). Most of the nursing aides experienced low back pain in past year; 80% of 8-hour night shift reported high pain level of low back pain, which was moderate to severe pain in the last year (Figure 4.22). As shown in Figure 4.23, only 30% of 12-hour day shift had experienced low back pain; 8-hour day and evening had about 50% of nursing aides reported low back pain in past year. The other body regions, including lower leg and foot and shoulder and neck had more responses with high pain. Conversely, hand and wrist pain had less response in pain level.

A significant difference was found for pain level in two body regions: hand/wrist and knee. About 28% of 8-hour day shift had hand/wrist pain in the past year while 10% of 12-hour night shift had hand/wrist pain while 12-hour day, 8-hour evening and night shifts had no or mild pain in the hand/wrist area (Figure 4.23). Knee pain was the other body region that had significant difference among the nursing aides for each of the shifts (Figure 4.24). The 8-hour shifts, especially night shift, had a higher prevalence of knee pain than 12-hour shifts with 60% of the nursing aides on 8-hour night shift reporting knee pain as compared to 10% for 12-hour night shift. In addition, 12-hour day shift, 8-hour day and evening shift had 30%, 11.1% and 23.1% of nursing aides reporting high level of knee pain, respectively.

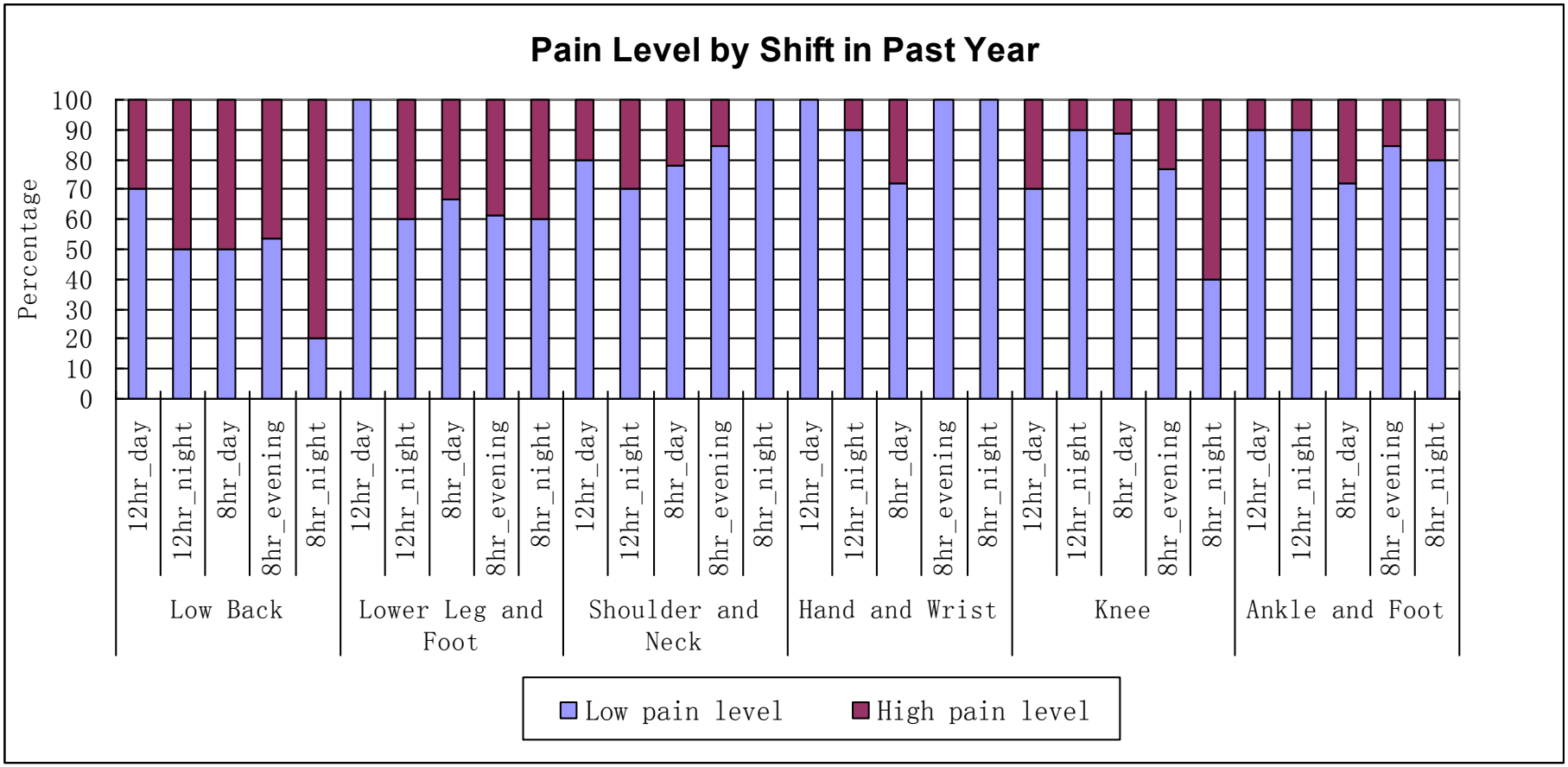

Figure 4.21: Percentage of reported muscle pain level in different body regions by nursing aides on each of shifts.

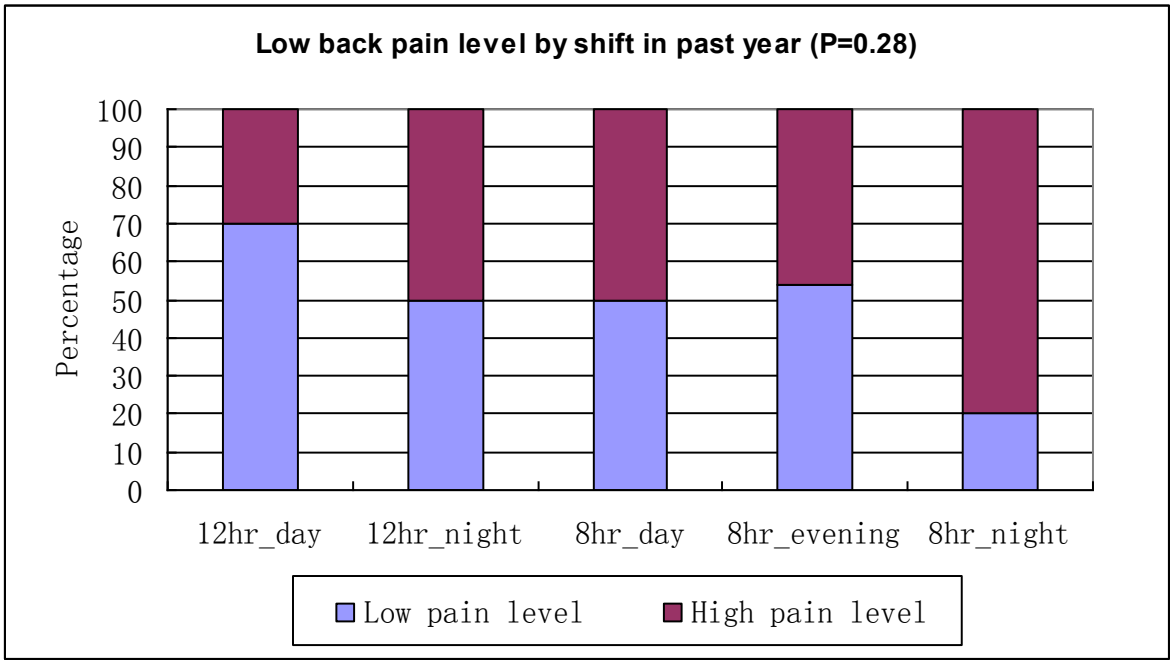

Figure 4.22: Percentage of nursing aides with low back pain in past year for each of the shifts.

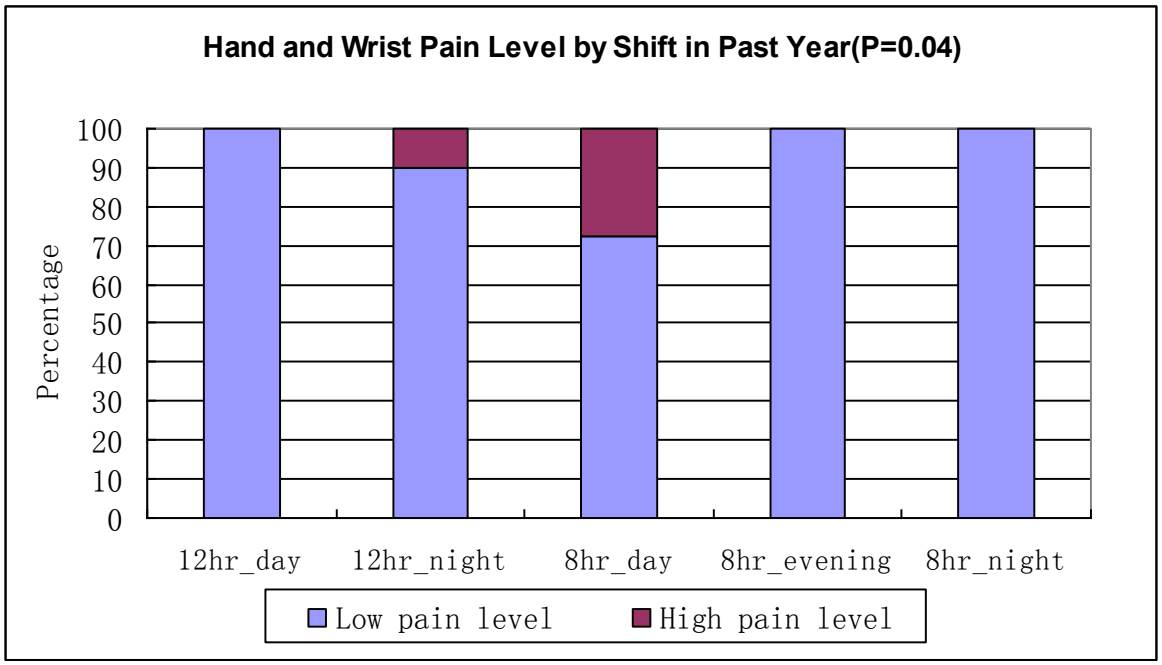

Figure 4.23: Percentage of nursing aides with hand and wrist pain in the past year for each of the shifts.

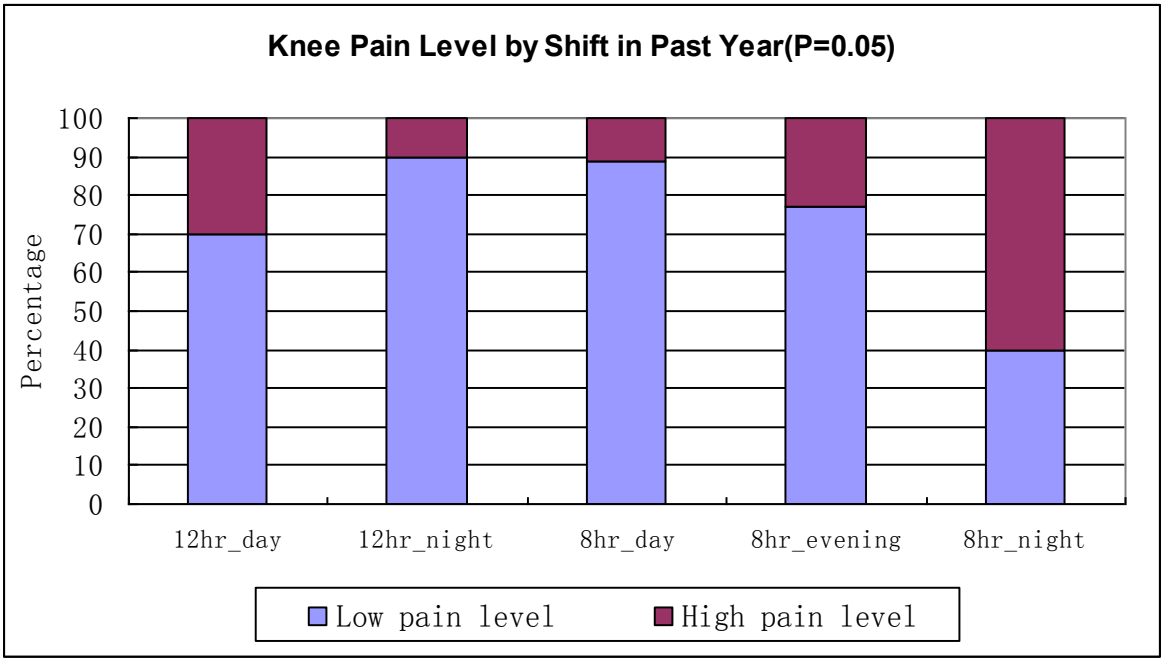

Figure 4.24: Percentage of nursing aides with knee pain in the past year for each of the shifts.

As reported in the survey, more nursing aides had lost of work days due to low back pain 8-hour shifts with the lowest number for 12-hour day shift. The 8-hour shift also had more lost of work days for more body regions than 12-hour shifts with only 10% of nursing aides on 12-hour day shifts lost 1-2 weeks of work days due to knee pain. About 5%, 15% and 10% of 8-hour day, evening and night shift, respectively, had lost their work days due to lower leg and foot pain. A similar frequency of lost days was found for should and neck pain: 5% of 8-hour day shift and 10% of 8-hour night shift. Approximately 10% of 8-hour night shift lost work days due to hand and wrist pain while 8% and 10% of 8-hour evening and night shift, respectively, had lost work days due to knee pain (Figure 4.25).

The results showed that significant difference was found on lost of work days due to ankle and foot pain for each of the shift in past year. The 8-hour night shift had most

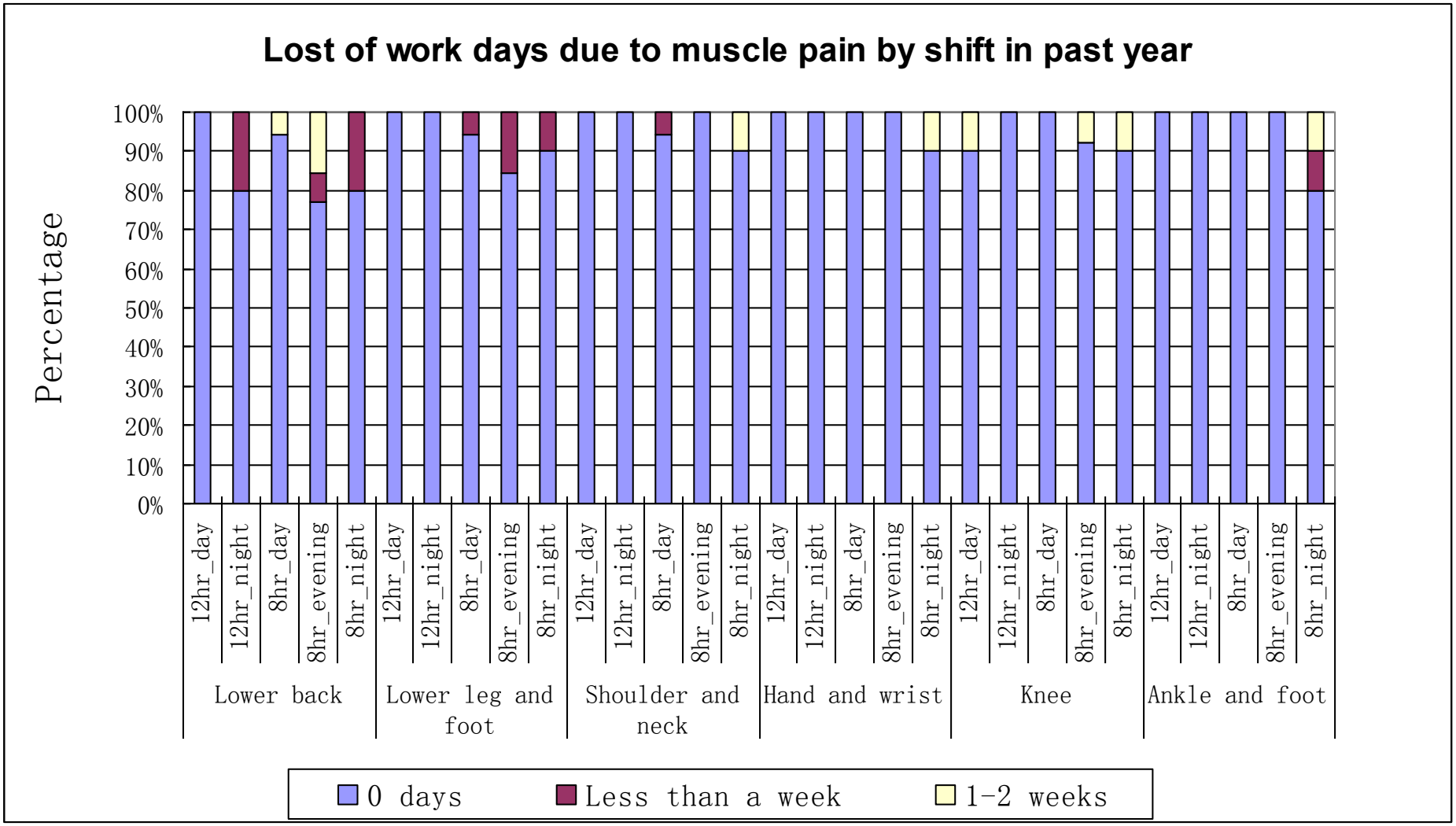

Figure 4.25: Percentage of nursing aides with lost of work days due to muscle pain in past year for each of the shifts

responses due to ankle and foot pain in the past year with 10% of the nurse aides missing injuries requiring the missing of less than one week of work days while another 10% of the nurse aides missed one to two week of work days due to the pain (see Figure 4.26).

No significant difference was found on the percentage of responses of nursing aides who lost work days due to low back pain in past year. However, low back pain was the major reason for the nursing aides to lose the work of day. There were 20% of nursing aides on 12-hour and 8-hour night shifts as well as 7% of 8-hour evening shift who had lost work days for less than a week; and 5.6% and 15.4% of 8-hour day and evening shift aides lost 1-2 weeks of work days due to low back pain in past year. Adding the responses of nursing aides for all the lost of work days, there were approximately 23% of the nursing aides on 8-hour evening who had lost work days due to low back pain in past year (Figure 4.27).

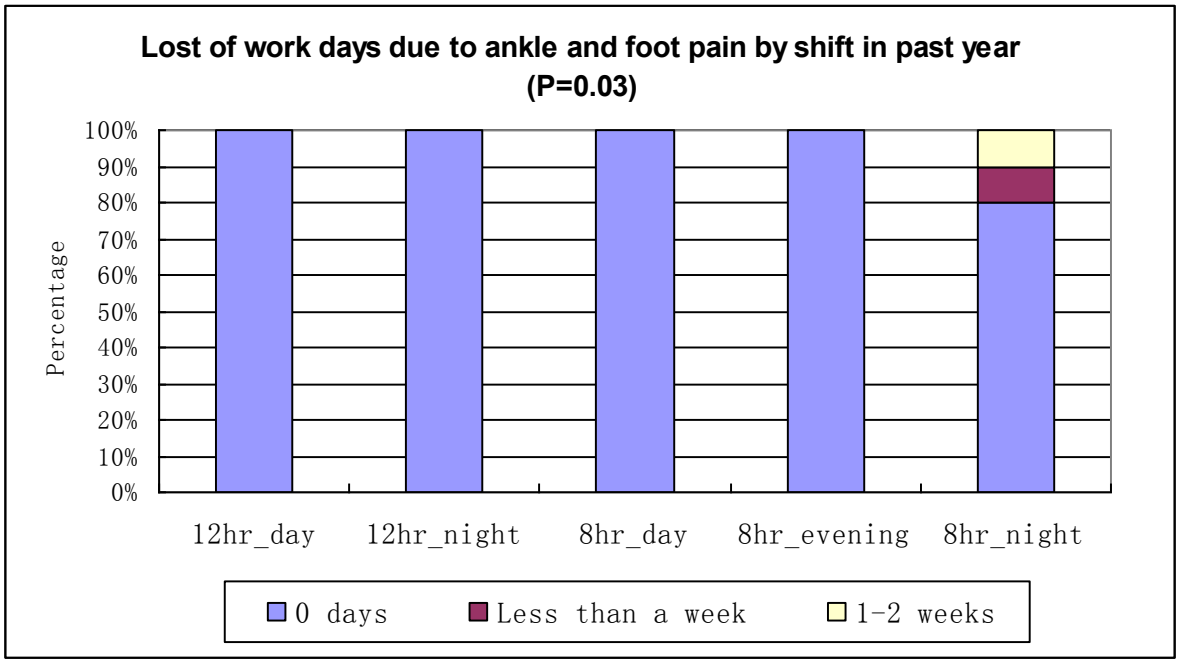

Figure 4.26: Percentage nursing aides with lost work days due to ankle and foot pain in the past year for each of the shifts.

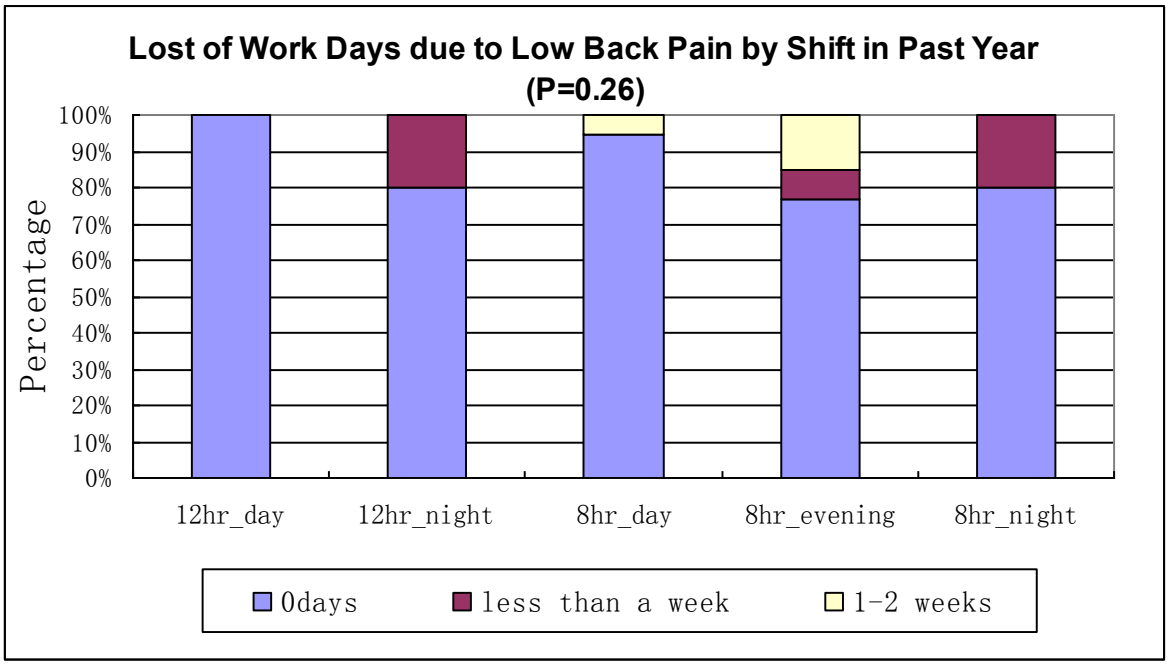

Figure 4.27: Percentage nursing aides who lost work days due to low back pain in past year for each of the shift.

The frequency of the pain in different body regions was re-categorized from rarely or never; some of the time; and all of the time to no pain (rarely or never) and pain (some of the time and all of the time) (showed in Figure 4.28). As seen in Figure 4.28, low back pain was the number one category with more pain experienced among the nursing aides for each of the shifts. Overall, pain was lowest for 12-hour shift than 8-hour shifts. There was no pain reported by nursing aides on 12-hour day shift for lower leg/foot and hand/wrist. The difference on percentage frequency of lower leg/foot pain of nursing aides was significant for each of the shifts in past year (Figure 4.29). About 40% of 12- and 8-hour night shifts reported lower leg/foot pain while 50% and 54% of 8-hour day and evening shifts, respectively, had pain in foot/leg pain. The pain levels for the 12-hour shifts were 40% and 60% for day night shifts, respectively, for the shoulder and neck areas in past year. The 8-hour shifts had about 50% indicating the presence of shoulder and neck pain. About 33% of

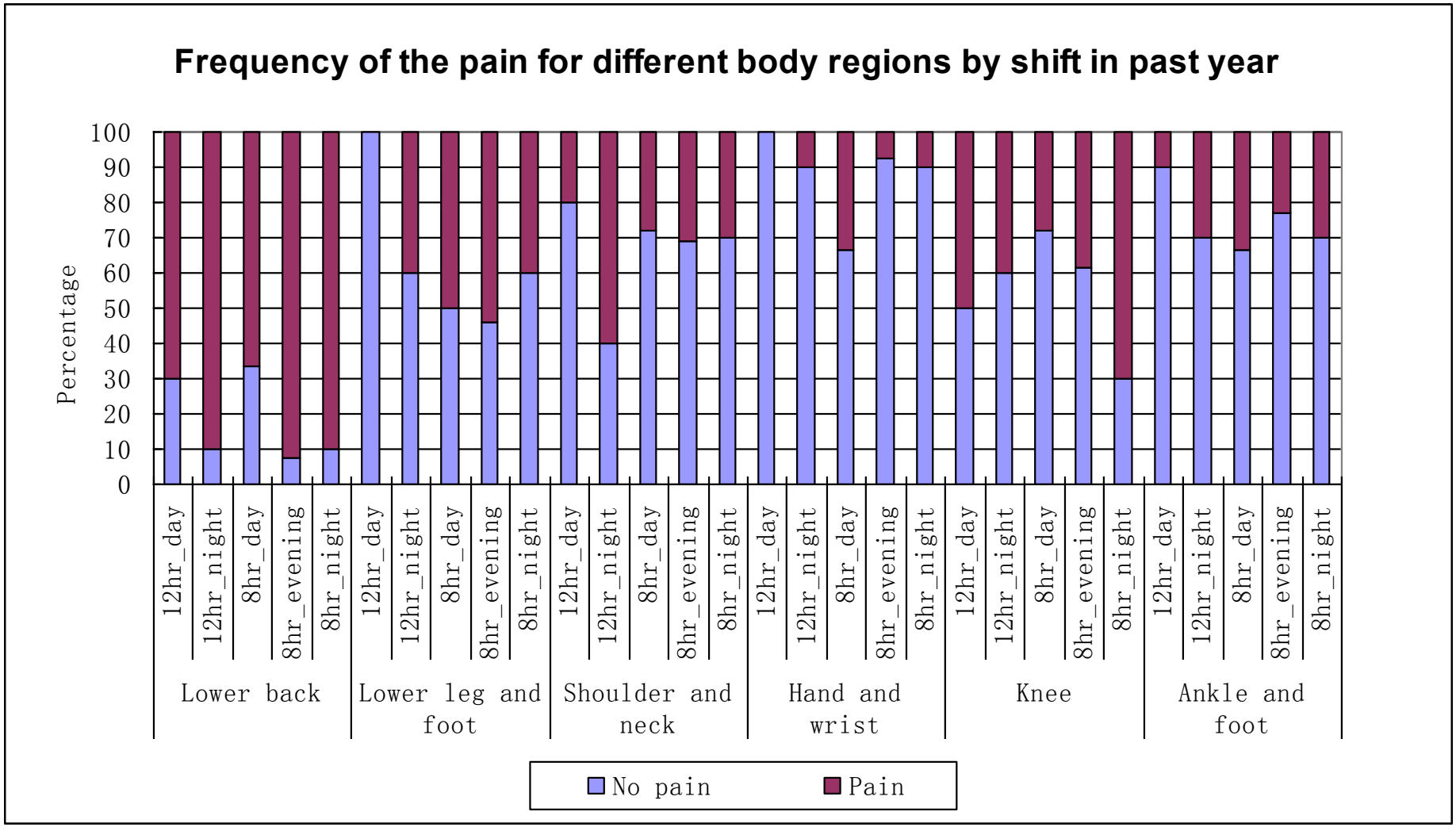

Figure 4.28: Percentage frequency of pain in different body regions of nursing aides for each of the shifts.

8-hour day shift (highest among the shifts) experienced hand/wrist pain in past year with the rest of the shifts at about 10%. The frequency of knee pain was highest for the 8-hour night (70%), followed by 12-hour day (50%), 12-hour night, 8-hour evening (40%) and 8-hour day shift (27.8%), respectively.

Figure 4.30 showed the frequency of low back pain of nursing aides for each of the shift. A large percentage of the nursing aides had low back pain in the pact year with more than 90% for evening (8-hour) and night (12-hour and 8-hour) shifts. The lowest low back pain was reported for the 8-hour day shift at 66.7%. Even though the difference was not significant for each shift, the prevalence of low back pain in past year among the nursing aides was astounding.

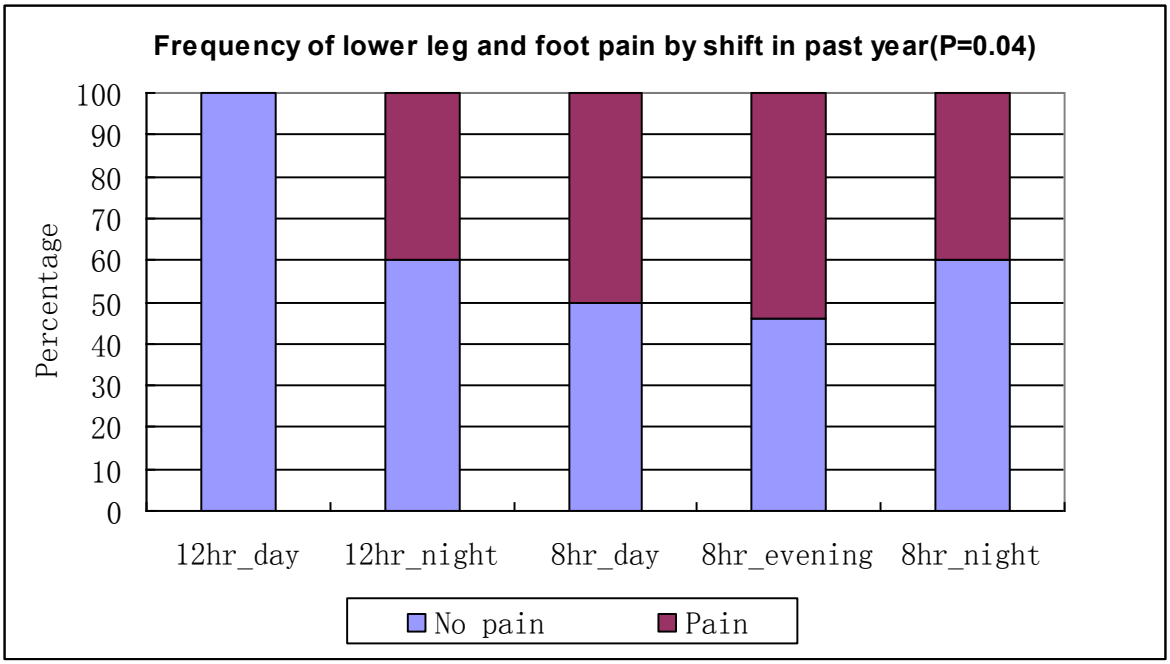

Figure 4.29: Percentage frequency of pain in the lower leg and foot of nursing aides for each of the shifts in the past year.

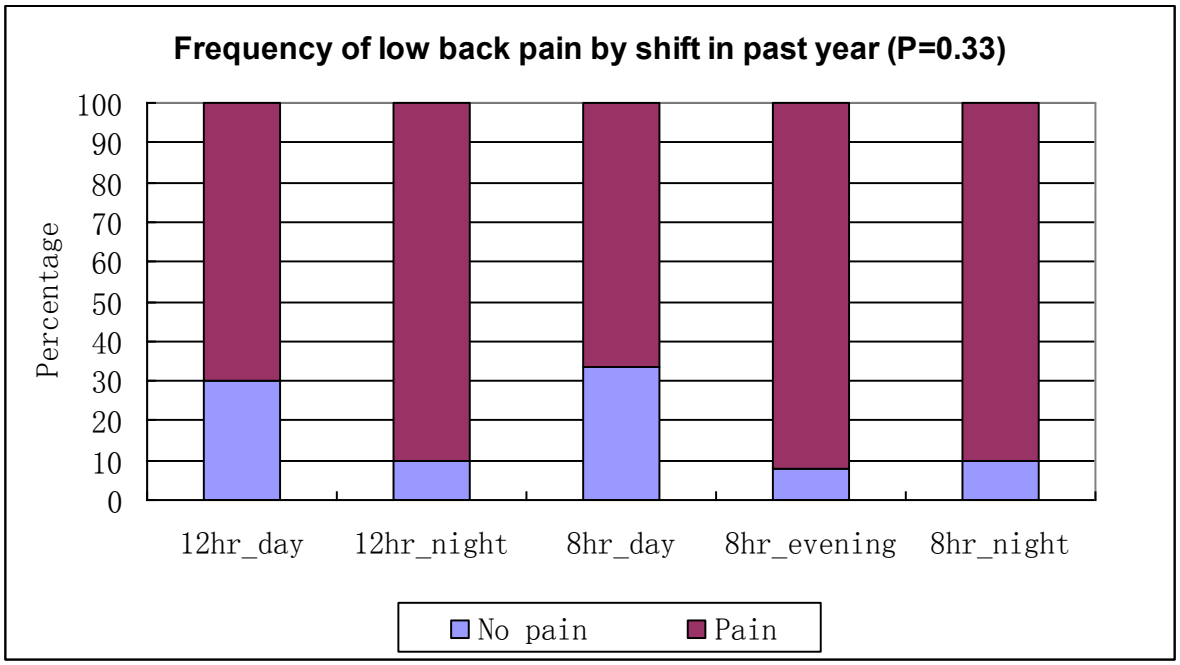

Figure 4.30: Percentage frequency of nursing aides who had low back pain in past year for each of the shifts

4.4.2 Current pain

The current musculoskeletal pain for nursing aides was classified as high pain level when moderate and severe pain were reported by the nursing aides; and low pain level when none and mild pain were reported. As showed on Figure 4.31, most of the shifts had nursing aides had with current muscle pain, especially low back. Two of the current symptoms, hip and knee pain, had showed significant difference among the shifts (Figure 4.32 and 4.33). It was indicated that the 12-hour and 8-hour day shift had low pain levels in the hips. The 12-hour night shift had the highest prevalence of hip pain with 30% of nursing aides reporting moderate to severe hip pain. The 8-hour evening and 8-hour night shifts had 7.7% and 10.0% of the nursing aides reporting pain, respectively. There were no nursing aides reporting current knee pain for 8-hour day shift while 40% of 8-hour night shift aides reported having knee pain currently.

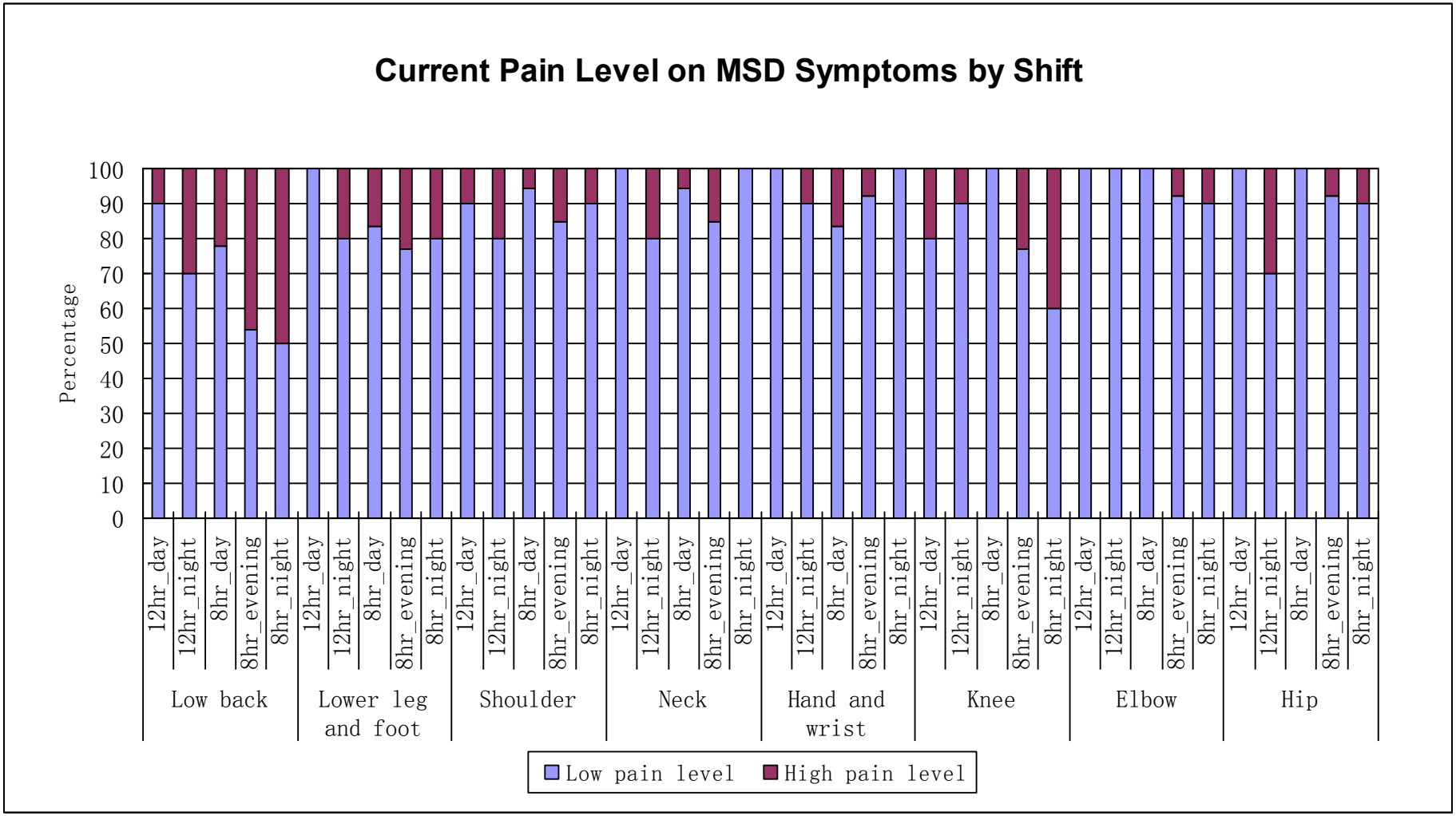

Figure 4.31: Percentage of reported current muscle pain level on different body regions by nursing aides for each of the shifts.

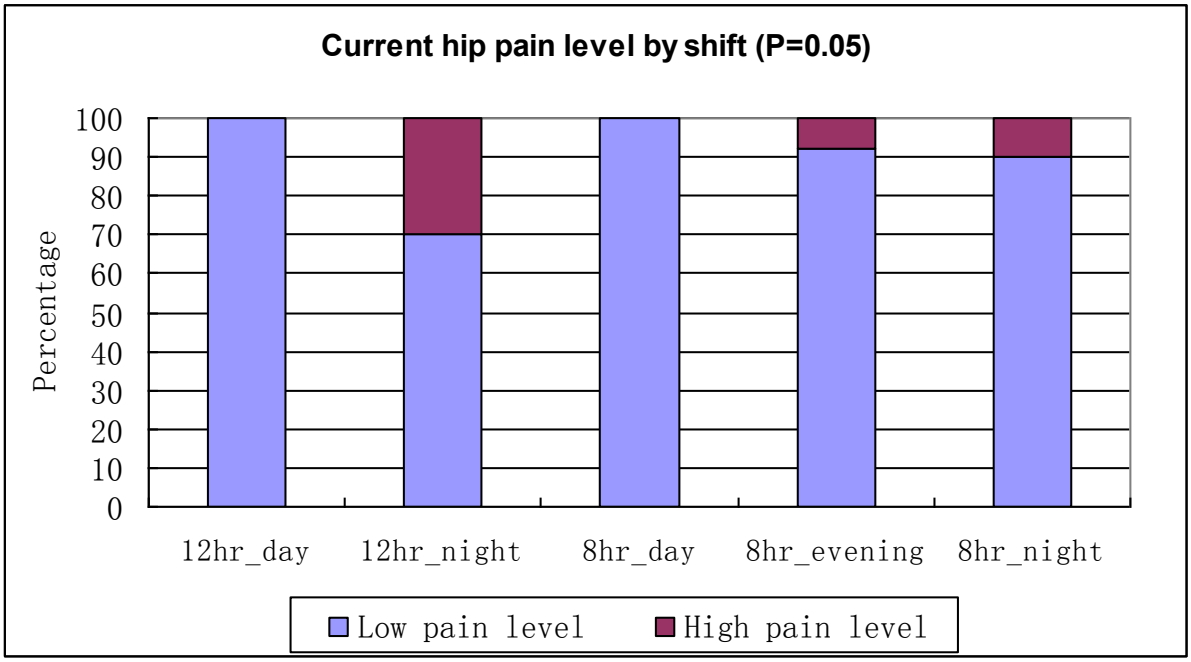

Figure 4.32: Percentage number of nursing aides reported current hip pain level for each of the shifts

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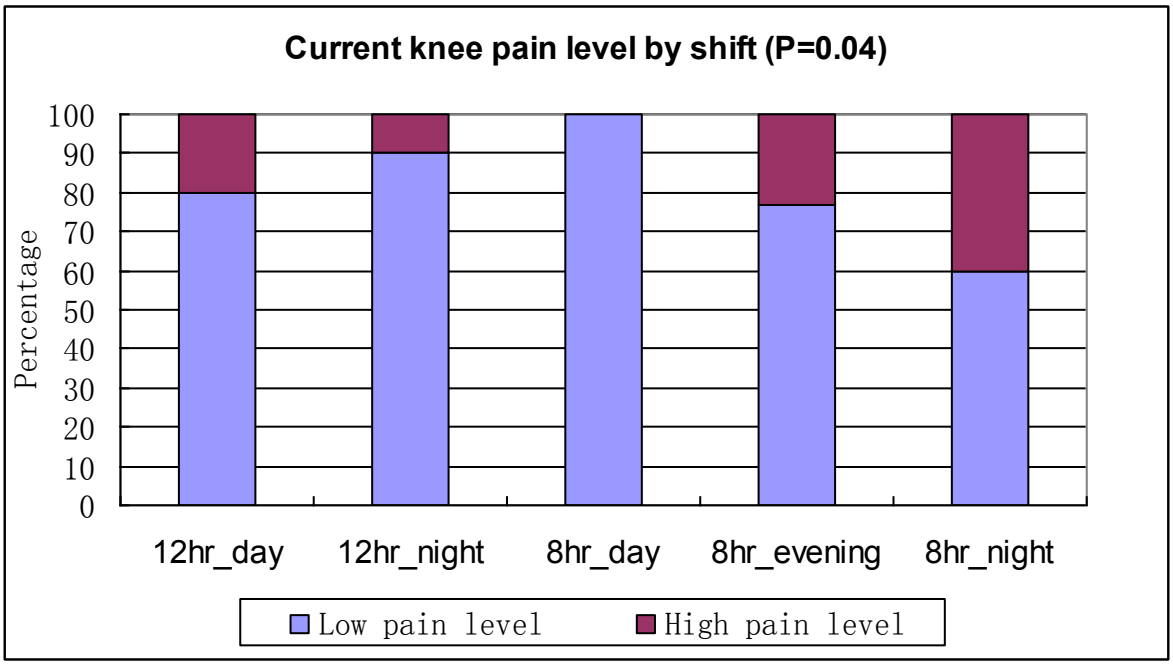

Figure 4.33: Percentage number of nursing aides reported current knee pain level for each of the shifts.

No significant difference was found among the aides for current low back pain (P=0.23). However, similar to the low back pain in the past year, al shifts had high prevalence of low back pain. In Figure 4.34, 8-hour evening and night shifts had more low back pain than other shifts (trend but not significant). Nearly half of the aides working on 8-hour night shift had moderate to severe low back pain with similar values for 8-hour evening shift. It also indicated that day shift no matter 12- or 8-hour shifts had the lowest prevalence of moderate to severe low back pain.

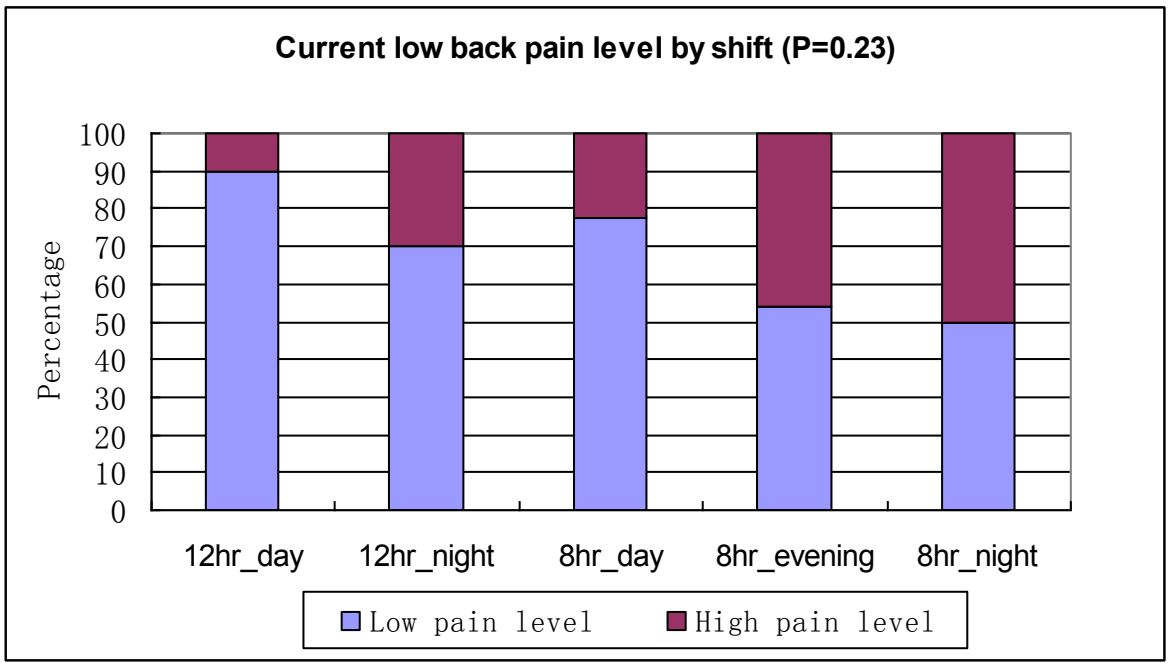

Figure 4.34: Percentage number of nursing aides reported current low back pain level for each of shifts.

CHAPTER 5

DISCUSSION

5.1 Hypothesis 1: Significant Differences Among Work Demands for Different Types of Shifts

5.1.1 Shift Work and Physical Demands

In nursing homes, the physical demands result from the daily routine of taking care of the residents for nursing aides. For eight-hour day shift, nursing aides generally complete the following tasks: wake up the residents; help with dressing and toileting; provide medication; making bed; help with the residents with breakfast and lunch as well as assist with residents in getting ready for nap. In addition, some facilities require day shift aides to wake up a certain number of residents from naps before evening shift nursing aides are on duty. In contrast, the evening shift nursing aides wake up residents from naps, help with toileting and dinner, provide night medicines, and assist residents in getting ready for bed such as showering or bathing. The night shift aides mainly help with the toileting and conduct regular checks on the residents every two hours. Obviously, there are overlapping tasks between each shift at the time of transition times when shifts are changing.

For twelve-hour shifts, similar tasks are performed as eight-hour shifts but the distribution of tasks with shift changes happening early morning (7 am) and late evening (7 pm). For the twelve-hour day shift, similar tasks are completed as for eight-hour day shift nursing aides but also assist the residents at dinner and afternoon

naps. The 12-hour night shift requires the same tasks as the 8-hour night shift and the late parts of the 8-hour evening shift such as getting residents showered and ready for bed and nightly medicines. No matter what shift, residents are routinely checked every two hours, especially if they have special needs or are handicapped.

Each of the shifts has unique demands placed on the nursing aides in long-term care facilities. However, we are just starting to understand these demands and the negative impact on the nursing aides.

5.1.1.1 Differences of the Physical Activity between Shifts

It was apparent that the eight-hour day shift was the most energy consuming shift by walking most and sitting least compared to other shifts hourly. This result was not unexpected totally as the majority of activity in the nursing home is conducted in the day, i.e. waking up, cleaning, showering, etc. In addition, day-shift aides need a fast pace to finish the job therefore the body increases heart rate and consumes more energy to adept to the working load. The energy consumption fluctuated through out the shift depending on the physical activity level the aides performed. However, the 12-hour day shifts had less energy consumption hourly than the 8-hour day shift, which indicated that although the nursing aides work extended hours in the 12-hour shift, the workload was potentially quite dispersed hourly as well as may reflect a less active period in the evening. The bottom line is that the workload for 8-hour and 12-hour day shifts seems to be different. This conclusion was supported by a study (Järvelin-Pasanen, Ropponen, Tarvainen, Karjalainen, & Louhevaara, 2012) testing the heart rate variability between 8-hour and 12-hour shift in nursing work. The study

found few differences detected between the shifts, which may indicate that the more flexible organization of work duties possible during extended (12-hour) work shift allow for better regulation of physical activity. On the contrary, the 8-hour day shift aides need to work fast to finish the tasks before handing over the work to the evening shift. The bottom line is that nursing aides on the 12-hour shift appear to be able to regulate their hourly activity rate to some degree.

Comparing within the 8-hour shifts, day shift were on their feet longer than the evening and the night shift. Only 10% of the shift for day shift aides was spent sitting, which was mostly for lunch time, almost all of the rest of the time, they were on their feet either walking or standing. This percentage was also lower than the percentage of sitting time of 12-hour day shift. The evening shift appeared to be relatively easier on the nursing aides than the day shift, with less walking and slightly more sitting. The night shift had equal time of sitting, standing and walking, likely due to the sleep time of the patients where most of the walking was to check on the residents or provide medicines.

The physical work demands for the nursing aides on twelve-hour shifts may be overall more demanding as fatigue builds up over the shift. Josten and associates (2003b)reported that the feeling of tiredness and fatigue was often times greater for 12-hour shifts than the 8-hour shifts. Chen and associates (2011) also found that even though the working pace was slow in the extended four hours for nurses on twelve hour shift, the heart rate and energy expenditure were not significantly lower than the eight hour period, which indicated adverse physiological effect may have a

continuous effect on their health. Within the 12-hour shift, day shift nursing aides had nearly the same time spent on standing compared to the night shift (42% and 46% respectively, which was 5 to 5.5 hours) but had less time sitting. These breakdowns in the amount of walking, sitting and standing is likely to have been linked to the tasks and workflow requirements as the twelve-hour shifts incorporate the 8-hour shift as well as more regulation of the demands by nursing aides.

Prolonged standing over long periods and careers may have many detrimental affects on the nursing aides. Many researchers have shown the adverse impact of long-term prolonged standing on lower back pain (Andersen, Haahr, & Frost, 2007; Gregory & Callaghan, 2008; Macfarlane et al., 1997; Tissot, Messing, & Stock, 2009) and lower extremity disorders like hip osteoarthritis (Croft, Cooper, Wickham, & Coggon, 1992), vascular insufficiency (Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Krijnen, de Boer, Adèr, & Bruynzeel, 1997; Tomei, Baccolo, Tomao, Palmi, & Rosati, 1999), and muscle edema that aggravate knee arthritis (Krijnen et al., 1997).

On the other hand, people who are physically active have a healthier life than people who are inactive. Regular physical activity can produce long term health benefits not only physically but also mentally (Penedo & Dahn, 2005). As the overweight and obese population has been increased significantly in recent years in the US with more than one-third of adults being obese (Flegal, Carroll, Ogden, & Johnson, 2002; Ogden, Carroll, Kit, & Flegal, 2012), the working population also cannot avoid the trend. Healthcare workers, like nurse and nursing aides, are also on the way of gaining weight. Miller and associates randomly surveyed nearly 5000

registered nurse and nurse educators and found that almost 54% of subjects were overweight or obese (Miller, Alpert, & Cross, 2008). Performing physically demanding jobs may slow down the pace of overweight or obesity for nursing aides since their work is energy consuming. Actually, brisk walking is an active positive effect on the cardiovascular system and lowers the risk of coronary and cardiovascular disease (Hennekens, 2000; LaCroix, Leveille, Hecht, Grothaus, & Wagner, 1996); in contrary, prolonged sitting predicts increased risk of cardiovascular disease (Manson et al., 2002). However, moderation should be considered into what level the walking, standing and sitting for nursing aides should take since excessive or moderate physical workload produces different outcomes on human body, but more research should be done to balance the pros and cons.

Furthermore, walking and standing are only one part of the physical activity. Patient handling is another major contributor to physical activity and fatigue which was not measured in the current study. Menzel and associates (2004) reported a significant association between musculoskeletal pain and the number of patient-handling tasks performed per hour. Therefore the risk of musculoskeletal pain might be lowered by working in a 12-hour shift.

Additionally, the negative impact of prolonged standing and walking may be further exacerbated by the awkward postures and other physical exertions adopted by the nursing aides. Many of the tasks performed by nursing aides are complex and require much effort, oftentimes in poor postures (as seen in the next section).

In all, the physical activity may be an underlying factor for the high levels of musculoskeletal pain and injuries found for nursing aides. Physical activities such as walking, standing and sitting only might not describe the physical workload for nursing aides. Appropriate physical activities help nursing aides keep fit and healthy but on the other hand prolonged physical exposure could be a problem for musculoskeletal disorders. Especially the four extra hours for the extended shift (12 hours), what the appropriate level of the physical demand is in elderly care facilities need to be analyzed.

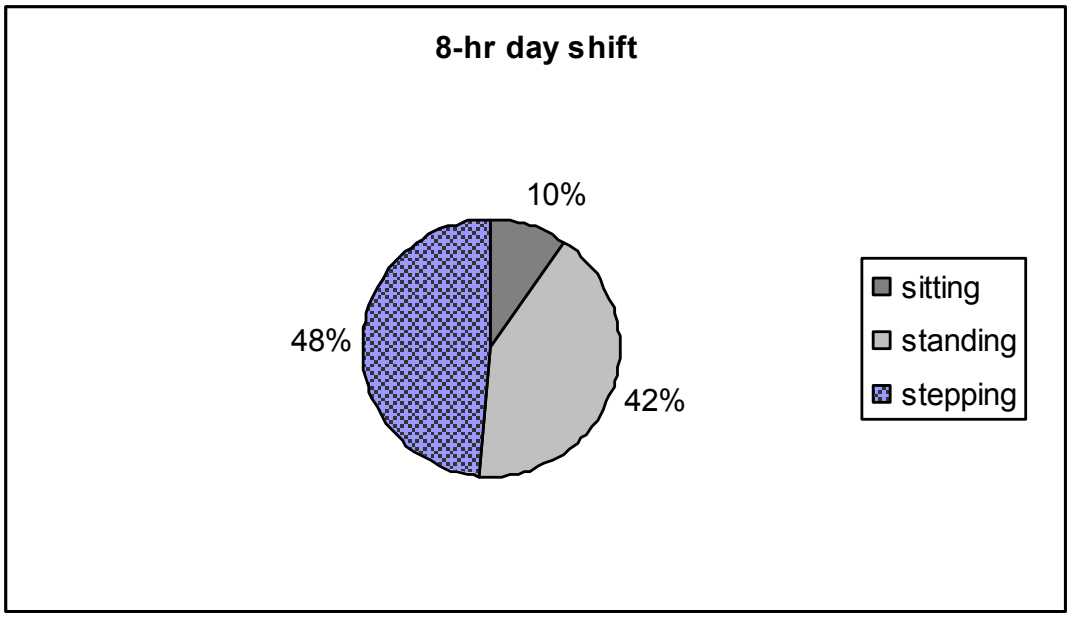

Figure 5.1: Percentage of time spent sitting, standing and walking on 8-hour day shift

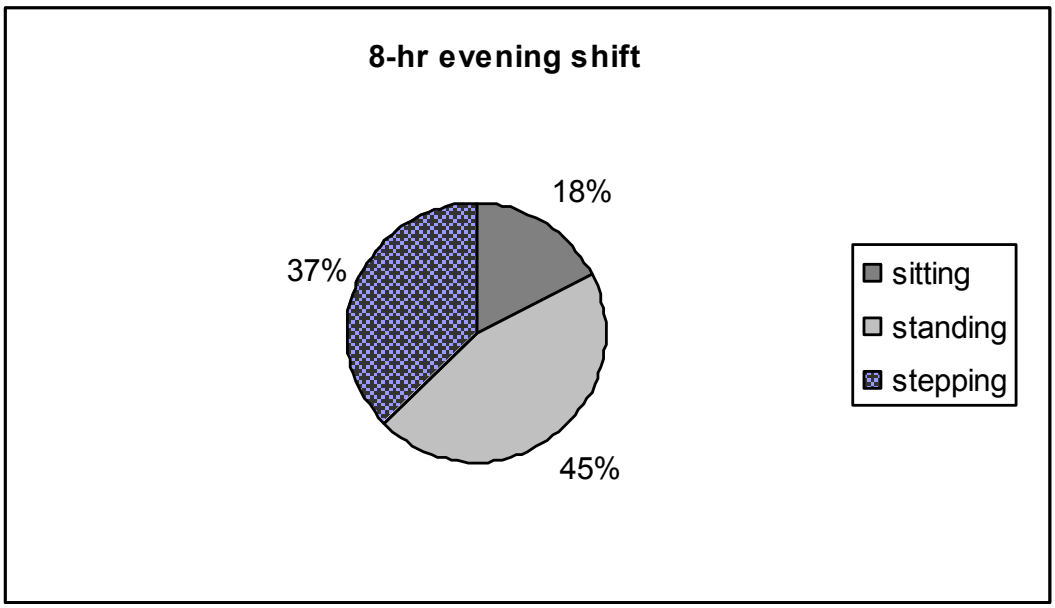

Figure 5.2: Percentage of time sitting, standing and walking on 8-hour evening shift

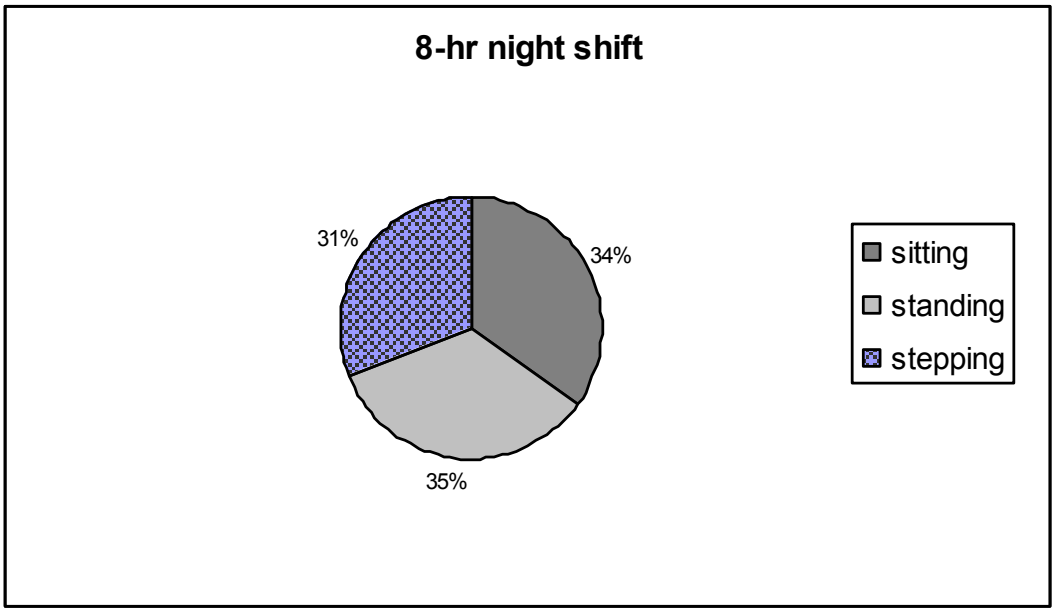

Figure 5.3: Percentage of time sitting, standing and walking on 8-hour night shift

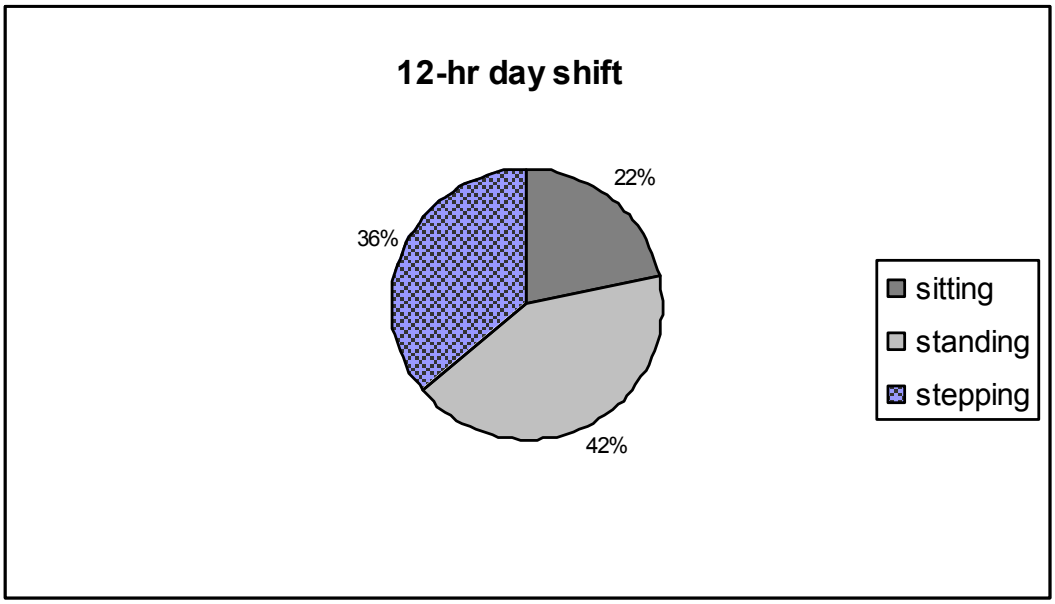

Figure 5.4: Percentage of time sitting, standing and walking on 12-hour day shift

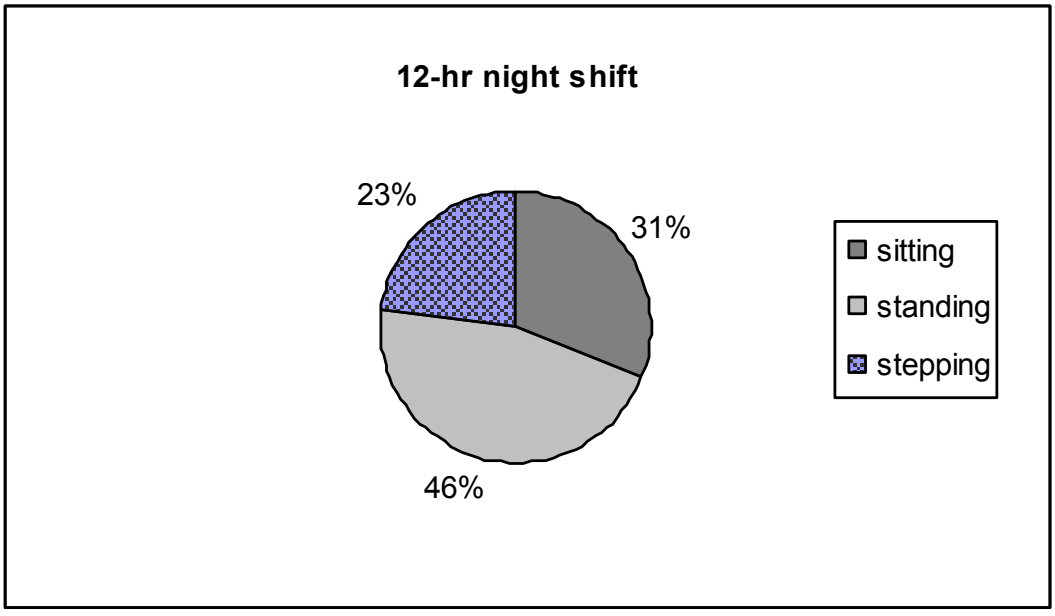

Figure 5.5: Percentage of time sitting, standing and walking on 12-hour night shift

5.1.1.2 Postural Demands

5.1.1.2.1 REBA Score

The REBA score calculated in this study was revised from the traditional REBA score calculation by adding computer use items, which were designed and validated with study in hospital settings (Janowitz et al., 2006). The Upper Body score was the sum of both sides of upper extremities (left and right shoulders, arms and wrists), plus neck and any small range of motion plus the use of the mouse on computer. The nursing aides were required to record on a Kiosk for their tasks done, therefore the method was proper to use for measuring physical workload for nursing aides. Separation of a whole body score with upper body and lower body can avoid the high upper extremity score being eased by low trunk and lower extremity score and vice versa . The higher the score indicates the higher risk level of musculoskeletal disorder and urgent need of intervention. The theoretical score range for upper body is -4 to 67, and -4 to 103 in the revised REBA scoring algorithm, with the highest score indicates the extreme awkward posture and heavy load but not realistic. REBA defined ≥8 as a high strain score of whole body posture. Although all the upper body and lower body posture scores were below 8, significant difference of postures for each shift was found and which shift involved the more awkward posture on upper or lower extremities was able to be distinguished. In addition, the working habits of the nursing aides among the shifts were examined by the adopted postures. The results showed that the 8-hour evening shift had the highest score, which potentially indicated more awkward postures and/or more weight handling. The 12-hour day shift was the next

shift that had a relatively high score for upper extremities. The higher upper body index may reflect the additional tasks that are commonly performed by the nursing aides on this shift: bathing, repositioning a resident up in bed, changing clothing, and transferring a resident from bed to chair or toilet (Garg & Moore, 1992; Menzel et al., 2004; Nelson et al., 2003). These tasks are basically done during the day shifts and sometimes in the evening time but rarely at night.

As in the research of Janowitz and associates (2006), the average individual upper and lower extremities scores were 9.0 and 6.6 for 178 hospital nurses compared to 7.01 and 6.77 (highest number among the shifts, 8-hour evening shift) in current study. When calculate the score, the weight, or the force exerted should be input into the PDA program for both upper and lower extremities. These levels of forces max out the REBA scores for force no matter how you estimate the forces of handling patients. In the nursing homes, researchers have identified the average weight of the residents was around 74.8 Kilograms and maximum weight at 136.1 Kilograms (as reported by the nursing aides in the questionnaires). While force necessary by the nursing aide was never just a simple calculation of the body weight when handling patients, actual forces were a complex relationship between capability of the patient, weight of the patient, and the task being completed. Given that the current study examined the differences of physical and psychosocial workload for each of the shifts, further insight into both cumulative and peak force for weight/patient handling combined with awkward posture was highlighted as an area for future research.

No significant difference was found for the lower extremities. The trunk and

lower extremity score indicated the balance of weight bearing, trunk, leg and knee postures, foot support, sitting position as well as rapid position change. Day shift aides may bear more weight but have better trunk, leg and knee postures while night shift had more forward bending posture and sitting positions that may prevent blood from circulating freely since more time is spent on sitting for nursing aides on the night shift. These complex situations produced similar scores of trunk and lower extremity for each of the shifts.

The revised REBA score showed medium high strain of postures for nursing aides on each of the shifts. It also indicated that improper postures might be adopted by the nursing aides on an 8-hour shift for upper extremity. The current study also shed light on a future direction of investigating the high strain posture with force exerted by nursing aides when performing the patient handling task.

5.1.1.2.2 Awkward Joint Posture

Improper or awkward posture is associated with musculoskeletal disorders, which has a high prevalence among different occupations especially the jobs that are involved in physically demanding tasks, and awkward posture was found to be one of the risk factors that were associated with MSDs in many research studies (Erick & Smith, 2011; Estryn-Behar et al., 1990; Nag, Vyas, Shah, & Nag, 2012; Roffey, Wai, Bishop, Kwon, & Dagenais, 2010). Moreover, the prolonged standing posture was found associated with low back pain (Tissot et al., 2009), and standing postures, especially constrained standing postures were associated with increased lower extremity pain (Messing, Tissot, & Stock, 2008). Health professionals have to face the

risk factors of MSD including awkward posture, sometimes in confined space, during patient handling, heavy workload, and work stress and time pressure (Gerbaudo & Violante, 2008; Ibrahim & Mohanadas, 2012). Awkward posture is often defined as various parts of the body (e.g., limbs, joints, back) in bent, extended or flexed position rather than in a straight or neutral position. In general, the more extreme the postures the more force are needed to complete the task (OSHA, 2001). As in previous research studies, 20% or 25% of time was found for hospital and elderly care nurses working in awkward postures (Karhu, Kansi, & Kuorinka, 1977). In addition, frequent bending as an awkward posture was considered stressful other than in the patient transferring task (Engels et al., 1996). Yip and associates' prospective study (2004) found that working in bending postures was an independent predictor for new case of low back pain.

The range of joint angles are indicators of awkward posture, when in the REBA checklist, each joint range was given a certain score for the severity, for example, the trunk score was 1 (low strain) when upright and was 4 when trunk flexion angle above 60 degree (high strain). In the current study, the joint angle ranges that fell into the low or high score categories can show the postures the nursing aides adopt from other than score calculation of body parts. The posture of the nursing aides was observed on an average of every five minutes interval and then recorded for 8 or 12 hours depending on what shift duration the nursing aides work on. The frequency of each joint angle category was recorded and then averaged for an hourly rate. The joint angle per hour (Tables 4.2 and 4.3) showed that the 8-hour night shift had the most

awkward shoulder posture when shoulder angles were 2.39/hr for the left side and 2.85/hr for the right side at the range of flex>45 and ext>20. That indicated nearly 20% of the observations out of the total observations for their working time the nursing aides had such poor posture; as well as 44% of the observations the right elbow fell into the high score category (flex<60,ext>100) for the 8-hour night shift. Compared with the other shift, the 8-hour day shift had the lowest rate of awkward posture for each joint that had significant differences among the shifts although day shift had most interaction with the residents. (See Table 5.1, adapted from Table 4.3). Moreover, the 12-hour day shift had more high risk wrist posture, on the right side. While there was no significant difference among the shifts for trunk posture, a trend was observed that 8-hour night shift was involved in more trunk flexion where nursing aides routinely flexed forwards more than 60^{o}. Freitag (2007) used a quantitative method to test the awkward back posture for morning shift nurses described a total of 72 minutes was spent bending forward with an inclination of ≥20º, which accounted for 23% of the working time; postures with trunk bending forward ≥60º accounted for 2.2% of working time with bed making (21%), basic care (16%) and clearing up/cleaning (16%) being the main tasks responsible for this awkward posture. It also found that patient handling work only took a small portion of the shift (2 minutes) (Freitag, Ellegast, Dulon, & Nienhaus, 2007). In Hodder's (2010) similar study it was found that patient lifts and transfers accounted for less than 4% of the shift while patient care, unloaded, standing and walking and miscellaneous tasks accounted for 85%, which indicates that the other frequent posture for tasks other than

patient handling play an important role on developing MSD. Since Freitag only did research on day shift with assumption of high physical demand for that shift, the situation of other shifts as in the current study was not comparable. However, the severe trunk postures in Freitag's research had indicated that the bending motion was quick, and lasted only 3-4 seconds, which means the findings in the current study could be more severe for nursing aides. The percentage in table 5.1 was the awkward postures observed out of the total 96 (8 hours) or 144 (12 hours) observations. The more observation was taken, and the higher percentage of awkward posture might be caught. In addition, as shown in table 5.1 the high strain posture, i.e. awkward posture, the difference among the shifts indicates that different shifts adopt different postures for their tasks and the tasks involved in trunk bending might be different for day shift and other shifts. The trunk postures were significantly different for each of the shifts on upright position and <20ºangles, the 8-hour day shift was observed more in an upright position (4.01/hr), but the 12-hour night had the least observations of upright position (1.68/hr). The same difference was found for the 0-20º and extension 0-20º, day shifts (8 and 12) had more observations for these two ranges than night shifts while 8-hour day shift had higher frequency than 12-hour day shift in that range. Nevertheless, for the awkward trunk posture, the times of trunk bending over 60º for each of the shifts were similar. Since making bed, basic care and cleaning composite show that the postures bending over 60º for day shift, the other tasks that are involved in such posture for other shifts, especially night shift should be examined not only for trunk posture, but also other joints that at risk.

Table 5.1: Percentage of awkward posture observations for each of the shift

Joints	Angles	8-hr day	8-hr evening	8-hr night	12-hr day	12-hr night
Neck	flex>20,ext	15.4%	9.6%	8.7%	8.6%	12.3%
LShoulder	flex>45,ext>20	10.2%	17.9%	19.9%	13.2%	16.9%
LWrist	flex15-22,flex/ext >22	23.8%	35.3%	29.1%	34.9%	31.0%
RElbow	flex<60,ext>100	25.9%	32.0%	44.2%	39.4%	39.8%
RShoulder	flex>45,ext>20	10.7%	14.8%	23.8%	16.8%	17.8%
RWrist	flex15-22,flex/ext >22	22.6%	31.7%	32.5%	34.8%	34.4%
Trunk	flex>60 ext>20	10.8%	13.6%	17.4%	12.6%	12.3%

Therefore the investigation on the trunk posture for evening and night shifts should be considered. The prevalence of musculoskeletal disorders was reported on different body regions (Harcombe, McBride, Derrett, & Gray, 2010; Ibrahim & Mohanadas, 2012; A. M. Trinkoff, Lipscomb, Geiger-Brown, & Brady, 2002), the posture would be one of the major risk factors with differences between shifts.

5.1.2 Shift Work and Psychosocial Workload

The psychosocial demands were comprehensively examined including social interactions, mental workload, and job satisfaction. In the current study, nursing aides on the 8-hour shifts had a negative attitude toward supervisor and coworker support, especially evening and night shift. The 12-hour day shift felt they were supported by their supervisor on their job. Compared to 8-hour shifts, nursing aides on the 12-hour shifts felt more positive on supervisor support and coworker relationship.

The overall stress of the nursing aides was greatest for the nursing aides on the 8-hour night shift where they were commonly faced with the least amount of personnel on the floor. Furthermore, the late night shift results in a sleepless night that interrupts the circadian rhythm which has been shown to adversely impact stress and

health (Caruso, Lusk, & Gillespie, 2004; Drake et al., 2004; Scott, 2000; Shields, 2002; A. M. Trinkoff, Storr, & Lipscomb, 2001; Wilson, 2002).

The night shift requires one nursing aide to take care of more residents than the aides on day shifts since fewer activities occur at night (Blau & Lunz, 1999; Pigors. P & Pigors, 1944). However, night shift is not a relaxed night for nursing aides with need of routine tasks and sometimes additional cleaning tasks or handling emergent situations. The nature of night shift designed with less personnel, along with the shortage of staff, the nurses had more burnout and job dissatisfaction (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Sheward, Hunt, Hagen, Macleod, & Ball, 2005). It has been stated that nursing aides who work on night shift have less support from other staff, as well as supervisors (McGowan, 2001; McIntosh, 1990; McVicar, 2003). This was one of the work stressors that caused physiological stress among nursing aides, and was one of the common reasons for nursing aides to leave their jobs (J. Choi & Johantgen, 2012; McGuire, Houser, Jarrar, Moy, & Wall, 2003). In the present study, 8-hour night shift aides also reported lack of recognition from supervisors for good performance in the respect of greater supervisory support was found associated with reduced job stress for nursing aides (McGilton, Hall, Wodchis, & Petroz, 2007). Therefore, to enhance the favorable relationship between nursing aides, and aides and supervisor would be the emphasis for nursing homes to keep staff and lower the psychosocial demand in nursing homes.

On the other hand, the sleep deficiency was noticed after the night shift, an average of 3.5 hour of sleep shortage was found and sleep time was reduced (Axelsson et al.,

2004; Lamond et al., 2001). The night shift experienced less sleep time and lower sleep efficiency compared to the day shift (Niu et al., 2013), which could result in chronic fatigue (Edéll-Gustafsson, Kritz, & Bogren, 2002; Samaha, Lal, Samaha, & Wyndham, 2007) Edéll-Gustafsson, Ulla,M. 2002;1236 Samaha,Elias 2007.

Moreover, the frustration of having less freedom for decision making other than the routine job, less information of the patient comes from coworkers and the supervisor, social isolation from family and friends brought up more stress for nursing aides (Blau & Lunz, 1999; Fitzpatrick et al., 1999; Lapane & Hughes, 2007; Scott, 2000).

Comparing the psychosocial stressors between the length of the shift (8-hour vs. 12-hour), the present study discovered that 12-hour shifts, had less psychosocial demands than 8-hour shifts. In the current study, the 12-hour shift aides had a better relationship with coworker and supervisor as well as less family interference with job. In a review study comparing 8 and 12 hour shift systems by Smith, 12 hour shifts were advantageous in terms of lower stress levels, better physical and psychological wellbeing, improved durations and quality of off duty sleep as well as improvements in family relations (L. Smith et al., 1998). The response could be satisfied with their schedule, less work days, longer time off, more social time for 12-hour shift compare to 8 hour shift (Lowden, Kecklund, Axelsson, & Akerstedt, 1998).

In all, even working 4 additional hours than 8-hour shifts might lead to subjective feelings of fatigue and tiredness (Josten et al., 2003a; McGettrick & O'Neill, 2006), but nursing aides on the 12-hour shift had more positive psychosocial demands, including

peer support, supervisor coworker relationship and family value, which may indicate better job satisfaction. Stone and associates (2006) valuated nurses in a hospital setting working on 8-hour and 12-hour shifts. These researchers found that the nurses working 12-hour shifts were more satisfied with their jobs and schedules, experienced less emotional exhaustion, were less likely to report missing shifts, and 12-hour shifts had lower vacancy rates than 8-hour shifts.

As the shortage of nursing staff has become more and more severe in recent years, keeping personnel is very important. With more nurses joining the 12-hour shift for the benefit of less psychosocial stress, easy planning with family and social lives (Lowden et al., 1998), the negative physiology effect should not be neglected for adverse health may overwhelm the beneficial aspects of the 12-hour shift (CHEN et al., 2011). The advantages and disadvantages of the 12-hour shift is equivocal; more in-depth research is needed. Supervisors should acknowledge the good performance of the nursing aides to lower the stress of lack of support and recognition.

5.2 Hypothesis 2: Significant Differences Among Musculoskeletal Pain for Different Types of Shifts

5.2.1 Musculoskeletal Pain and Injuries

Most of the nursing aides had musculoskeletal pain in multiple body regions. The aides working on 8-hour night shifts had more hand and wrist pain as well as higher prevalence of knee pain. In addition, the 8-hour night shift had the most lost work

days due to foot and ankle pain. The 8-hour evening shift had the most leg and foot pain in the past year.

Musculoskeletal pain was more prevalent for nursing aides on the 8-hour shift than the 12-hour shift. Although some of the symptoms for 12-hour shift were more severe than 8-hour shift, the overall prevalence of the symptoms was lower. For example, the 12-hour day and night shifts had hand and wrist pain, with about 30% and 10%, reported having moderate to severe pain, respectively. On the other hand, 60% of the nursing aides on the 8-hour night shift reported having moderate pain.

There was no significant difference on low back pain but the 8-hour night shift had the highest prevalence, 80% of nursing aides on that shift reported having had moderate to high level of low back pain last year; the rest of the shifts were nearly 50% and the 12-hour day shift had 30% of nursing aides reporting moderate to high level of low back pain in past year. Compared to the previous reported prevalence of low back pain, it was relatively high. Studies done for the musculoskeletal disorders showed that the prevalence of low back pain for nurses, nursing personnel with lower back was from 45% to 76.2% in previous year, and low back pain had the highest prevalence among the pain in different body regions (Ando et al., 2000; Chung et al., 2013; Engels et al., 1996; Smedley et al., 1995; D. R. Smith, Wei, Kang, & Wang, 2004; A. M. Trinkoff et al., 2002). A lifetime low back pain prevalence of 35-90% has been reported (Knibbe & Friele, 1996) previously. Certified nursing assistants were a vulnerable population with high low back incident rate that are three to four times that of registered nurses (Fuortes et al., 1994). A high prevalence of low back pain in the

present study indicated low back pain is severely affecting the nursing aides' population. Not only low back pain, nursing personnel also experienced pain in other body region like neck (31.3%-56.7 %), shoulders (38.9 -47%), arm (18.6%-30%) and leg (16%-38.9 %) (Ando et al., 2000; Chung et al., 2013; Engels et al., 1996; Smedley et al., 1995; D. R. Smith et al., 2004; A. M. Trinkoff et al., 2002).

Research has indicated that both physical workload and psychosocial factors could lead to musculoskeletal disorders (MSDs) (Bongers et al., 1993; Davis & Heaney, 2000; Devereux et al., 1999; Hales & Bernard, 1996). As for the high prevalence of MSD in the current study, the physical and psychosocial work demand for nursing aides in the investigated nursing homes was considered elevated. Research on MSD and shift work research especially on nursing aides are few although some research indicated that both shift work and long work hours are associated with musculoskeletal injuries (Fredriksson et al., 1999; Lipscomb et al., 2002; Waersted & Westgaard, 1991). Research on disturbed sleep and pain found disturbed sleep was associated with decreased pain threshold, increased discomfort and fatigue (Lentz, Landis, Rothermel, & Shaver, 1999; Moldofsky, 2001). That could be the case for nursing aides working on night shift with sleep deficiency. Taking a nap during the night shift was found to reduce pain in arms and legs but not low back (Takahashi, Iwakiri, Sotoyama, Hirata, & Hisanaga, 2009). The mechanism on low back pain development is complex and more research should be done to relieve the pain for the working population. Working extended hours and/or working shift work are potential risk factors that developing musculoskeletal injuries as reported in some research

(Fredriksson et al., 1999; Lipscomb et al., 2002; Waersted & Westgaard, 1991). The current study indicated that muscle pain affects all the nursing aides in different body regions but the 12-hour shift showed less prevalence on muscle pain compared to the 8-hour shift. It seems that less hourly physical workload, better psychosocial response for 12-hour shifts might lead to less muscle pain symptoms.

The high prevalence of muscle pain, especially low back pain among the nursing aides indicates a need of prevention and intervention. Physical factors, such as postures adopted, psychosocial factors like peer and supervisor support are the main area for intervention. The management of nursing homes could implement taking a short nap for nursing aides on night shift between the regular routine jobs to reduce the incidence of muscle pain.

5.3 Limitations

The current research was a comprehensive cross-sectional study with objective measurement of physical workload. However, there are a few limitations that need to be addressed.

First, the linkage between shift work along with the modifiers and the MSD was not investigated. Although the physical and psychosocial factors as well as MSD symptoms have shown differences between shifts, the mechanism of how shift work effects the development of MSD was not examined.

Second, a small sample size is hard to detect statistical difference. For example, some of the psychosocial factors were marginally significant. If the sample size is

large enough, more differences should appear statistical significant and the situation of nursing aides' population should be clearer on the complex demand in nursing homes. In addition, the model of investigating the relationship of shift work through physical and psychosocial factors affect the muscle symptoms could be implemented with a larger sample size, and the factors that interact between the independent variable and dependent variable would be more efficiently tested.

Third, all subjects are female that may neglect the different physical and psychosocial response between male and female, since there are male nursing personnel work in nursing homes. The MSD could be severe for male personnel since they handle heavy weight lifting in a female dominant working environment. The family duties, response of facing stress are different for men and women.

Fourth, limit a few nursing homes with less coverage of different culture and processes tested. The environment and management of nursing homes may be different in a large scope. The current study only investigated five facilities in the greater Cincinnati area, the nursing home in the rural area could be another different situation on nursing aides shortage, shift assignment, residents characteristics (physical demand); and the social life, role conflict, peer and supervisor support (psychosocial demand) etc.

Fifth, no quantification on patient handling per hour and the weight and/or exertion force used when the patient or weight was handled, which was a limitation for physical workload measurement. The weight of the patient is important for estimating physical demand when nursing aides lift or transfer the patients. However,

the force exertion for the calculation on REBA score was estimated and could result in underestimation. In addition, the observation on the tasks, especially patient handling was not attentive. The location of tasks taking place and tasks were recorded but not very clear or in detail. That added the difficulty on estimating force exertion and on understanding the postures that nursing aides adopted when performing weight/patient handling tasks.

Sixth, the characteristics of demographic of the nursing aides could lead to bias. The nursing aides who participated in the study showed that half of the subjects were Caucasian (50.8%) and nearly half was African-American (44.3%), and a small portion were Hispanic (1.6%) and Asian (3.3%). The 8-hour evening shift was relatively younger 26.5(4.4) and employed less time with their current employer (14.9mos) and were less experienced (35.1) and more aides had child less than 3 years old. These differences could affect their response on physical and psychosocial response and muscle symptoms. Insufficient skills of nursing aides brought in stress and frustration (Lapane & Hughes, 2007; Muntaner et al., 2006); less training could result in poor posture adoption, and young child need more attention and physical demanding for nursing aides other than working jobs, which may cause muscle pain symptoms. In addition, the BMI of the nursing aides showed that they were all overweight and night shifts both 8 and 12 hours were obese. Overweight and obesity was one of the risk factors of MSD has been reported in previous studies (Bener, Alwash, Gaber, & Lovasz, 2003; Leboeuf-Yde, Kyvik, & Bruun, 1999; National Institute of Diabetes and Digestive and Kidney Diseases, 2000). There was no

significant difference on education, smoking, marital status between shifts. For overtime, as a risk factor of developing MSD (A. M. Trinkoff et al., 2006), night shift especially 12-hour day shift had worked more overtime/week. Moreover, there were a couple of nursing aides working second jobs, which could bring on more risk factors for fatigue and MSD. These factors could affect the results on physical and psychosocial response of nursing aides and add bias into the analysis.

5.4 Future Research

In the current study, significant differences were found on both physical and psychosocial workload; however, perhaps due to the amount of subjects the difference was indistinguishable. To build a model for the demands and shift work in the future, the researcher needs to recruit more subjects both male and female from more nursing homes in different areas and collect more information on the working environment, for example, the physical workload on patient handling tasks, the information on patient weight and the objective force exerted when handling the weight, not only patient, but also equipment, pushing or pulling force etc. In addition, the patient handling per hour needs to be collected for a better view of physical workload. Moreover, the continuous objective method on physical workload, especially handling loads and awkward posture simultaneously should be considered in future research to have better understanding of the mechanism of low back pain in nursing aides. On the other hand, the tasks other than patient handling should be examined since low back pain is all over the place but night shift has less weight handling tasks with a

higher prevalence. Therefore research on detailed posture analysis especially on evening and night shift will be considered in the future. Furthermore, the extended 4 more hours for 12 hour shift should be continuously investigated on physical and psychosocial aspects.

CHAPTER 6

CONCLUSION

The current research investigated the complex physical and psychosocial demands for nursing aides working in nursing homes. The shift duration (8 hours and 12 hours), and shift pattern (day, evening, night) have been evaluated together with objective physical activity level and posture observation conducted for the whole shift, which was seldom done in previous studies. Based on the results, the conclusion was drawn as following:

1. There was significant difference on physical workload among the shifts. Although 12-hour shift work involved a longer time, the workload was dispersed throughout the whole shift. Postures adopted by nursing aides were different for each of the shifts.
2. Psychosocial factors, the relationship with supervisor, coworker and peer support were significantly different among shifts, with the 12-hour shift having a better response than the 8-hour shift, and the day shift was better than the night shift.
3. Day shift aides had less prevalence of musculoskeletal symptoms than evening and night shift aides even though with the high workload. The 8-hour night shift had the highest risk of MSD compared to other shifts.

Based on the investigation, sufficient training on right posture and working habit was important for nursing aides, in order to decrease the risk of developing musculoskeletal disorders. For example, nursing aides raise up the bed when routinely check on patients which could significantly decrease the bending forward posture

above 60 degree. The relationship with the supervisor and coworkers and the peer support was essential for a healthy and happy work environment as well as lowering the turnover rate. Workshop on team work and peer support is needed as education on having good relationship with all the personnel. In addition, the shortage of nursing aides increases the physical workload for each nursing aide, how to keep their staff and maintain the right aides-residents ratio is a long term effort for nursing home management.

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888-275-4772 (Ask-HRSA) (Toll Free); TTY: 877-489-4772; Fax: 703-821-2098; e-mail: ask@hrsa.gov; Web site: http://www.ask.hrsa.gov.

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Appendices

General Information Questionnaire

Facility:_____
Subject:_____ Date: _____

1. Birth date:_____(mm/dd/yy) 2. Sex (circle one): Male / Female

3. Ethnicity
- ☐ Caucasian
- ☐ African American
- ☐ Hispanic
- ☐ Asian
- ☐ Other_____

4. Education (highest grade completed)
- ☐ Elementary school
- ☐ Junior high (8^{th} and 9^{th} grade)
- ☐ High School
- ☐ Junior college (1-2 years college)
- ☐ College graduate
- ☐ Graduate school

5. What is your marital status?
- ☐ Single
- ☐ Married or living with a partner
- ☐ Divorced/Separated
- ☐ Widowed

6. How many children do you have?
- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ more than 3

7. Do you have children less than 3 years old? Yes_____ No_____

8. Do you smoke? Yes___ No____

9. How long have you worked with your **present** employer? _____Years_____Months

10. How many residents you are usually assigned during a workday? _____

11. What is the patients' average weight? _____

12. How long have you worked in this job? _____Years_____months

13. Select the most appropriate description of your JOB SITUATION:

- ☐ Full-time permanent employee
- ☐ Full-time temporary employee
- ☐ Part-time permanent employee
- ☐ Casual
- ☐ Other

14. You work on:

- ☐ Day shift of 12-hour shift,
- ☐ Night shift of 12-hour shift,
- ☐ Morning shift of 8-hour shift
- ☐ Afternoon shift of 8-hour shift
- ☐ Night shift of 8-hour shift
- ☐ Rotating shift

15. How long have you worked the shift you indicated above? _____Years_____months

16. How many hours do you normally work per week in your job? _____hours/week

17. How many hours overtime do you work in an average week? _____

18. Do you work out of this facility? Yes_____ No_____

19. If yes, how many hours per week do you work on any other job? _____hours/week

Entire Shift Questionnaire

Subject ID: _____ Date: _____

The next set of questions are concerned with various aspects of your work activities. Please answer each question by placing an "X" or a check in the box with the most appropriate answer. Sometimes none of the answers fit exactly, please choose the answer that comes closest.

1. How much influence do you have over the availability of supplies and equipment you need to do your work?

   □ Very little
   □ Little
   □ A moderate amount
   □ Much
   □ Very much

2. How much influence do you have over the order in which you perform tasks at work?

   □ Very little
   □ Little
   □ A moderate amount
   □ Much
   □ Very much

3. How much influence do you have over the amount of work you do?

   □ Very little
   □ Little
   □ A moderate amount
   □ Much
   □ Very much

4. How much influence do you have over the pace of your work, that is how fast or slow you work?

   □ Very little
   □ Little
   □ A moderate amount
   □ Much
   □ Very much

5. How much influence do you have over the arrangement and decoration of your work environment?

   □ Very little
   □ Little
   □ A moderate amount
   □ Much
   □ Very much

6. How much influence do you have over the decisions concerning which individuals in your work unit do which tasks?

   □ Very little
   □ Little
   □ A moderate amount
   □ Much
   □ Very much

7. How much influence do you have over the hours or schedule that you work?

   □ Very little
   □ Little
   □ A moderate amount
   □ Much
   □ Very much

8. How much influence do you have over the decisions as to when things will be done in your work unit?

   □ Very little
   □ Little
   □ A moderate amount
   □ Much
   □ Very much

9. How much do you influence the policies, procedures, and performance in your work unit?

□ Very little
□ Little
□ A moderate amount
□ Much
□ Very much

10. How much influence do you have over the availability of materials you to do your work?

□ Very little
□ Little
□ A moderate amount
□ Much
□ Very much

11. How much influence do you have over the training of other workers in your work unit?

□ Very little
□ Little
□ A moderate amount
□ Much
□ Very much

12. How much influence do you have over work and work-related factors?

□ Very little
□ Little
□ A moderate amount
□ Much
□ Very much

The next set of questions asks about your relationships with the people that you interact with at work. Please answer each question by placing an "X" or a check in the box with the most appropriate answer. Sometimes none of the answers fit exactly, please choose the answer that comes closest.

1. How much does your immediate supervisor (boss) go out of their way to make your work life easier?

□ Very much
□ Somewhat
□ A little
□ Not at all
□ Don't have any such person

2. How easy is it to talk with your immediate supervisor (boss)?

□ Very much
□ Somewhat
□ A little
□ Not at all
□ Don't have any such person

3. How much can your immediate supervisor (boss) be relied upon when things get tough at work?

□ Very much
□ Somewhat
□ A little
□ Not at all
□ Don't have any such person

4. How much is your immediate supervisor (boss) willing to listen to your personal problems?

□ Very much
□ Somewhat
□ A little
□ Not at all
□ Don't have any such person

5. How much does other people at work go out of their way to make your work life easier?

   □ Very much
   □ Somewhat
   □ A little
   □ Not at all
   □ Don't have any such person

6. How easy is it to talk with other people at work?

   □ Very much
   □ Somewhat
   □ A little
   □ Not at all
   □ Don't have any such person

7. How much can other people at work be relied upon when things get tough at work?

   □ Very much
   □ Somewhat
   □ A little
   □ Not at all
   □ Don't have any such person

8. How much do other people at work willing to listen to your personal problems?

   □ Very much
   □ Somewhat
   □ A little
   □ Not at all
   □ Don't have any such person

9. How much does your spouse, friends, and relatives go out of their way to make your work life easier?

   □ Very much
   □ Somewhat
   □ A little
   □ Not at all
   □ Don't have any such person

10. How easy is it to talk with your spouse, friends, and relatives?

    □ Very much
    □ Somewhat
    □ A little
    □ Not at all
    □ Don't have any such person

11. How much can your spouse, friends, relatives be relied upon when things get tough at work?

    □ Very much
    □ Somewhat
    □ A little
    □ Not at all
    □ Don't have any such person

12. How much is your spouse, friends, and relatives willing to listen to your personal problems?

    □ Very much
    □ Somewhat
    □ A little
    □ Not at all
    □ Don't have any such person

The next set of questions asks you to indicate how often in the last month certain things happen at your job. Please answer each question by placing an "X" or a check in the box with the most appropriate answer. Sometimes none of the answers fit exactly, please choose the answer that comes closest.

1. How often is there a marked increase in the workload?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

2. How often is there a marked increase in the amount of concentration required on your job?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

3. How often is there a marked increase in how fast you have to think?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

4. How often have you been upset because of something that happened unexpectedly at work?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

5. How often have you felt that you were unable to control the important things?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

6. How often have you felt nervous or "stressed"?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

7. How often have you dealt successfully with day-to-day problems and annoyances?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

8. How often have you felt confident about your ability to your personal problems?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

9. How often have you felt that things were going your way?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

10. How often have you found that you could not cope with all the things that you had to do?

    □ Rarely
    □ Occasionally
    □ Sometimes
    □ Fairly often
    □ Very often

11. How often have you been able to control irritation?

    □ Rarely
    □ Occasionally
    □ Sometimes
    □ Fairly often
    □ Very often

12. How often have you felt that you were on top of things?

    □ Rarely
    □ Occasionally
    □ Sometimes
    □ Fairly often
    □ Very often

13. How often have you been angered because of things that happened were outside of your control?

    □ Rarely
    □ Occasionally
    □ Sometimes
    □ Fairly often
    □ Very often

14. How often have you felt difficulties were piling up so high that you could not overcome them?

    □ Rarely
    □ Occasionally
    □ Sometimes
    □ Fairly often
    □ Very often

The next set of questions asks about how often certain things happen at your job. Please answer each question by placing an "X" or a check in the box with the most appropriate answer. Sometimes none of the answers fit exactly, please choose the answer that comes closest.

1. How often does your job let you use the skills and knowledge you learned in school?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly Often
   □ Often

2. How often are you given a chance to do things you do best?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly Often
   □ Often

3. How often can you use the skills from your previous experience and training?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly Often
   □ Often

4. How often is there a marked increase in workload?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly Often
   □ Often

5. How often is there a marked increase in the amount of concentration required on your job?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly Often
   □ Often

6. How often is there a marked increase in how fast you have to think?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly Often
   □ Often

The next set of questions asks about how you have been feeling in general about your job. Please answer each question by placing an "X" or a check in the box with the most appropriate answer. Sometimes none of the answers fit exactly, please choose the answer that comes closest.

1. Knowing what you do now, if you had to decide all over again whether to take the type of job you now have, what would you decide? I would . . .

    - ☐ Decide without hesitation to take the same job
    - ☐ Have some second thoughts
    - ☐ Decide definitely not to take this type of job

2. If a friend of yours told you he/she was interested in working in a job like yours, what would you tell him/her? I would . . .

    - ☐ Strongly recommend it
    - ☐ Have doubts about recommending it
    - ☐ Advise against it

3. All in all, how satisfied would you say you are with your job? I am . . .

    - ☐ Very Satisfied
    - ☐ Somewhat satisfied
    - ☐ Not too satisfied
    - ☐ Not at all satisfied

Individual Job Questionnaire

Subject ID: _____ Date: _____

This set of questions are concerned with various aspects of each specific job. Please answer each question by placing an "X" or a check in the box with the most appropriate answer. Sometimes none of the answers fit exactly, please choose the answer that comes closest.

1. My job requires a great deal of concentration?

   □ Strongly agree
   □ Slightly agree
   □ Slightly disagree
   □ Strongly disagree

2. I must keep my mind on the work at all times?

   □ Strongly agree
   □ Slightly agree
   □ Slightly disagree
   □ Strongly disagree

3. I can take it easy and still get my work done?

   □ Strongly agree
   □ Slightly agree
   □ Slightly disagree
   □ Strongly disagree

4. I can let my mind wander and still do the work?

   □ Strongly agree
   □ Slightly agree
   □ Slightly disagree
   □ Strongly disagree

5. How often does your job require you to work very fast?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

6. How often does your job require you to work very hard?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

7. How often does your job leave you with little time to get things done?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

8. How often is there a great deal to be done?

   □ Rarely
   □ Occasionally
   □ Sometimes
   □ Fairly often
   □ Very often

The next set of questions asks about how you have feel about the job you just completed. Please answer the following questions about your attitude towards the job. Circle a number from 0 to 9 according to how strongly you agree with the extremes.

1. How motivated were you to do the job?

Not at all								Very Much
1	2	3	4	5	6	7	8	9

2. Do you think the content of the job was?

Very Dull								Very Interesting
1	2	3	4	5	6	7	8	9

3. How eager were you to do well at the job?

Very Eager								Very little
1	2	3	4	5	6	7	8	9

4. How do you feel after doing the job?

More Cooperative								More Annoyed
1	2	3	4	5	6	7	8	9

5. How much mental effort did you exert?

Very Little								A Great Deal
1	2	3	4	5	6	7	8	9

6. I wanted to succeed on this job?

Very Much								Very Little
1	2	3	4	5	6	7	8	9

7. How would you feel if you performed badly in the next job?

Very Unconcerned								Very Upset
1	2	3	4	5	6	7	8	9

8. I think that doing this job was?

Very Worthwhile								A Waste of Time
1	2	3	4	5	6	7	8	9

9. Please rate your MENTAL DEMAND: How much mental and perceptual activity was required?

Low								High
1	2	3	4	5	6	7	8	9

10. Please rate your PHYSICAL DEMAND: How much physical activity was required?

Low								High
1	2	3	4	5	6	7	8	9

11. Please rate your TEMPORAL DEMAND: How much time pressure did you feel due to the pace at which the job tasks occurred?

Low								High
1	2	3	4	5	6	7	8	9

12. Please rate your PREFORMANCE: How successful do you think you were in accomplishing the goals of the job?

Low								High
1	2	3	4	5	6	7	8	9

13. Please rate your EFFORT: How hard did you have to work (mentally and physically) to accomplish your level of performance?

Low								High
1	2	3	4	5	6	7	8	9

14. Please rate your FRUSTRATION: How discouraged, irritated, stressed, and annoyed did you feel during the last job?

Low								High
1	2	3	4	5	6	7	8	9

For the next set of questions, you will be asked to look at a list of words that describe people's moods or feelings. Please indicate how well each word describes how you felt WHILE PERFORMING THE JOB. For each word, circle the answer from 1 to 4 which best describes your mood.

1. Happy
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

2. Dissatisfied
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

3. Energetic
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

4. Relaxed
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

5. Alert
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

6. Nervous
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

7. Passive
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

8. Cheerful
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

9. Tense
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

10. Jittery
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

11. Sluggish
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

12. Sorry
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

13. Composed
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

14. Depressed
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

15. Restful
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

16. Vigorous

1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

17. Anxious
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

18. Satisfied
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

19. Unenterprising
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

20. Sad
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

21. Calm
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

22. Active
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

23. Contented
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

24. Tired
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

25. Impatient
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

26. Annoyed
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

27. Angry
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

28. Irritated
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

29. Grouchy
1) Definitely 2) Slightly 3) Slightly Not 4) Definitely Not

Quality of Worklife Module (NIOSH)

Please answer each question by circling the number in front of each question with the most appropriate answer. Sometimes none of the answers fit exactly, please choose the answer that comes closest.

1. How would you describe your work arrangement in your main job?

1 I work as an independent contractor, independent consultant, or freelance worker
2 I am on-call, and work only when called to work
3 I am paid by a temporary agency
4 I work for a contractor who provides workers and services to others under contract
5 I am a regular, permanent employee (standard work arrangement)

2. How long have you worked in your present job for your current employer?

1 LESS THAN 6 MONTHS
2 6-12 MONTHS
3 ENTER YEARS

3. In your main job, are you salaried, paid by the hour, or what?

1 Salaried
2 Paid by the hour
3 Other (SPECIFY)

4. Which of the following best describes your usual work schedule?

1 Day shift
2 Afternoon shift
3 Night shift
4 Split shift
5 Irregular shift/on-call
6 Rotating shifts

5. How many days per month do you work extra hours beyond your usual schedule? ___

6. When you work extra hours on your main job, is it mandatory (required by your employer)?

1 YES
2 NO

7. How often are you allowed to change your starting and quitting times on a daily basis?

1 Often
2 Sometimes
3 Rarely
4 Never

8. How often do you work at home as part of your job?

1 Never
2 A few times a year
3 About once a month
4 About once a week
5 More than once a week
6 Worker works mainly at home

9. (This question applies only to people who indicate that they work at home as part of their job.)
Is it usually because you want to, you have to in order to keep up with your job, or for some other reason?
1 Worker wants to work at home
2 Worker has to work at home to keep up with job
3 Other combinations and other reasons

10. How hard is it to take time off during your work to take care of personal or family matters?
1 Not at all hard
2 Not too hard
3 Somewhat hard
4 Very hard

11. How often do the demands of your job interfere with your family life?
1 Often
2 Sometimes
3 Rarely
4 Never

12. How often do the demands of your family interfere with your work on the job?
1 Often
2 Sometimes
3 Rarely
4 Never

13. After an average work day, about how many hours do you have to relax or pursue activities that you enjoy? __

14. Do you have any jobs besides your main job or do any other work for pay?
1 YES
2 NO

15. Now I'm going to read you a list of statements that might or might not describe your main job. Please tell me whether you strongly agree, agree, disagree, or strongly disagree with each of these statements.
My job requires that I keep learning new things
1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

16. My job requires that I work very fast
1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

17. I get to do a number of different things on my job

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

18. I have a lot of say about what happens on my job

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

19. My main satisfaction in life comes from my work

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

20. I have too much work to do everything well

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

21. On my job, I know exactly what is expected of me

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

22. My job lets me use my skills and abilities

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

23. At the place where I work, I am treated with respect

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

24. I trust the management at the place where I work

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

25. The safety of workers is a high priority with management where I work

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

26. There are no significant compromises or shortcuts taken when worker safety is at stake

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

27. Where I work, employees and management work together to ensure the safest possible working conditions

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

28. The safety and health conditions where I work are good

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

29. I am proud to be working for my employer

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

30. Conditions on my job allow me to be about as productive as I could be

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

31. The place where I work is run in a smooth and effective manner

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

32. Workers need strong trade unions to protect their interests

1 Strongly Agree
2 Agree
3 Disagree
4 Strongly Disagree

33. In your job, do you normally work as part of a team, or do you work mostly on your own?

1 Yes, I work as part of a team
2 No, I work mostly on my own

34. In your job, how often do you take part with others in making decisions that affect you?

1 Often
2 Sometimes
3 Rarely
4 Never

35. How often do you participate with others in helping set the way things are done on your job?

1 Often
2 Sometimes
3 Rarely
4 Never

36. How often are there not enough people or staff to get all the work done?

1 Often
2 Sometimes
3 Rarely
4 Never

37. Now I'm going to read you another list of statements about your main job. For each, please tell me if the statement is very true, somewhat true, not too true, or not at all true with respect to the work you do.

The chances for promotion are good
1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

38. I have an opportunity to develop my own special abilities

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

39. I receive enough help and equipment to get the job done

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

40. I have enough information to get the job done

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

41. I am given a lot of freedom to decide how to do my own work

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

42. My fringe benefits are good

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

43. My supervisor is concerned about the welfare of those under him or her

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

44. I am free from the conflicting demands that other people make of me

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

45. Promotions are handled fairly

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

46. The people I work with take a personal interest in me

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

47. The job security is good

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

48. My supervisor is helpful to me in getting the job done

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

49. I have enough time to get the job done

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

50. The people I work with can be relied on when I need help

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

51. I have the training opportunities I need to perform my job safely and competently

1 Very true
2 Somewhat true
3 Not too true
4 Not at all true

52. In general, how would you describe relations in your work place between management and employees?

1 Very good
2 Quite good
3 Neither good nor bad
4 Quite bad
5 Very bad

53. Does your job require you to do repeated lifting, pushing, pulling or bending?

1 YES
2 NO

54. Does your job regularly require you to perform repetitive or forceful hand movements or involve awkward postures?

1 YES
2 NO

55. When you do your job well, are you likely to be praised by your supervisor or employer?

1 Yes
2 Maybe
3 No

56. When you do your job well, are you likely to get a bonus or pay increase?

1 Yes
2 Maybe
3 No

57. How fair is what you earn on your job in comparison to others doing the same type of work you do?

1 Much less than you deserve
2 Somewhat less than you deserve
3 About as much as you deserve
4 Somewhat more than you deserve
5 Much more than you deserve

58. Do you feel that the income from your job alone is enough to meet your family's usual monthly expenses and bills?

1 YES
2 NO

59. Were you laid off your main job at any time in the last year?

1 YES
2 NO

60. How easy would it be for you to find a job with another employer with approximately the same income and fringe benefits as you have now?

1 Very easy to find similar job
2 Somewhat easy to find similar job
3 Not easy at all to find similar job

61. Taking everything into consideration, how likely is it you will make a genuine effort to find a new job with another employer within the next year

1 Very likely
2 Somewhat likely
3 Not at all likely

62. Do you feel in any way discriminated against on your job because of your age?

1 YES
2 NO

63. Do you feel in any way discriminated against on your job because of your race or ethnic origin?

1 YES
2 NO

64. Do you feel in any way discriminated against on your job because of your gender?

1 YES
2 NO

65. In the last 12 months, were you sexually harassed by anyone while you were on the job?

1 YES
2 NO

66. In the last 12 months, were you threatened or harassed in any other way by anyone while you were on the job?

1 YES
2 NO

67. Would you say that in general your health is Excellent, Very good, Good, Fair, or Poor?

1 Excellent
2 Very good
3 Good
4 Fair
5 Poor

68. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good? __

69. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good. __

70. During the past 30 days, for about how many days did your poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation? __

71. How often do you find your work stressful?

1 Always
2 Often
3 Sometimes
4 Hardly ever
5 Never

72. How often during the past month have you felt used up at the end of the day?

1 Very often
2 Often
3 Sometimes
4 Rarely
5 Never

73. In the past 12 months, have you had back pain every day for a week or more?

1 YES
2 NO

74. In the past 12 months, have you had pain in the hands, wrists, arms, or shoulders every day for a week or more?

1 YES
2 NO

75. In the past 12 months, how many times have you been injured on the job? __

76. Have you had any assaults by residents in your current job?

1 YES

2 NO

76.1 (This two question applies only to people who answered YES on question 76.)
Please indicate the frequency of assaults by residents in your current job using the following descriptive ratings

1 less than once per month
2 once per month
3 every couple weeks
4 once a week
5 a couple times per week
6 every day

76.2 Please describe your frequency of reporting assaults to your supervisors categorized by the following responses

1 never
2 seldom
3 occasionally
4 often
5 always.

77. All in all, how satisfied would you say you are with your job?

1 Very satisfied
2 Somewhat satisfied
3 Not too satisfied
4 Not at all satisfied

Symptom Survey

Subject ID_____ Date _____

1. Are you currently experiencing pain in any of the following body regions? Please check one of the levels of pain?

	None	Mild	Moderate	Severe
Low back	☐	☐	☐	☐
Lower leg and foot	☐	☐	☐	☐
Shoulder	☐	☐	☐	☐
Neck	☐	☐	☐	☐
Hand and wrist	☐	☐	☐	☐
Knee	☐	☐	☐	☐
Elbow	☐	☐	☐	☐
Hip	☐	☐	☐	☐

2. Have you ever been told by a **PHYSICIAN** that you had any of the following? Please check yes or no for each diagnosis.

	Yes	No
Ruptured, herniated or slipped disk in **back**	☐	☐
Ruptured, herniated or slipped disk in **neck**	☐	☐
Tendonitis	☐	☐
Joint problems	☐	☐
Carpal tunnel syndrome	☐	☐
Epicondylitis (tennis elbow),	☐	☐
Tenosynovitis	☐	☐
Rotator cuff tendonitis or tear	☐	☐
Tension neck syndrome	☐	☐

The next set of questions will be asking about the pain and discomfort that you may have suffered in **THE PAST 12 MONTHS (YEAR)**:

3. In the past year, how much **low back pain** have you had?

- ▯ Rarely or never
- ▯ Some of the time → Would you describe this pain as:
- ▯ All of the time → ▯ mild ▯ moderate ▯ severe

For this pain, have you seen a:
▯ None ▯ Doctor ▯ Chiropractor ▯ Other:_____

In the past year, how much missed work due to this pain?
- ▯ 0 days
- ▯ less than 1 week
- ▯ 1 - 2 weeks
- ▯ 3-4 weeks
- ▯ more than 4 weeks

4. In the past year, how much **lower leg and foot pain** have you had?

- ▯ Rarely or never
- ▯ Some of the time → Would you describe this pain as:
- ▯ All of the time → ▯ mild ▯ moderate ▯ severe

For this pain, have you seen a:
▯ None ▯ Doctor ▯ Chiropractor ▯ Other:_____

In the past year, how much missed work due to this pain?
- ▯ 0 days
- ▯ less than 1 week
- ▯ 1 - 2 weeks
- ▯ 3-4 weeks
- ▯ more than 4 weeks

5. In the past year, how much **shoulder and neck pain** have you had?

- ▯ Rarely or never
- ▯ Some of the time
- ▯ All of the time

Would you describe this pain as:
▯ mild ▯ moderate ▯ severe

For this pain, have you seen a:
▯ None ▯ Doctor ▯ Chiropractor ▯ Other:_____

In the past year, how much missed work due to this pain?
- ▯ 0 days
- ▯ less than 1 week
- ▯ 1 - 2 weeks
- ▯ 3-4 weeks
- ▯ more than 4 weeks

6. In the past year, how much **hand and wrist pain** have you had?

- ▯ Rarely or never
- ▯ Some of the time
- ▯ All of the time

Would you describe this pain as:
▯ mild ▯ moderate ▯ severe

For this pain, have you seen a:
▯ None ▯ Doctor ▯ Chiropractor ▯ Other:_____

In the past year, how much missed work due to this pain?
- ▯ 0 days
- ▯ less than 1 week
- ▯ 1 - 2 weeks
- ▯ 3-4 weeks
- ▯ more than 4 weeks

7. In the past year, how much **knee pain** have you had?

- ▯ Rarely or never
- ▯ Some of the time →
- ▯ All of the time →

Would you describe this pain as:
▯ mild ▯ moderate ▯ severe

For this pain, have you seen a:
▯ None ▯ Doctor ▯ Chiropractor ▯ Other:_____

In the past year, how much missed work due to this pain?
- ▯ 0 days
- ▯ less than 1 week
- ▯ 1 - 2 weeks
- ▯ 3-4 weeks
- ▯ more than 4 weeks

8. In the past year, how much **ankle and foot pain** have you had?

- ▯ Rarely or never
- ▯ Some of the time →
- ▯ All of the time →

Would you describe this pain as:
▯ mild ▯ moderate ▯ severe

For this pain, have you seen a:
▯ None ▯ Doctor ▯ Chiropractor ▯ Other:_____

In the past year, how much missed work due to this pain?
- ▯ 0 days
- ▯ less than 1 week
- ▯ 1 - 2 weeks
- ▯ 3-4 weeks
- ▯ more than 4 weeks