Shift work research in the Philippines: current state and future directions

Jingky P. Lozano-Kühne[7]*, Maria Eliza R. Aguila[1],

Gayline F. Manalang, Jr.[2], Richard Bryann Chua[3], Roselyn S. Gabud[5],
Eduardo R. Mendoza[4,6]

[1] Department of Physical Therapy, College of Allied Medical Professions,
[2] Department of Environmental and Occupational Health, College of Public Health,
[3] Department of Physical Sciences and Mathematics, College of Arts and Sciences,
   University of the Philippines Manila

[4] Department of Computer Science, College of Engineering,
   University of the Philippines Diliman

[5] Institute for Informatics,
[6] Faculty of Physics and Center for NanoScience,
   Ludwig-Maximillians-Universität München

[7] Department of Public Health, University of Oxford

Shift work has been reported to affect the worker's health and well-being. However, the many interacting factors involved in shift work make it difficult to understand the mechanism underlying its effects. The currently rising demand for shift workers in the Philippine business process outsourcing (BPO) industry, particularly in the contact center sector, has spurred increased interest in research on the effects of shift work on Filipino workers. The fact that shift work affects employees' health and well-being, and in turn affects economic productivity, gives enough reason for doing shift work studies. In this paper, we review research publications, project reports and theses (graduate and undergraduate) to determine the current state of knowledge on shift work in the Philippines and to define future research directions. Results of this review indicate that many aspects of shift work have been explored in studies in the Philippines, but there is still a big gap in knowledge that needs to be addressed. While there are studies that investigated health effects, job satisfaction, job performance, lifestyle, risk behaviors and other topics, the number of studies done in the country is still quite limited and the variables investigated do not allow comparison with situations in other countries. There is still a need for more detailed studies to be able to provide empirical evidence on shift work's effects on Filipino workers and to be able to make relevant interventions to improve the workers' health and well-being. In terms of research questions, there are no local studies that looked into chronic diseases such as

cardiovascular diseases and cancer. There are also no published studies yet that investigated the Filipino chronotype in relation to shift work. The chronotype characterizes how an individual's internal biological clock synchronizes to the external clock. The importance of chronotype in shift work research has been shown in studies in other countries. However, the chronotype variation among Filipinos is not yet known. Other untapped topics on shift work research in the Philippines include light and shift work, speech ability and shift work, actual physical work load and time pressure, exposure to heat, dust or other hazards during shift work, dermatological problems related to shift work, genes and shift work, social and psychological aspects of shift work and long term effects of shift work. We also included here a framework of research approaches on how to thoroughly investigate the effects of shift work on the worker's health and well-being. The framework was adopted from the European project consortium called ClockWORK which aimed to optimize the individual's structure of work, free time and sleep. An offshoot of the ClockWORK project is the PhilSHIFT initiative. PhilSHIFT is an interdisciplinary group of researchers from the University of the Philippines and the Ludwig-Maximilians-Universität München studying chronotype variation among Filipinos and shift work in the Philippines.

KEYWORDS

shift work, contact center, call center, business process outsourcing (BPO) industry, circadian system desynchronization, chronotype, chronobiology, occupational health

INTRODUCTION

The effects of shift work on a person's health and well-being have been shown in several studies. Acute health effects (e.g., sleep and digestive disturbances), chronic effects (e.g., metabolic and cardiovascular pathologies and increased cancer risk) and social effects have been reported in different shift work studies (Kantermann et al. 2010).

Recently, public awareness on shift work in the Philippines has increased with the quick rise in the past ten years of the business process outsourcing (BPO) industry in the country. The BPO industry provides services which include medical transcription, computer animation, software development, engineering and architectural design, back office operation, human resource management services, and other professional services, with the contact center or call center sector as the biggest component (Sibal 2011). Professional organizations in the Philippine BPO industry include the Animation Council of the Philippines Incorporated, Business Processing Association of the Philippines, Contact Center Association of the Philippines, Gaming Development Association of the Philippines, Health Information Management Outsourcing Association of the Philippines and the Philippine Software Industry Association. The booming industry which employs mostly shift workers has

expanded at a fast rate in the last decade contributing revenues of 350 million U.S. dollars (USD) in 2001 to 7.2 billion USD in 2009 (UPDPI/ILO 2010). The BPO industry in the Philippines currently employs around 400,000 employees (Bajaj 2011). Most of these employees are shift workers. Non-shift workers in the industry are usually those with administrative positions. The Philippines surpassed India as the leading BPO provider in 2010 in the pure voice-based revenue (Lal 2010). Continued growth of the industry is predicted with a yearly increase of 25 to 30 percent in financial benefits (Bajaj 2011).

The currently rising demand for shift workers in the Philippines especially in the BPO industry indicates positive economic effects. However, it also poses several issues and concerns about its shift workers. The fact that shift work affects employees' health and well-being and in turn affects economic productivity spurred interest among several investigators to study it in detail in different settings.

This paper aims to determine the current state of knowledge on shift work and its effects on the Filipino workers and to define future research directions in studying shift work in the local setting. We do not intend to do a meta-analysis of previous studies in this paper. And although the aim is to learn what is known in Philippine literature about shift work effects, we only present here a general description of the studies and an overview of results. Some of the reviewed studies have more information to offer while others have less. In other cases, we are also limited by the availability of the complete research report. We hope that the general information presented in this paper would help generate ideas for researchers who want to pursue the topic. The readers who are interested in details not mentioned in this paper (e.g., procedures used in the data collection of each study, socio-demographic details, statistical methods employed, technical definition of variables and other terms) may want to look into the cited original publications or research reports. This paper is divided into five major parts: (1) definition and evolution of shift work in the Philippines, (2) description of local shift work studies, (3) findings of local shift work studies, (4) gaps in knowledge, future directions and issues in shift work research, and (5) recommended approaches in shift work research.

Definition and Evolution of Shift Work in the Philippines

In a rough and general sense, shift work is an employment practice that involves different work schedules or shifts aside from the usual "standard" day shift (e.g., 8 a.m. – 5 p.m.). It is a mode of scheduling hours of work to ensure continuity in the service or production process. Others loosely define it as an arrangement that involves irregular hours or rotating hours. Kantermann (2008) presented different aspects of shift work, which make it difficult to have a simple universal definition (See Table 1). Shift work schedules can be described in more detail other than categorizing it as morning, midday or night shift. A shift work schedule can also be characterized by the direction of schedule rotation. For example, a worker can have a clockwise

or counterclockwise rotating schedule or just a permanent morning or night shift work. The frequency of shift rotation and the length of shift work in hours are also important aspects to consider in defining shift work schedules. Unfortunately, many shift work studies fail to characterize the different aspects of the shift work schedule. Kantermann (2008) also advised researchers to carefully interpret results of studies which only measured the total years of shift work that an individual experienced.

Shift work schedules may vary greatly between industries within a country and also between countries. In the Philippines,

Figure 1. Classification of reviewed literature related to shift work in the Philippines.

Figure 2. The online site of the PhilMCTQ – a questionnaire for assessing the Filipino Chronotype.

the shift work system commonly implemented in the manufacturing and service industries from the early period of its industrial undertakings is categorized as continuous, semi-continuous or discontinuous. A *continuous* shift system operates around the clock without a daily or weekly break and without public holidays. A *semi-continuous* shift work also operates around the clock without a daily break and may also operate on public holidays but has breaks on certain days such as weekends. On the other hand, a *discontinuous* shift work operates less than 24 hours a day and therefore includes a daily break and usually a weekend break as well (Manigque et al. 1985). Shift schedules are arranged to comply with the normal eight hours of work provided by law. In an industry operating on a continuous or semi-continuous shift system, three types of shift schedules are defined, i.e. first, second and third shift. Usually, the shift time schedules are defined as follows:

- *first shift* : 6 a.m. to 2 p.m.
- *second shift* : 2 p.m. to 10 p.m.
- *third shift* or *graveyard shift* : 10 p.m. to 6 a.m.

Other companies use different starting times such as 8 a.m. or 11 p.m. for the first shift. During shifts, meal and coffee breaks can be availed by employees and those who work between 10 p.m. and 6 a.m. receive an additional pay. In accordance with Article 86 of the Labor Code of the Philippines, the hourly additional pay of an employee working between 10 p.m. and 6 a.m. should not be less than 10 percent of his regular wage per hour (Presidential Decree No. 442 1974 (art) 86). Shift work schedules may be affected by the demand for the services or products, number of available workers, availability of raw materials and other factors. When there is a high demand for products or there is a depleted number of workers, shift schedules may be made to overlap and workers can also render overtime services. A 12-12 hour scheme is sometimes practiced in some companies, allowing workers to work four extra hours beyond their usual number of working hours (Manigque et al. 1985).

Aside from the BPO industry, establishments such as hotels, restaurants, shopping malls, entertainment businesses, security agencies, transport establishments and health care industries also employ a lot
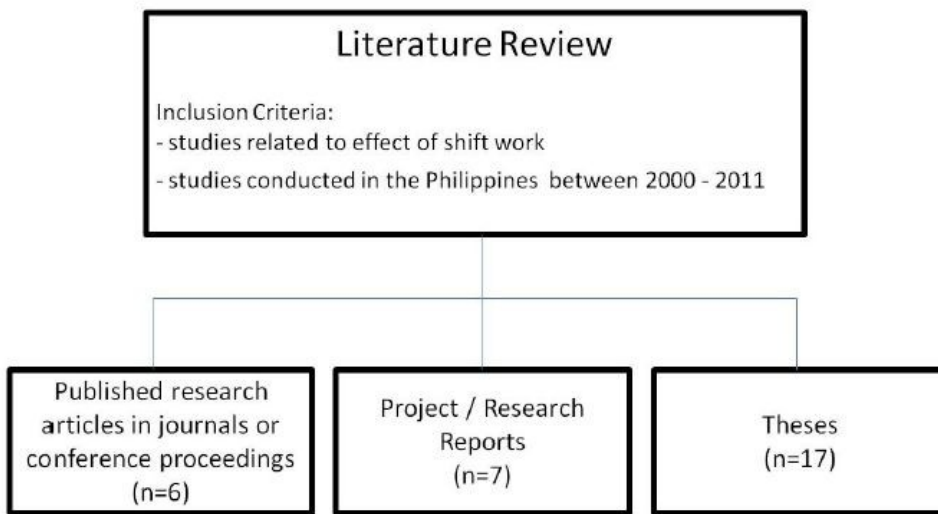
of shift workers. The shift work schedule in these establishments also varies. Some have longer and irregular shift work schedules. Nurses, for example, routinely work long shifts and sometimes need to do mandatory or unplanned overtime. They work irregular day and night shifts with most of them working more than 40 hours a week (De Castro 2010). Before the entry of the BPO industry in the Philippines, nurses were the typical subjects in studies concerning shift work, occupational health, job satisfaction and performance evaluation. With the surge of the BPO industry at the start of the century, shift work in the Philippines became more associated with contact center or call center employees than with factory or hospital workers. A new group of shift workers evolved from the increased demand for employees in the contact center sector of the BPO industry. Compared to manufacturing industry and health sector workers whose shift schedules are primarily designed based on product demand and availability of employees, the BPO industry shift schedules are primarily adapted to the time zones and geographical location of clients. For example, a work shift from 6p.m. to 3a.m. (Manila time) is oriented towards servicing US East Coast clients while the shift from 3p.m. to 12 noon is for servicing clients in the US West Coast. The scheduling is also affected by the nature of the line of business, business seasonality, employees' technical expertise and language skills.

According to the Business Processing Association of the Philippines (BPAP), shift work schedule in the Philippine BPO industry can be generally categorized as follows:

- *Morning shift* : typically starts before 12 p.m. - for regular office functions of the company (e.g., human resources); also for Australia / New Zealand client support;
- *Mid shift* : typically starts between 12 p.m. to 3 p.m. – for UK client support;
- *Night shift* : starts after 3 p.m. – for US client support.

Shift workers may be assigned on *permanent shift* or may assume *rotating shifts*. Permanent shift workers work only on one shift schedule (e.g., closing shift) while rotating shift workers change their shift schedule after a certain period. Many BPO industries adapt a permanent shifting schedule for their employees but allow change of shift schedule on a case to case basis. Increased attention in local shift work research has been focused lately on shift workers in contact centers because of their continuously rising proportion in the Philippine workforce. Concerns about their

health and welfare became interesting themes in shift work research.

Description of Shift Work Studies in the Philippines

The earliest documented study of shift work in the Philippines dates back to the early 1980s in an exploratory study conducted by the Institute of Labor and Manpower Studies (ILMS) of the Ministry of Labor and Employment (or MOLE, now the Department of Labor and Employment). The study was supported by the International Labor Organization (ILO) and conducted on manufacturing and mining industries which first adopted the shift work system. The reported number of shift workers in December 1980, based on the Integrated Quarterly Survey of Establishments done by MOLE, was 794,000. This was roughly 5% of the total 17 million employed in 1980 (Manigque et al. 1985). Nine firms were randomly selected from the top 100 corporations in the Philippines to participate in the ILMS study. The study provided baseline information about the working conditions of shift workers at that time. It investigated shift work schedules, length of shift work per day, remuneration for doing shift work, social services for shift workers, problems encountered in shift work and the advantages and disadvantages of doing shift work. Although informative in many aspects, the study was limited in its statistical analysis.

Following the ILMS study were mostly studies conducted on a smaller scale (e.g., involving only one Philippine company). In this paper we focused mainly on researches relevant to the current shift work situation in the Philippines. Thus, we searched
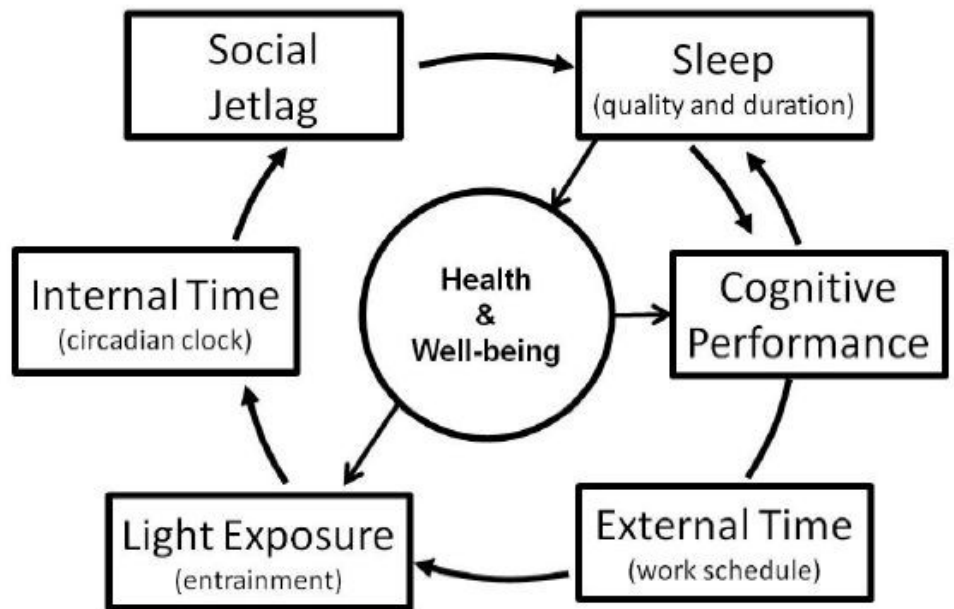

Figure 3. Conceptual framework of the ClockWork Project on health and well-being as a function of internal and external time (Mendoza and Aguila 2010)

for studies related to shift work conducted from year 2000 up to the present. This review is not a usual systematic review. Other forms of non-systematic search such as asking experts for research papers and project reports were employed because of the very few published literature on shift work in the Philippines. Initially PubMed database was used for looking for journal articles online. The search terms used were: *shift work* and *philippines*. This gave only 6 research publications and not all of them were related to what we need. Google Scholar search engine was used instead of PubMed. It gave more results including the ones shown in PubMed. Using the terms *shift* and *work* entered simultaneously resulted to almost 4 million articles excluding patents in Google Scholar. Adding the word *Philippines*, narrowed down the research result to 171 thousand web pages. Further limiting the search to articles with *abstract*, *results* and *conclusion* gave 36 thousand web pages. Modifying the search criteria using more specific terms (i.e. *"shift work" OR "shiftwork" OR "night work" OR "night job" Philippines study abstract results conclusion*) resulted in 591 articles. Excluding blog pages finally resulted in 573 articles. The titles and displayed text of these articles were manually checked to determine the relevant ones. During the manual checking, studies that were conducted from year 2000 to present and which looked into effects of shift work or its relationship with other factors were read in detail. Online news articles or documents that only cited shift work statistics or basic information were not selected. Due to the limited number of related peer reviewed publications, efforts were also made to look for research articles,

reports and theses (graduate and undergraduate) with at least an abstract. However, not all of them are accounted for in this literature review. Most research reports and theses are only available in print in local university libraries or research offices and not easily accessible to the general public. Other documents only became known to the authors through contacts with experts or word-of-mouth. In the end, only 30 studies qualified for this review. Figure 1 shows their classification.

Table 2 summarizes the characteristics of the reviewed shift work studies in the Philippines according to study design, study area, subjects or type of workers included in the study, methods of data collection and factors investigated.

Study Design. Studies on shift work in the Philippines are in general observational field studies. Most are purely descriptive studies, while some are analytic in nature. By study design, most are classified as cross-sectional studies where all factors are measured from the study subjects at one particular point or period in time. Survey methods are usually employed in cross-sectional studies. There are also those which are classified as case studies. They describe only a specific workplace and have data from key informants or a limited number of respondents. Case studies are usually done as a preliminary step to a large survey or bigger research endeavor. A few studies managed to implement a cohort design and followed-up the study subjects for the measurement of an outcome. There are no published studies yet of laboratory experimental studies related to shift work in the Philippines. One undergraduate thesis (Averia et al. 2001) which reported to have implemented an experimental design in hospital shift work measured the nurses' scores in mental health, fatigue, memory and response to stimuli tests to be able to recommend an optimal shift work schedule. Other studies (e.g., Keitel 2009) did not collect data from shift workers but instead reviewed records related to laws, policies and other issues related to shift work.

Study Area. Earlier studies on shift work include rural areas covered by mining industries, but recent shift work studies are mostly done in urban areas because the usual target subjects are either based in hospitals or offices. Metro Manila is a commonly chosen study area primarily because most BPO offices are located in the city. Other cities in the Philippines such as Metro Cebu which have contact center offices are also included in some studies. There is no study yet that characterizes shift work conditions in the whole archipelago. Most studies only focus on
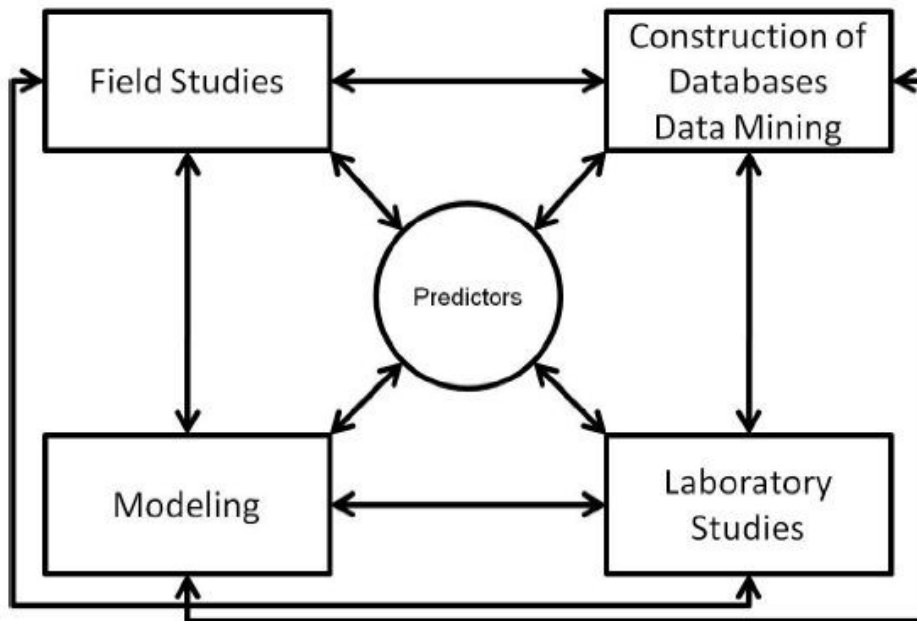

Figure 4. Research Approaches in Determining Predictors for Shift Work-Related Health Effects (adapted from the ClockWork Project)

selected urban areas where many shift workers can be found.

Study Subjects. Recent studies on shift work include contact center employees and other BPO industry employees as participants. Health care workers such as nurses were also typical subjects in earlier studies. The subjects of shift work studies are usually the young, economically productive age group. In studies which investigated contact center employees, the ages of study subjects usually ranged from 20 to 35 years old. Aside from contact centers and hospitals, study subjects have also been recruited from manufacturing industries (e.g., semi-conductor and yarn companies), aviation companies, wholesale and retail trade, hotels and restaurants, transport, storage and communications, real estate, renting and business sector, security agencies, educational and financial institutions.

Methods of data collection. All shift work studies in the Philippines are field studies. There are no studies yet performed directly in a laboratory or under simulated situation outside the real-life work setting. Like other studies in developed countries, previous researches reported difficulty in recruiting companies and employees to participate in shift work studies in the Philippines. Study subjects are usually recruited by convenience sampling due to limitations in implementing random sampling or other special sampling strategies. Subjects participate voluntarily in researches and the most common method of data collection is via self-administered survey questionnaire. Other studies conduct focus group discussions (FGDs), key informant interviews and face-to-face interviews of the study subjects. In a few studies, collection of physiological data such as heart rate and temperature was done. It is rare to find a study with repeated and follow-up data collection method. Follow-up of participants for repeated data measurement is not easy to do especially in contact centers because of the fast turnover of employees. This situation may alter the individual shift work exposure and possibly introduce bias to the research result. One of the cohort studies (OHSC 2001) included in this review followed up employees for only a few weeks. The other cohort

study (Marquez 2000) implemented a retrospective cohort study design and reviewed past records for data collection.

Factors investigated. Shift work studies in the Philippines have investigated different factors in search of possible explanations of shift work's effects on health and well-being. Demographic characteristics such as age, gender, marital status and place of residence are routinely included in most investigations. Educational background, work experience and socioeconomic status are also commonly asked. As outcome variables, studies commonly investigate health factors in relation to shift work. General, mental and reproductive health, health perception and condition, health complaints (e.g., musculoskeletal complaints, fatigue, and stress), health and safety hazards at work and nutritional status are examples of health factors investigated. Other studies (e.g., Dominguez et al.

Table 1. Different aspects of shift work schedule (adapted from Kantermann 2008).

Aspect	Definition/Example
Shift type	morning, mid, night shift
Change-over time	the starting hours of shift work schedules
Direction of rotation	clockwise shift rotation, counterclockwise, fixed or permanent night shift
Frequency of rotation	shift schedule changes every week or every month
Length of shift	8-hour, 12-hour shifts

Table 2. Characteristics of Shift Work Studies in the Philippines from 2000-2011.

Characteristic	Categories
Study Design	cross-sectional (20), case study (3), cohort (2), experimental (1), exploratory and others (4)
Study Area	usually urban area (e.g. Metro Manila, Metro Cebu)
Study Subjects	commonly contact center employees, nurses and manufacturing industry workers; some studies include employees from the following industries: aviation companies, wholesale and retail trade, hotels and restaurants, transport, storage and communication, real estate, renting and business sector, security agencies, educational and financial institutions
Methods of Data Collection	questionnaire, interview, focus group discussion, physiological data measurements (e.g. temperature, heart rate)
Factors Investigated	demographic and socio-economic factors, health (e.g. musculoskeletal disorders, sleep problems, physiological functions, occupational diseases and injuries, nutrition and eating habits, stress), job satisfaction, job performance, social interaction and marital relationship, risk behaviors, physical activities, lifestyle, quality of life, environmental factors, legal aspects and other issues and concerns related to shift work

*number in parentheses are the counts of reviewed studies

2006, Palabay and Jorge II 2007) looked into the level of sleepiness and sleep quality of Filipino shift workers. One study (Manuel and Ramos 2008) describes environmental factors that affect the quality of sleep of contact center employees. Job satisfaction and performance, work-life balance, quality of life and physical activities in relation to shift work have also been investigated. Some studies (Adala et al. 2007, UPDPI/ILO 2010, Marcos and Mariano 2008) comprehensively investigated workers' lifestyles by collecting data on consumption, expenditure, saving, diet, smoking and drinking habits, drug or substance abuse and leisure. Marital relationship, social interaction and sexual activities have also been explored in a few studies conducted in Metro Manila and Metro Cebu. Research papers on legal aspects (e.g., labor laws and policies) of shift work are also found in the literature (UPDPI/ILO 2010, Keitel 2009).

One main aspect that differs across shift work studies is the definition of shift work. Most studies loosely defined the term and categorized shift work simply as day and night shift without specifying the shift schedule. Other studies add further information about the frequency of shift work rotation -- whether it is done every 15 days, every 3 to 6 months or as required. However, there are also studies (e.g., Magpili 2011) which only looked at one shift schedule. The big variability in defining shift work as a factor in shift work studies poses difficulties in making general recommendations from the results of all studies available.

Many factors are still untapped in the field of shift work research in the Philippines. For example, circadian or biological clocks which control physiology and affect mental and physical performance (Kantermann et al. 2010) are not given much attention in the Philippine setting. In general, circadian research is not a well explored topic in the Philippines. There is one published study by Jurao et al. (2008) on the effect of circadian rhythm among Filipinos, but this was done in relation to nephrotoxicity of aminoglycosides among hospital patients and not in relation to work and shift workers. Cancer and other chronic diseases in relation to shift work are also unexplored topics in local studies.

Findings of Shift Work Studies in the Philippines

Given that most studies on shift work in the Philippines are cross-sectional in design, one cannot simply assume causal relationships between predictor and outcome variables that show significant associations in the study analysis. The succeeding sections describe the important findings in relation to the effect of shift work on an individual's health and well-being in Philippine studies.

Health. Studies that investigate the health effects of shift work have looked into different aspects. Musculoskeletal disorders involving the neck, upper back, lower back, right shoulder, upper right arm, hand and wrist have been reported

among Filipino shift workers in several researches (OSHC 2003, Jayme and Capio 2004, Asis et al. 2006). Semi-conductor workers with shorter shift (8 hour) rotation have been found to have a higher proportion of occupational diseases compared to workers with longer shift (12 hour) rotation (Gutierrez 2003). In a study among nurses, non-day shift work schedules and working mandatory overtime are associated with work-related injury and work-related illness (De Castro 2010). The study reported that 65% of nurses study participants worked more than 40 hours per week, and 23% had shifts lasting beyond 8 hours a day. More than a third of the nurses reported working a shift other than a regular day shift and 83% worked mandatory or unplanned overtime at least once per month. In terms of length of overtime work, 42% of the nurses in De Castro's study worked 1–16 hours of overtime per month.

In contact centers, health complaints concerning the eyes, cough, voice disorders and insomnia are common (OSHC 2003, Asis et al. 2006, Ho et al. 2008). The study of Dela Cuesta (2004) has shown that the work-rest ratio among outbound contact center employees is a significant predictor of the probability of workers' health complaints. An increase in shift length and more work days (i.e., 6:1 work:rest ratio) both increased the probability of workers' health complaints. Not only the health of the workers but also their productivity is affected. Contact center employees have lower success rate of calls when assigned to the afternoon or evening shift. In Dela Cuesta's study, the success rate of call is defined by the probability of having an 80 percent or higher productive calls to total calls ratio. Shift workers in contact centers have also shown job-related psychosocial stress which might be attributed to the high workload, excessive supervision and monitoring, job insecurity and unpredictable work schedules (OSHC 2007). Manuel and Ramos (2008) also affirm the difficulty of maintaining work-life balance among BPO employees, most of whom work in contact centers. In addition, night shift contact center employees have been reported to have lower general well-being compared to day shift employees (Geronimo et al. 2009).

Nutritional status is another health aspect investigated among contact center employees. The study of Adala et al. (2007) in a selected contact center found that 75% of its employees have normal body mass index (BMI) while the rest are either overweight, obese or underweight based on the BMI classification for adults. Meal patterns and dietary intake were also determined in the study using the Food Frequency Questionnaire and the 24-hour Food Recall method, respectively. The results for vitamin A, vitamin C, Thiamin, Niacin, and Riboflavin were adequate based on the recommended dietary allowance. This is probably due to the employees' intake of vitamins and dietary supplements. However, Calcium levels were found to be inadequate. In another study by Marcos and Mariano (2008) on eating habits and health of call center employees assigned on graveyard shift, no serious health risks have been found to be related to the employees' eating habits.

Most of the complaints were common colds, cough, migraine and back pain which the researchers said can be attributed more to the physical environment, stress and nature of the job than to shift work per se. However, it should be noted that the study might not have enough power to analyze thoroughly the relationship of eating habits and health because of the limited number of study subjects (n=30).

Physiological aspects have also been studied among shift workers in the Philippines. In a study which investigated female shift workers in a yarn manufacturing company, only marginal changes have been noted in the heart rate and body temperature, which were monitored for three days on both day and night shifts, suggesting that the shift workers are already adapted to the shift work (OSHC 2001). The study, however, had very limited sample size (n=15) and had recommended measurement of long-term changes in the physiological parameters.

Sleep Quantity and Quality. Sleep duration, sleep quality and daytime sleepiness have also been described in some shift work studies. One of the studies of the Occupational Safety and Health Center (OSHC 2001) observed the duration of sleep in a group of shift workers exposed to a 3-shift system (i.e., 6 a.m. to 2 p.m. or day shift, 2 p.m. to 10 p.m., 10 p.m. – 6 a.m. or night shift) that rotates every 15 days. The observed duration of sleep did not significantly change between days within a particular shift schedule. But comparing the duration of sleep between the day shift and the night shift, they noted longer sleep hours during the first two days of night shift compared to the first two days of day shift. Perceived soundness of sleep of the workers in the same study did not differ within a shift and also between day and night shift. In another study conducted by Dominguez et al. (2006) on sleepiness and sleeping patterns among air traffic controllers and communicators, the prevalence of excessive daytime sleepiness (EDS) measured by the Epworth Sleepiness Score (ESS > 10) was 63%. EDS was found to be more common among shift workers than among those who worked fixed hours. In a similar study on contact center workers and regular office workers, Palabay and Jorge II (2007) reported 55% prevalence of abnormal daytime sleepiness (ESS > 10) among the contact center shift workers and 10% prevalence among regular office workers. No correlation was noted by the study group between ESS and hours of shift, order of shift rotation, duration of rotation of shift schedule and number of days off. Prevalence of insomnia (36%), restless leg syndrome (4%) and Obstructive Sleep Apnea (7.4%) among call center workers were also observed in the study. The prevalence of insomnia among call center workers (36%) was significantly higher compared to the prevalence among regular office workers (10%). In addition to loss of sleep, a high level of anxiety is another direct effect of night shift work. This was observed among security guards by Bayot (2004). Security guards either smoke or drink coffee or other energy drinks to be able to avoid sleepiness during night shift work.

Poor quality of sleep and lack of sleep cause dissatisfaction among night shift workers. In a recent descriptive study of Magpili (2011) on sleep and environmental factors, 64% of the night shift contact center workers who were interviewed said that the environmental factors affect their sleep the most. Topping the list of factors is noise. Other factors mentioned by the respondents that affect their sleep were bright lighting, warm temperature, not being used to daytime sleep and uncomfortable sleeping areas.

Job Satisfaction / Performance. Some studies looked into job satisfaction and performance at work of shift workers. Job satisfaction is also usually reflected in employees' complaints. Dissatisfied employees experience more psychological distress and physical health problems (De Castro 2008). Work stress is also correlated with sleep problems (Ho et al. 2008). In contact centers, employees complain of high stress level which is one major reason for the high turnover rate of employees in the industry. Despite the good compensation and benefits in contact centers, the industry experiences high attrition rates (Abadilla 2010). Limited opportunities for promotion, night shift schedule, type of task and recognition at work are among the top reasons for high attrition cited by Sibal (2011). In one study, gender has been noted to be a significant predictor of job retention of contact center employees. Male employees were observed to less likely leave the job compared to female employees (Jamandre 2008). However, this cannot be generalized to the whole contact center sector as the study only looked into one contact center company. With respect to job performance, Alfaro et al. (2005) reported in their thesis that among phone bankers in a banking call center, job performance ratings significantly vary between shifts. The study noted that majority of phone bankers did not comply with call handling criteria and significant factors related to work performance include civil status, previous work experience in a similar field, average duration of sleep, feelings of fatigue associated with both work duration and rest period, work environment and motivation. In another thesis by Averia et al. (2001), this time involving rotating nurses, job performance was evaluated using memory error rate. The authors reported that nurses assigned in the night shift experience a significantly higher memory error rate, poor mental health, more subjective feelings of fatigue, and longer stimuli reaction time as compared to when they were assigned in the morning shift and to those with permanent shift schedule. In a similar thesis study on nurses done by Marquez (2000), it was found that there is a difference between the 8-hour and 12-hour shift in terms of the quality of work of nurses. The completion of the Intake and Output (I&O) sheets is better in the 8-hour shift while the completion of the IV fluid sheet is better in the 12-hour shift. However, it was also noted that the length of shifts of nurses does not affect the completion of the medication and doctor's orders sheet.

Lifestyle and Risk Behaviors. The University of the Philippines Population Institute recently finished a study on the lifestyle of workers in Metro Manila and Metro Cebu

(UPDPI/ILO 2010). The study subjects were workers in contact centers and other non-contact center industries (e.g., education, hotels and restaurants, manufacturing, wholesale-retail trade, renting and business activities, financial intermediation and real estate). The study has a relatively large number of subjects and participating industries. It included 16 contact centers contributing 675 respondents and 17 non-contact center industries contributing 254 respondents. Lifestyle factors such as consumption and expenditure, diet, smoking and drinking habits, drug/substance use, leisure activities, relationships and sexual activities were investigated. The study also looked into the level of knowledge of workers regarding reproductive health, sexually transmitted infections (STIs) and Human Immunodeficiency Virus (HIV) prevention. It has a detailed report on all the factors mentioned. Just to highlight some specific results, it was noted that workers in contact centers and non-contact centers do not significantly differ in ownership of consumer goods. However, there is a higher proportion of contact center employees in Metro Manila with cars and latest electronic gadgets such as iPod. Obviously, this is due to higher compensation enjoyed in the contact center sector. The UPDPI/ILO study (2010) also reported that contact center employees usually have irregular meals due to their irregular work schedule and majority are daily coffee drinkers and have a sedentary lifestyle. In relation to lifestyle, another study by Abesamis (2008) showed that work schedule affects the physical activity involvement of call center employees. Day shift employees were found to be more involved in physical activities such as doing exercises than employees in the graveyard shift.

With regard to relationships and sexual activities, the study of UPDPI/ILO (2010) reported that workers in the contact center industry have more active and liberal sexual behavior compared to workers in non-contact center industries. The level of knowledge in reproductive health, STIs and HIV/AIDS was higher among contact center employees than among those in the non-contact center industries. However, higher level of knowledge does not always mean lower health risks. In recent studies by Melgar et al. (2009, 2010) on risk behaviors for sexually transmitted infections among contact center employees in the Philippines, high risk behaviors (e.g., unprotected sex with multiple partners, use of alcohol during sex) were noted to exist in high frequency among the respondents.

Legal Aspects and Other Issues and Concerns. Labor laws and policies concerning shift work in the Philippines also received attention from shift work researchers. Keitel (2009) presented a review of provisions and amendments in existing Philippine labor laws concerning protecting women working at night. Sibal (2011) also elaborated on legal aspects and other issues and concerns in relation to shift work and the BPO industry. One important law that affects the BPO industry is the Philippine Labor Code – (art) 130 which imposes night work prohibition for women. The government enacted this law in 1974 in accordance with the International Labor Organization's (ILO)

recommendation to give more protection to female workers. Recently, President Benigno Aquino Jr. signed into law the "Act Rationalizing Night Work Prohibition on Women Workers". The law amended Articles 130 and 131 of the Labor Code of the Philippines, finally removing the restrictive and discriminatory provisions against women night workers.

There are studies that looked into motivations, issues, challenges and coping strategies in shift work. Using a survey questionnaire, Lorenzana and Molino (2010) asked students working as call center employees regarding work motivation, challenges and coping strategies. The work motivation was noted to be high due to the financial benefit of the job. However, problems such as excessive tardiness and absences from school, difficulties meeting school requirements and passive class participation have been observed among the working students. Some managed to develop coping strategies like studying during days off and decreasing leisure time. Others resorted to engaging in smoking or drinking habits to cope with the stress. In another study that looked into issues and challenges in shift work, also among contact center employees, respondents reported poor quality of life in the physical, mental, social and emotional aspects of living (Medina 2008). The respondents also reported difficulty in handling problems and dissatisfaction in several areas of their life including their job.

Issues and challenges in family life have also been studied in the Philippine setting. Tolentino (2008) conducted a survey among married women working in contact centers to characterize the problems and challenges encountered in the area of marital relationships. In the different aspects of marital happiness investigated, wives who work in a non-standard (e.g., graveyard shift) schedule experienced marital happiness only in the aspect of household chores. Disagreements about financial matters, problems in communication, jealousy, personal differences and insecurities were commonly cited as problems. The study was conducted only among wives working as call center employees. Whether the observed issues and challenges are more frequent in the said group than in working wives in other industries is beyond the scope of the study.

We have attempted to describe the major results of known existing researches in the Philippines related to shift work effects since 2000. There are however limitations to the coverage of this review. Other occupational studies on individual subjects that are not formally categorized as shift workers, for example workers in the entertainment business and commercial sex workers, are not included here. Although equally interesting and important, studies conducted on these groups of workers usually focus on other factors affecting health risk and not on the work or shift schedule per se. Currently, most of the recent researches available on shift workers in the Philippines involve the contact center industry which is one of the big revenue contributors to the country.

Gaps in Knowledge, Future Directions and Issues in Shift Work Research in the Philippines

Many aspects of shift work have been explored in studies in the Philippines but there is still a big gap in knowledge that needs to be addressed in this field. While there are studies that investigated health effects of shift work, the number of studies is still quite limited considering that there are no local studies yet that looked into chronic diseases such as cardiovascular diseases and cancer. Further, no studies have been done yet in the Philippines on pharmacological interventions investigating the effects of specific drugs on improving sleep and on counteracting the effect of night work on local workers. Studies that investigated physiologic functions and other health effects are also limited in number and scope to be able to provide empirical evidence on the effects of shift work and be used as bases to make relevant interventions. There is also a need for research with stronger designs to be able to answer questions on causal relationships.

As regards the role of the circadian (biological) clock which controls our physiology, behavior, mental and physical performance (Kantermann et al. 2010), there is no published study yet conducted among Filipinos in relation to shift work. Our internal biological clock which produces its own internal day synchronizes to the external 24-hour day primarily by the light-dark cycle and also by many other possible time-giving cues or *zeitgebers*. *Social jetlag*, with symptoms similar to the usual jetlag due to travelling to different time zones, can be experienced by individuals when there are discrepancies between the internal biological time and external social time (Wittmann et al. 2006, Mendoza and Aguila 2010). Social jetlag is a consequence of circadian system desynchronization with the external time. The relationship between the internal time and external time is called *phase of entrainment*. Different individuals may differ in their phase of entrainment and therefore have different *chronotypes* (Roenneberg et al. 2007). Chronotype may be quantified through the Munich Chronotype Questionnaire (MCTQ; see Roenneberg et al. 2003 for details). Some individuals may be an early-chronotype ("lark" or "early bird") while others may be a late-chronotype person ("owl"). The chronotype plays a key role in an individual's ability to adjust to shift work (Kantermann et al. 2010). It can be used to predict the degree of sleep disturbance and the degree of distress the shift workers will experience (Juda 2010). It can also be used in choosing work schedules or in choosing the proper timing to administer drugs or perform medical tests (Lee Phillips 2009). While chronotype variation has been described for other populations, no such data yet exist for Filipinos (Manalang Jr 2011).

An on-going study of the PhilSHIFT Research Group (an interdisciplinary group in shift work research; http://philshift.upm.edu.ph/) aims to determine the chronotype variation among Filipinos. People are invited to participate in the PhilSHIFT chronotyping survey by accomplishing the Philippine MCTQ (PhilMCTQ) online at http://www.bioinfo.mpg.de/thewep/. The PhilMCTQ is located under the public projects in TheWeP site. A screenshot of the web portal is shown in Figure 2. People who take part in the survey get a feedback about their chronotype. Additional information about chronotype, MCTQ and research initiatives in this field in the Philippines can be found in the article of Mendoza and Aguila (2010).

Besides assessing an individual's chronotype, Kantermann and colleagues also recommended assessing an individual's internal time or *circadian phase* during different shifts to be able to quantify the effect of alternating work times on an individual's biological clock and how it contributes to stress and the development of diseases. The internal time can be estimated by measuring the body temperature or the melatonin level. The melatonin level is a better marker than body temperature but it can be affected by light, medication, diet or other stimulants. In addition, measuring the melatonin level is expensive and time consuming (Kantermann et al. 2010). Currently, the technology to be able to measure internal time effectively is still being developed.

Interdisciplinary studies involving the circadian clock, shift work and other factors can also be implemented. In Europe, a network of specialists formed a project consortium called ClockWORK. It was funded by the Gottlieb Daimler- und Karl Benz-Stiftung for the investigation of the interaction of biological, psychological, and sociological factors that contribute to the daily structure of work and free time. The aim of the project is to be able to optimize the individual's structure of work, free time, and sleep (Roenneberg 2010). The topics investigated in the ClockWORK project from 2005 to 2010 are as follows:

- Chronobiological basis: shift work, chronotypes and risks
- Sleep, diet, temperature and vigilance
- Circadian factors in task switching, language processing and motor control
- Social jetlag in shift work
- Effects of different light environments on human circadian physiology and cognitive performance at schools and PC workplaces
- Development of sensitive methods to assess cognitive control variations in applied work settings
- Prevention of accidents caused by language-based performance deficits in shift work
- Sensorimotor performance in the daily structure of work

Detailed information about the concluded ClockWORK project may be found at http://clock-work.org and also at http://www.daimler-benz-stiftung.de/cms/index.php?page=clockwork-report-en. Some of the topics investigated in

the ClockWORK project can also be easily investigated in the Philippine setting. For example, one can conduct shift work studies to investigate the effect of light in synchronizing to different shifts in contact centers. A study on blue-enriched light (8000 Kelvin) by Vetter (2010) shows its potential to override seasonal adaptive behaviors and help workers entrain or adapt to the office hours. Knowing that the efficacy of light as time-giving cue or *zeitgeber* is affected by many factors including the individual circadian phase (Kantermann et al. 2010), it would be interesting to see if the same light effect can be observed among Filipinos. Figure 3 from Mendoza and Aguila (2010) shows the important factors (including light) affecting health and well-being in the context of internal and external time dependency.

In addition to the above-mentioned topics, other untapped topics on shift work research in the Philippines include speech ability and shift work, actual physical work load and time pressure, exposure to heat, dust and other hazards during shift work, dermatological problems related to shift work, genes and shift work, social and psychological aspects of shift work and long term effects of shift work. Most of these are not yet investigated in detail even in other countries.

Shift work studies in general face several issues. One main issue pointed out earlier is the definition of shift work. Oftentimes, studies define shift work loosely, taking for granted the time schedule, the direction of shift work rotation and also the frequency of rotation or how often a worker changes his shift schedule. The definition of shift work should be clearly laid down in a research study. Another issue that is common specifically in cross-sectional studies is the "healthy worker effect" (Li and Sung 1999). Looking at the study population at only one point in time may allow seeing only the healthy workers. Unhealthy workers who have already quit work are not usually documented. This may give an incorrect impression that all shift workers are healthy. One alternative study design to avoid the "healthy worker effect" is to do a cohort study. This involves follow-up of shift workers for a certain period of time and is ideal if one wants to measure long-term effects of shift work. However, following-up of shift workers is not that easy especially in industries where the turnover rate is fast. In addition, difficulty of recruiting study participants can be a real challenge.

Approaches in Shift Work Research

Ideally, shift work research should encompass different approaches to be able to thoroughly investigate its effect on the worker's health and well-being. Kantermann et al. (2010) described a framework of different but interrelated approaches in determining predictors that can estimate the effect of shift work on an individual's health and well-being. Figure 4 is an adaptation of the framework of the ClockWORK project described by Kantermann et al. (2010).

A candidate predictor for shift work-related health effects could be the duration and quality of sleep of an individual. Researchers from various fields can investigate predictors using different approaches. One approach is via laboratory (lab) studies. Lab studies can be either experiments or observational studies performed in the laboratory or in a non-real life setting. Laboratory experiments are usually done to develop instruments and procedures that can be used to accurately monitor for example an individual's physiological characteristics. Other laboratory experiments utilize model organisms such as mice and flies to study physiological and biological factors related to shift work. Results of these laboratory experiments on model animals are usually prerequisites to laboratory and clinical studies involving humans. The use of non-human model organisms for shift work research is quite recent and there is still a need for consensus on what "shift work" for mice or flies means. Laboratory results contribute data that can be used in data mining approaches, modeling approaches and field studies. Data mining approaches include for example neural networks, genetic algorithm, data visualization and machine learning expert system. They utilize large databases for analysis and usually employ web resources and tools.

Databases are particularly important in the research process especially in data mining approaches. Modeling approaches on the other hand can be theoretical or statistical. They can be based on empirical data from the lab or field studies. In some cases, computer simulated data can also be used. Models are useful in determining predictors that will estimate the effect of shift work on an individual's health.

Another research approach is via field studies. These are usually epidemiological studies conducted in a real-life setting. An epidemiological study can either be an observational study (e.g., case study, exploratory study, cross-sectional study, cohort study) or it can also be an interventional or experimental study that considers treatment and control groups. Similarly, the results of field studies contribute data about possible predictors. The field data can be used to create prediction models or refine existing models. They can also be fed to the database for data mining analysis or to the lab for improvement of measurement procedures. However, one issue of data from field studies is that data heterogeneity makes it difficult to mine the data. The process of determining predictors iterates in the network of the different approaches to come up with reliable predictors that can be used for making recommendations in improving shift work conditions. These predictors can again be tested in the field and their estimation can be improved again in the lab or via modeling or data-mining approach, and so on in a repeated process. This process is not an easy task and would involve multi-center projects and collaborative efforts of researchers doing different shift work studies.

Despite challenges in conducting shift work studies, various initiatives have been organized in the Philippines to determine the effects of shift work on the workers' health and well-being.

There are still a lot of things to do locally to be able to assess how different the shift work situation and the risk faced by shift workers in the Philippines are compared to other countries. With the available studies, one cannot confidently say that we know enough about the specific effects of shift work in the local setting. There is still a need for more detailed studies to be able to provide empirical evidence of shift work's effects and to be able to make relevant interventions to improve the workers' health and well-being. Currently, the high demand for shift workers in the BPO industry and the attractive financial incentives are the major considerations why workers decide to go on shift work in the Philippines. Additional information resulting from shift work studies can also help workers decide whether shift work is suited for them.

For future research, one should also keep in mind the suggested iterative approach (Figure 4) in investigating shift work. Laboratory studies and field studies as well as data mining and modeling approaches should contribute to form a network of research to be able to thoroughly investigate shift work.

CONFLICTS OF INTERESTS

All authors declare no conflict of interest.

CONTRIBUTIONS OF INDIVIDUAL AUTHORS

JPLK, MERA, GFM, RBC, RSG and ERM contributed to the planning, content and revision of the paper. JPLK wrote the paper.

REFERENCES

Major references with softcopy are available online in the PhilSHIFT Collection. Simply register with the EUCLIS website (http://www.bioinfo.mpg.de/euclis/) to be able to access the PhilSHIFT Collection which is under "Clock References".

* The references specific on shift work research in the Philippines are denoted by an asterisk.

Abadilla EV. Call centers address high Attrition Rate. The Manila Bulletin Newspaper Online. January 27, 2010. (URL: http://mb.com.ph/node/240535/call-center)

*Abesamis JB. A comparison of the physical activity involvement of call center agents based on work schedule: a case study. Thesis. University of the Philippines Diliman, 2008.

*Adala KB, Bolinguit EAB, Echon MAP, Vinluan KCJ. Nutritional status of call center agents aged 20 to 35 years at a selected company. Thesis. University of the Philippines Manila, 2007.

*Alfaro RO, De Leon CAC, Guieb PC. Analysis of factors influencing work performance in a Call Center. Thesis. De La Salle University, Philippines, 2005.

*Asis R, Navarro M, Quijano G, Rosana L, Turingan R, Co-Aseron A. Prevalence of musculoskeletal disorders among call center workers in NCR: A pilot study. Thesis. University of Sto. Tomas, Manila, Philippines, 2006.

*Averia JRC, Joson JS, Reyes JMM. An Ergonomic Study on the Shift Work of Medical-Surgical Unit Nurses of the Manila Sanitarium and Hospital. Thesis. De La Salle University, Philippines, 2005.

Bajaj V. The New York Times. A new capital for call centers. November 25, 2011. (URL: http://www.nytimes.com/2011/11/26/business/philippines-overtakes-india-as-hub-of-call-centers.html?_r=1&scp=1&sq=a%20new%20capital&st=cse)

*Bayot G. Perceived effects of night shift work on the health and well being among selected security guards in Metro Manila. Thesis. De La Salle University, Philippines, 2004.

*De Castro AB, Fujishiro K, Rue T, Tagalog EA, Samaco-Paquiz LPG, Gee GC. Associations between work schedule characteristics and occupational injury and illness. International Nursing Review 2010; 57:188–194.

De Castro AB, Gee GC, Takeuchi D. Relationship between job dissatisfaction and physical and psychological health among Filipino immigrants. AAOHN J. 2008; 56(1):33–40.

*Dela Cuesta LM. Associated effects of shift work on productivity and health in outbound call center operations. Thesis. University of the Philippines Diliman, 2004.

*Dominguez EA, Salonga R, Jorge M, Terencio J. Sleepiness and sleeping patterns among air traffic controllers and communicators. Chest 2006; 130:266S-d-267.

*Geronimo AGA, Medina AR, Menghrajani RT. The implications of work schedule on the well-being, social interaction and stress of call center employees. Thesis. De La Salle University, 2009.

*Gutierrez A. A survey on the present shiftwork practices in the semiconductor industry. Thesis. De La Salle University, Philippines, 2003.

*Ho H, Ples M, Sia Su G. Sleep Problems, Work-Stress and Health Complaints in Call Centers in Quezon City, Philippines. eHealth International Journal 2008; 4:20-23.

*Jamandre NKF. A study of the communication-related variables that contribute to the job retention of call-center agents: the case of eTelecare. Thesis. University of the Philippines Diliman, 2008.

*Jayme JB, Capio C. Incidence of Work-Related Musculoskeletal Disorders of the Elbows and Hands/Wrists Among Call Center Representatives in One Call Center. Thesis. University of the Philippines Manila, 2004.

Juda M. The importance of chronotype in shift work research. Dissertation. Faculty of Psychology, Ludwig-Maximilians-University Munich, 2010. (URL: http://edoc.ub.uni-muenchen.de/11814/)

Jurao Jr LL, Coo JC, Montero LJ. Glomerular filtration rate circadian rhythm: its relationship to aminoglycoside-induced nephrotoxicity. Phil J Microbiol Infect Dis 2008; 37(2):41-42.

Kantermann T. Challenging the human circadian clock by Daylight Saving Time. Dissertation. Ludwig-Maximilians-University Munich, 2008. (URL: http://edoc.ub.uni-muenchen.de/9428/)

Kantermann T, Juda M, Vetter C, Roenneberg T. Shift-work research:

Where do we stand, where should we go?. Sleep and Biological Rhythms 2010; 8:95–105. doi: 10.1111/j.1479-8425.2010.00432.x

*Keitel R, Ledesma DM. Night Work Prohibition of Women Workers in the Philippine Call Center Industry. Conference on Regulating for decent work: Innovative labor regulation in a turbulent world, 2009. (URL: http://www.ilo.org/legacy/english/protection/travail/pdf/rdwpaper35b.pdf)

Labor Code of the Philippines, Presidential Decree No. 442, Art. 86: 1974.

Labor Code of the Philippines, Presidential Decree No. 442, Art. 130 and 131: 1974, as amended by An Act Rationalizing The Nightwork Prohibition of Women Workers: 2011.

Lal N. Philippines pulls ahead of India in race for outsource dollars. The Jakarta Globe (November 18, 2010). http://www.thejakartaglobe.com/opinion/philippines-pulls-ahead-of-india-in-race-for-outsource-dollars/407294

Lee Philips M. Of owls, larks and alarm clocks. Nature 2009; 458:142-144.

Li CY, Sung FC. A review of the healthy worker effect in occupational epidemiology. Occup Med 1999; 49:266-229.

*Lorenzana KRC, Molina KBO. Motivations, challenges, and coping strategies of UP students as call center agents. Thesis. University of the Philippines Diliman, 2010.

*Magpili KAM. A descriptive study of the sleeping areas of selected night shift call center agents in relation to environmental factors. Thesis. University of the Philippines Diliman, 2011.

Manalang Jr GF. PhilSHIFT: Two years of working towards an understanding of the biological clock, shift work and health of Filipinos. Star Science. The Philippine Star. 10 March 2011.

Manigque E, Cadaoas JM, Elizalde Z, Espiritu E, Hamoay B, del Rosario V (Contributors). Shift work in the Philippines. Institute of Labor and Manpower Studies, Ministry of Labor and Employment, Philippines, 1985.

*Manuel CS, Ramos RR. Work Organization and Work-Life Balance in the BPO Sector: the Experiences of Selected BPO Workers in Metro Manila. University of the Philippines, SOLAIR, 2008.

*Marcos EB, Mariano MR. Dig'in the graveyard shift: a study on eating habits of call center agents. Thesis. University of … ?. 2008.

*Marquez A. A comparative study of the nurses' documentation in the 8-hour and 12-hour shift at the ICU of PCGH. Thesis. University of the Philippines Manila, 2000.

*Medina MLC. Work situation and quality of life of call center employees. Thesis. University of the Philippines Diliman, 2008.

*Melgar IE, Bangi A, Mandel J, McFarland W, Daganzo MA. Risk behaviors among young professionals in the Philippines: a qualitative study. Project Report. Institute of Philippine Culture, Ateneo de Manila University and University of California San Francisco, 2010.

*Melgar IE, Ofroneo MP, Kintanar NS, Canoy N. Risk behaviors among young professionals in the Philippines. Project Report.

International Labour Organization, 2009.

Mendoza ER and Aguila MER. Social jet lag, shift work and senior citizens. NAST Transactions 2010 (Proceedings of NAST ASM, Manila, July 14-15, 2010).

*OSHC (The Occupational Safety and Health Center), Department of Labor and Employment. Comparison of Health and Well-being of Females Working in Day and Night Shift. 2001. (URL: http://www.oshc.dole.gov.ph/ 201/)

*OSHC (Occupational Safety and Health Center), Department of Labor and Employment. Case Study on the Health, Safety and Working Conditions in a Call Center. 2003.

*OSHC (Occupational Safety and Health Center), Department of Labor and Employment. The occupational safety and health conditions in selected contact centers in the Philippines. 2007. (URL: http://www.oshc.dole.gov.ph//183/ EXAMINING-HEALTH-AND-SAFETY-IN-CONTACT-CENTRES)

*Palabay C, Jorge II M. Comparative Study of Sleeping Patterns and Daytime Sleepiness of Call Center Employees and Regular Office Workers. Phil J Internal Med 2007; 45:49-56.

Roenneberg T. ClockWORK – Auf dem Weg zu optimierten Arbeitszeitmodellen. From Lab to Labour. Abschlusskonferenz des Ladenburger Kollegs ClockWORK – ein Förderschwerpunkt der Gottlieb Daimler- und Karl Benz-Stiftung, 16 June 2010, Berlin.

Roenneberg T, Kuehnle T, Juda M, Kantermann T, Allebrandt K, Gordjin M, Merrow M. Epidemiology of the human circadian clock. Sleep Med Rev 2007; 11:429 – 438.

Roenneberg T, Wirz-Justice A, Merrow M. Life between clocks: daily temporal patterns of human chronotypes. J Biol Rhythms 2003; 18:80–90.

*Sibal JV. Strengthening offshoring in the Philippines: issues and concerns. The Forum 2011; 12(3). (URL: http://www.up.edu.ph/upforum2.php?i=67&pg=99&pgidx=1&pgmax=7&issue=42)

*Tolentino ML. The effects of call center shiftwork on marital relationships. Thesis. University of the Philippines Diliman, 2008.

*UPDPI (University of the Philippines Diliman Population Institute) / ILO (International Labor Office). Lifestyle, health status and behavior of young workers in call centers and other industries: Metro Manila and Metro Cebu. Final Report (submitted on March 12, 2010).

Vetter C. Clocks in action: Exploring the impact of internal time in real life. Dissertation. Faculty of Psychology, Ludwig-Maximilians-University Munich, 2011. (URL: http://edoc.ub.uni-muenchen.de/12749/)

Wittmann M, Dinich J, Merrow M, Roenneberg T. Social jetlag: misalignment of biological and social time. Chronobiology International 2006; 23(1&2):497-509. (URL: http://www.grp.hwz.uni-muenchen.de/pdf/wittmann_pdf/Wittmann06_Social%20Jetlag.pdf)