Perceived Work Strain as Indicator for Occupational Risks in Thai Female Field Activities

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Abstract

Human activities are important in any socio-economic professional work system of which the efficiency and the occupational risks for the human integrity are determined by imbalances between the job related workload and individual capacity. Evaluating the risks linked to imbalances between workload and capacity requires not only objective analysis of working conditions but also the less evident perceived strain formulated in subjective symptoms which are good indicators for future problems.

This study reports about the use of the perceived discomfort by means of the SWI (Subjective Workload Index) questionnaire. The subjects rate their experienced discomfort on an 11 point scale ranging from 0 (no problems) to 10 (extremely problematic) for 6 ‘work-related load’ factors (fatigue, risks, concentration, complexity, work rhythm and responsibility) and 2 ‘compensating’ factors (interest in the job and degree of autonomy) which attenuate the perceived load. An average score exceeding 2.5 reflects a risky work condition. 334 Thai female subjects, aged between 33-35 years, active in 4 different occupations (nurses, construction, garment and office) voluntarily participated in the study and rated their perceived discomfort through the SWI questionnaire. Despite the huge diversity in activities and individual capacities the SWI revealed specific risk factors. The average score of the 4 occupations in this study was 3.1 ± 0.07 with significant differences between the occupations ($P < 0.05$, Cronbach’s Alpha 0.63), Conclusions: The SWI correlated significantly with some job-related factors and objective cardiac strain (0.81 to 0.51 $P < 0.01$) and revealed useful evidence based risk-information.

Keywords: Risk assessment, Stress-strain, Subjective Workload Index, Cardiovascular load

Introduction

In an industrial setting the economic reality of the daily concern incites human resource researchers to respect the needs of stakeholders, employees and authorities. This includes a particular attention to the optimization and efficiency of productivity and to the quality of life issues (health, safety, well-being), to the consequences of unemployment, and none the least, to a good social environment, contributing to the countries' socio-economic welfare.

Essential in the development of prevention strategies is having good knowledge of the risk creating imbalances between workload and the workers' physical, intellectual and mental capacities, their experiences and skills.

Risk assessment methods have been developed worldwide. In most cases they are based on the retro-active analysis from proven imbalance-signs: accidents, injuries, diseases, absenteeism rates, productivity (quality and quantity), social conflicts etc. The causal combinations for damages in man-at-work systems lead to the establishment of checklists (putting the emphasis on the technical risks) and questionnaires (linking the risks with the impact on the exposed workers).

Many checklists and questionnaires have been developed and are widely used, such as for example the NIOSH lifting equation (Nelson, Wickes, & Jason, 1994) covering most aspects about material handling and lifting (frequency, weights, sizes, distances etc...) and the OCRA, Occupational Repetitive Action Index (Occhipinti & Colombini,1996) for repetitive work, the Nordic musculoskeletal questionnaire (Kuorinka, Jonsson, & Kilbom A,1980. Despite all available tools, there is no substantial progress in reducing the prevalence rates and their consequences of MSD and other cumulative trauma disorders and injuries.

Although these assessment techniques are useful and necessary to understand the problems as to steer the design of new conditions, such approaches only can be carried out after the problems occurred. The prediction of the efficiency of designed measures is therefore – unless in very clear cause-effect relations – discussable, uncertain and unreliable because of the differences in subjects, working conditions, materials, organization, are rarely, seldom, or never identical. As a consequence of the huge diversities there is no valid omniscient design which can guarantee a damage-free work-system because the most precarious factor lays in the management of the human operational behavior.

This behavior is determined by the personal information processing, in which the operator handles validation criteria which are often different from the existing advises, guidelines and directives. The individual criteria which steer the individual unconscious or cognitive decision-making have a much more subjective character. The values are life timely memorized as perceived experiences(pleasant, good, necessary, annoying, bad, risky, etc.) and determine, in a large extend the final operational behavior.

Because the effects of imbalanced working conditions are firstly recognized by a subjective awareness (fatiguing, unpleasant, annoying or painful), these experiences are essential in prevention as they may generate a risk anticipating behavior. However, caution should be paid to the fact that the mental status of the operator (either normal, under- or over-motivating, or other reasons), may influence the anticipating strategy.

Risk assessment of man-at-work systems should include all relevant interacting factors, i.e. work-related conditions (task, organization and environment) and the intrinsic capacities (physical, psycho-mental, intellectual and emotional) in one all-integrating device. This device could be the operator, who is exposed to all stressors with its skills and capacities.

The missing links in an overall risk assessment approach concern the human operators' reactions and not only the objective observable behavioral reactions, but also the physiological responses and the subjective experiences of perceived problems.

These considerations have been introduced in the SWI – Subjective Workload Index – in which the main goal is to obtain information about individually experienced problems, preceding the objective consequences as injuries, diseases, work interruption, absenteeism etc.

The SWI questionnaire, initially designed in 80's (Vanwonterghem, Verboven, &. Cloostermans,1985) was inserted as a complement in the workload assessment in Belgian coal mining research projects in frame of several research programs of the European Coal and Steel Industries (1980-2000) in order to obtain a better understanding of the anomalies appearing in the physiological fatigue measurements in rescue workers and in daily mining operations. The diversity in activities, the absence of identical tasks and conditions, non-standardized organizational settings, anthropologic characteristics and different levels of motivation required these information to rate correctly the workload assessment.

The development went along with the multidisciplinary evolution of ergonomics and the introduction of the participative principles in workload assessment. Subsequently, the SWI questionnaire has been embedded in the research techniques of EU-Framework Programs projects and introduced in a series of EU-funded research projects in Malaysia (Kammaruddin & Vanwonterghem,1995), Indo- nesia (Manuaba & Vanwonterghem, 1996) and Thailand (Intaranont &Vanwonterghem,1993); Yoopat, Vanwonterghem & Intaranont,1998), in China (Vanwonterghem & van Sprundel, 1995) and in many European countries.

Objectives

The study aimed to evaluate the workload by means of the perceived physical strain in different female professional activities in order to find out the problems which are causing the imbalances between workload and the individual capacities and to evaluate the use of the SWI in classic scientific risk assessment.

Methodology

Subjects: The choice of the participants has been made for 2 reasons: firstly the availability and willingness of the enterprises/organizations and the individuals to participate in this project. The second reason was to have a distribution over different professional activities – representative for female jobs in Thailand, which vary from low physical strain (office work) to more demanding jobs performed in open air (construction), inside work (garment with manual repetitive work) and nurses (in a hospital setting).

361 female employees participated in the project, distributed over office work (n = 98), construction (n = 87), garment (n = 78) and nurses (n = 98) all participating voluntarily in the study. The average characteristics are presented in table 1.

All subjects were in good health condition. Only the BMI and the systolic as diastolic blood pressure were significantly higher (P<0.05) for construction worker than other groups. Relative muscle strength in garment and accountant jobs (office work) are less than that of construction worker (P<0.05). Each subject described their normal duties (tasks) and more specific operations performed during the observed period

Methods:

SWI: Subjective Workload Index Questionnaire

The SWI was developed to discover work related problems as experienced by the exposed individuals rather than found by external experts (Vanwonterghem, Verboven, &. Cloostermans, 1985).

The SWI is build up in two parts: a general SWI which indicates the character and seriousness of the total job-problem, and a detailed analysis which reveals problematic sub-tasks and details for which improvement measures should be introduced with some priority.

The general SWI: The SWI-composing factors – selected from a large series of interviews – concern six 'strain' causing factors which refer to man at work related problems (fatigue, perceived risks, complexity, concentration, work rhythm and responsibility),

Table 1 Physical characteristic of subjects participated in the study (Mean ± SE)

Relative strength is determined by dividing total hand grip strength by body weight (in kilograms)

Jobs (N)	Age (yr)	Height (cm)	Weight (kg)	BMI (m^2)	SP (mmHg)	DP (mmHg)	Relative left strength	Relative right strength
Nurse (98)	33 ± 0.8	160 ± 0.5	55 ± 1	21.6 ± 0.4	108 ± 1	68 ± 1	0.50 ± 0.01	0.46 ± 0.01
Construction (87)	35 ± 0.3	153 ± 0.7	58 ± 1	25.1 ± 0.6	123 ± 2	79 ± 1	0.49 ± 0.01	0.49 ± 0.01
Garment (78)	35 ± 0.3	156 ± 0.7	55 ± 1	22.5 ± 0.4	114 ± 1	73 ± 1	0.47 ± 0.01	0.44 ± 0.01**
Office (98)	34 ± 0.7	157 ± 0.6	55 ± 1	22.5 ± 0.5	111 ± 1	72 ± 1	0.48 ± 0.00	0.24 ± 0.01**
Total (361)	34 ± 0.3	157 ± 0.4	56 ± 1	22.7 ± 0.3	113 ± 1	72 ± 1	0.49 ± 0.00	0.46 ± 0.01

** Significant from nurse and construction at p < 0.01

and two 'compensating factors' (interest in the job and the degree of autonomy). The seriousness of the problems are objectively rated on a 11-point scale (from 0 – 10, '0' for no problems at all and '10' for maximal acceptable load. For the attenuating factors, scores vary from '0' or '10' from no to a maximal compensation. Chronbach's **α**-validity varied between 0.61 (construction) to 0.64 (nurses, garment), which in terms of the variety between loading and compensating factors, tasks and respondents might be acceptable.

The SWI is calculated as follows:

SWI-assessment threshold

SWI = ([Σ LF] - Σ [CF]) /8

LF = load factors

CF = compensating factors

The Detailed SWI: A Detailed SWI includes the analysis of task and specific work composing factors and is carried out in case the SWI value exceeds 2.0 to 2.5 or when specific values are observed in one or two excessive scores . In a detailed analysis two specific working conditions are evaluated:

a) Task analysis: a job is composed of several operations having, in almost all cases, a different intensity and duration. The operations which are specific job oriented (number is mostly between 4 and 6) and are completed with additional operations which complete the total job (e.g. passive waiting times and resting or active as preparations, transportation (walking, stair climbing) etc… The total job-load is the sum of all operations. Each operation is characterized with its duration (summing up the time in case of scattered applications) and is expressed either in minutes or in % of the total time)

b) Work-composing factors: it concerns 11 items: the typical body load (movements and posture), the environmental factors such as climate (heat and cold), noise, vibrations, lighting and the quality of the environmental air (includes dust, smell, etc.) and also some problems experienced for the work organization and a category 'others' for not defined comments. The results of the detailed analysis are often an indication at which part of the job improvements are required.

SWI		Evaluation
	<1	No problems, no actions required
≥1	<2	Very light problems, check factors individually per load factor
≥2	<3	Light to moderate problems, check the compensating factors and peaks in LF. From the level of 2.5 a detailed analysis is advised and should include measures on medium term (months)
≥3	<4	Serious problems, pass to detailed analysis and envisage measures on short term (weeks)
≥4	<5	Very serious problems, Almost immediate actions are required (days). Is a critical level
	≥ 5	Activity should be stopped and relevance of data checked

Physiological measurements:

Important in workload assessment is the acceptance of the outcome and in a participative system approach subjective as objective elements should be present in order to balance the views of the exposed employees and management. SWI covers the subjective colored opinion of workers and external technical and organizational aspects (e.g. climate, weights, used materials, etc…) can be measured or evaluated by classic checklists.

The most man-related – often missing - representative 'objective' criterion of indicating the total fatigue, concerns the cardiac load, which is responsible for the oxygen supply to the active muscles and which is reflected in Heart rate (HR). HR is not only influenced by the spend energy (dynamic muscle load) but also and more indirectly, by static muscle contractions and some individual socio-cultural determinants. For example the HR at rest can vary from 40 beats/min for well physically trained persons to 90, 110 beats/min for non trained/sedentary individuals. Smoking, alcoholic beverages as some drugs also affect the cardiac reserves which could create serious health risks.

The cardiac load or Cardio-Vascular Load, (CVL) is calculated from measured heart rates (Polar equipment) and is expressed in a percentage distribution between rest and maximal limits: (Yoopat, Vanwonterghem, & Intaranont,1998); (Yoopat, Toicharoen, Glinsukon, Vanwonterghem, & Louhevaara, 2002)

$$\%CVL = 100 [(\Delta HRwork / (\Delta Hrmax8h)]$$

ΔHRwork = average HR at work – Hrrest

ΔHrmax8h = maximal allowed Hr for 8 hrs of work

Hrmax8h = 1/3(220 – age) + Hrrest

In general it is estimated that work intensity with < 30% CVL is within a safe range of physical fatigue. From >30% and < 60% CVL the load is reflects a moderate to heavy strain and the more exceeding the > 60% threshold, the more critical cardiac load asks for strain relieving interventions.

Procedures

The SWI questionnaires were completed under guidance of experienced observers of the Faculty of Science (Ergonomics Unit, Rangsit University). The observations of the procedures and work conditions took about 2 – 3 hours of which the physiological measurements were taken over a period of different representative performed operations for about 1 hour. Subjects signed an inform consent confirming their agreement to participate in the study. The data were processed in the laboratory of RSU and subjective as objective results were treated under medical secret. The reporting back to the participating enterprises was done under anonymous formats.

Results and Discussions

Tasks: All 4 categories had their own specific type of activities to perform. From the point of view of physical intensity, they can be classified as ‘light’ (L) ‘moderate (M) or heavy (H), as represented in figure 1.

Nurse-tasks consisted of general on hospital ward work for 27.7% (M) coordination meetings and administration for about 62.7% (L), and lifting patients for 9.6% (H) of total time.

Construction workers were occupied in specific tasks such as carpentering, brick laying, iron binding, electricity, driving etc for about 60.5%, (M) material handling for 19.5 % (M),

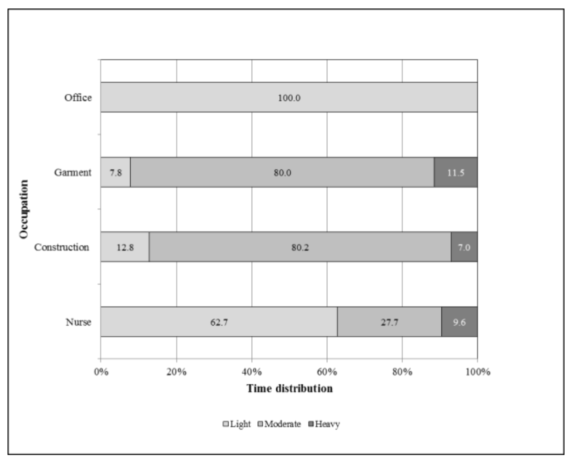

Figure 1 Time distribution per occupation (%)

pushing/pulling materials, lifting and digging for 7.0% (H), cleaning, walking and administrative work 12.8% (L),

In garment, the job included specific threading for about 80.80% (M) of the total time. The other tasks included material handling and lifting materials, pushing/pulling carts 11.5% (H), standing (waiting) walking and administration 11.5%.(L)

The office-work concerned mainly computer work for 69.1% of the total time, walking 17.6% and documentation/ coordination for 13.3%, all classified as physically light (L)

Office work has an almost negligible impact on the physical strain. Garment employees have some light and heavy work, but mostly the bobbin handling and treading are asking for permanent occupation estimated as moderate work, with some heavy efforts in material handling. Nurses: for more than 50% their working time was covered by physical low intensive work (meetings) and ward-work is estimated as moderate. Only patient lifting (even in team with 4 nurses) required intensive physical work, but took less than 10%.

Construction work has some balance between light +/- 13% (e.g. cleaning) and heavy work (+/- 7%) and 80% concerned a moderate intensity during typical construction tasks (brick laying, iron binding activities alternating with lower intensities (supplying materials). The heavy work (7.0 %) concerned mainly digging and heavy material handling.

Because the distribution of the different tasks spread over the observed period, (about 1 hr) could not be standardized for each operator, the impact on the body has to be handled with care. Some efforts were followed by a relaxation period where in other cases the conditions required an ongoing effort at a different level, sometimes more, in other cases less intensive. The SWI reflects the estimated strain over the total observed period

SWI perceived scores

The total SWI scores for all subjects was 3.05 which exceeds – with exception for female construction workers - the 'low problem' level of 2.5 and as shown in figure 2.

The comparison of the 4 professional jobs reveals only a significant difference in construction as garment employees and nurses (P < 0.001), and office workers (2.89)

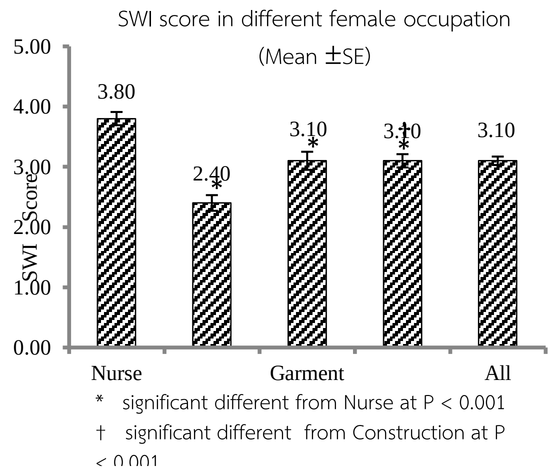

Figure 2 General SWI scores per occupation (Mean ± SE)

(2.89) with construction (P < 0.001) Although the physical work intensity of office workers and nurses was estimated as 'low' from the task-distribution, it could have been expected that their SWI should be low as well, but, on the contrary, they reach almost the level of the Garment employees and exceed the SWI of the physical demanding construction work.

From this first analysis, it can be concluded that workload for nurses shows the highest SWI (3.8) reaching an almost critical level, garment and office work exceeds SWI (3.1), and the lowest SWI is for construction (2.35) which normally estimated as physically the most heavy job for female workers ending below the 2.5 critical level. These results ask for the closer view on the SWI-composing factors (figure 3).

The highest load-value is the factor 'Responsibility' (average 8.46 which is very high), and obviously the factors is largely underestimated in the evaluation of employees commitment. The highest value is found in

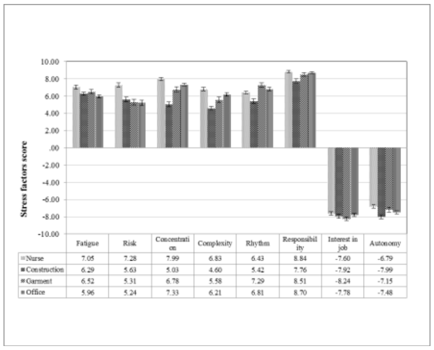

Figure 3 Work stress/distress factors of all female occupation (Mean ± SE)

nurses (8.84) which is quite obvious following the nature of their job, (sometimes life-determining) which needs high concentration (8.0) as well. Also for garment the responsibility score (8.51) is understandable as the fact of eventual thread ruptures in the large number of bobbins has immediate consequences for the productivity. For office work (8.7), errors in the administration jobs are estimated as critical because it concerns the contacts with the clients and the quality image of the enterprise. The value for construction, although somewhat lower (7.8), is important as it is the highest value from the 5 other load factors. Errors occurring in their job are recognized as serious consequences for technical quality/quantity as in the creation of risks in the working conditions (safety, health) for colleagues in the ongoing process.

The figures for 'Interest in the job' and 'Degree of autonomy' (which allows to adjust work rhythm and intensity) is appreciated in most of the jobs, but 'autonomy' received lower scores in nurses (meetings management and strict care-programs) and in garment (due to machine paced work). Awareness of risks and fatigue are mainly found in nurse-work and the compensation of job-interest and autonomy do not compensate these factors. Possibly because a large percentage of working time is spend on meetings and administration which obviously do not belong to the most exiting nurse-profession. 'Fatigue' in this case has to be seen as mental fatigue which also might be influenced by concentration.

The compensating factors are exceeding most of the load factors (except responsibility) and the level of autonomy (managing their own working time – e.g. work-rest schemata) is generally appreciated. Except for nurses which allocated the lowest score of all for 'Interest in the job' and 'Autonomy', very probably because of rather boring estimation of meetings for about 60% of working time).

Experienced workload on the body parts: The impact of the workload on the body complaints distribution is summarized in figure 4.

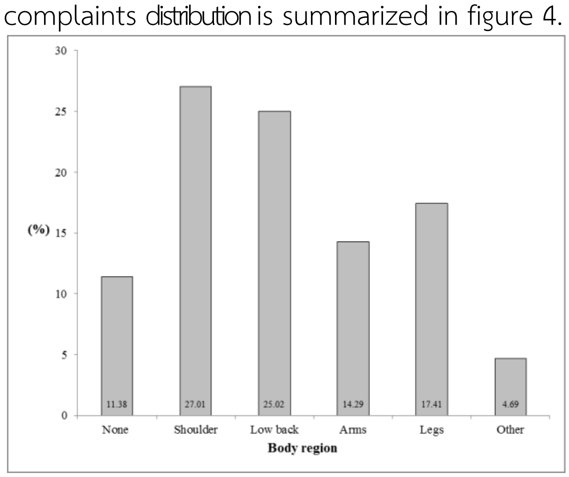

Figure 4 Total sum % complaints per body region

The figure 4 indicates that in only 11.4% of cases there are no problems and less than 4.7% for 'others' (mostly concerning the sensorial system) but the parts involved in the physical work to be performed: shoulders (27.0%) and low back (25.0%) cover half of the complaints and refer to static postural load necessary to give stability to the body. The upper and lower limbs (31.7%) involved in the movements have normally a less fatiguing impact because of alternating effort and recovery.

The distribution per job over the body parts (table 2) could give indication in which eventual improvement measures have to be developed

Table 2 Body-part complaints in different job(%)

Body region	Nurse	Construction	Garment	Office
None	0.0	19.5	24.4	15.2
Shoulder	25.0	9.2	10.3	59.6
Low back	31.0	34.5	25.6	6.1
Arms	14.1	21.8	16.7	6.1
Legs	29.9	8.0	11.5	7.1

Nurses are confronted with about 70.1 % of problems of the low back, shoulders and arms When performing patient handling in ward-work (awkward postures and securing a static stability of the trunk) but also the legs (29.9 %) are a problem (long standing and walking).

Construction workers suffer the most from low back problems (34.5%) and with the arm-problems (21.8%) covering (56.3%) of all complaints during lifting, material handling and specific postural load during brick lying and iron binding. Garment (low back, ±26% and arms (± 17%) during material and bobbin loading in racks.

Almost 60% of complaints in the shoulder and trunk region for office employees is a direct indication for problems in the sitting posture in front of computers and VDUs.

The relevance of the complaints about the environmental conditions composing factors is given in table 3 which reflects the correlation and probability (** significance level < 0.01). These confirm partly some conclusions as made in the different tables but also reveal new complaints which could not be quantified from previous results.

The most confirmed risks are found in construction and it's quite clear that movements and postures as well as the other environmental factors are specific for female work at construction sites in Thailand.

The link to physical work is clear and the low scores for 'cold', 'vibration' and lighting' is logic because none of them interfere in their activities.

For nurses, lighting (contrast and dimmed light in rooms results in visual load) and 'vibrations' needs some further analysis concerning place and used equipment.

Garment is confronted with noise and vibrations, both caused by the machinery for threading and weaving. Dust is linked to the nature of materials (cotton treads) which produces air-born and deposed dust.

Table 3. Environmental conditions: correlation between SWI and environmental factors and probability

Environmental conditions	Nurse	Construc	Garment	Office
Posture		.301**		.395**
Movements		.286**		.253**
Heat		.280**		
Cold				
Noise		.391**	.366**	
Vibrations	.287*		.412**	
Lighting	.242*			
Air quality		.244*		
Dust		.381**	.320**	
Organization.		.389**		
Other		.334**		

For office work, only posture shows statistical evidence and can be linked to the sitting working posture at desks with VDU and keyboards. The lack on correlation is related to the variety in individual experiences and capacities and the high variation in tasks and sequences (work-rest schedules) which cannot be standardized in practical occupational settings.

SWI Correspondence with CVL

Office Work, with a CVL as low as 10.7 % can be estimated as normal this type of activities performed in air conditioned environments. The employees in construction and in garment with CVL's of 43.1 % and 37.1% respectively can be estimated as fatigue causing over a normal shift. As the time is spend on "moderate" intensive physical work in unfavorable external conditions (heat stress, noise, air quality) attention has to be paid on their work posture,

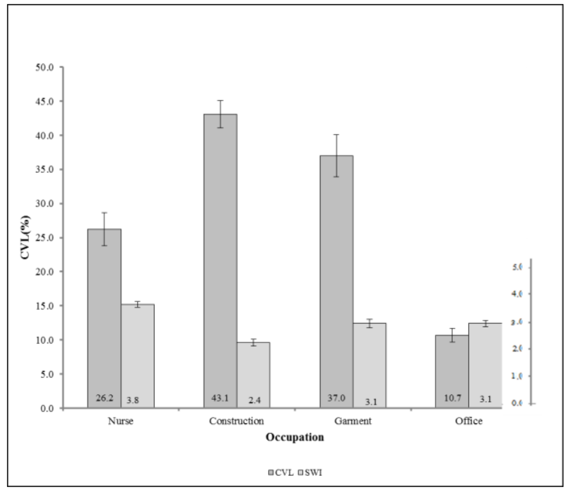

Figure 5 - Comparison cardiovascular strain and SWI (Mean ± SE) movements and climate. Noise and more

A complementary way to validate the SWI is comparing the complaints with the objectified cardiovascular strain which is derived from measured Heart Rate (HR), reflecting the physical fatigue of the exposed operators. From the previous mentioned time distributions and performed intensities, the CVL values seem to correspond with the normal physiological reaction to the job performed in the normal environmental conditions (figure 5). precisely vibrations may affect the cardiac strain (resonance), both are present in the garment environment which in combination with the mainly static physical work, affects on the blood circulation.

The difference in SWI for both professions may be explained by the fact that in construction there are more varied jobs, alternating with high and low efforts which offers a certain physical recuperation. Garment operators on the contrary have a more permanent occupation and this can explain the difference in SWI (e.g. work rhythm in machine paced work). Office work suggests no specific physic strain as most of the work is performed in sitting posture behind computers and VDUs. (10.7 % CVL) .The rather low CVL-level of nurses (26.2) is somewhat under estimated as ward-work and patient handling normally are quite intensive, but over the period there was an activity of meetings and discussions which exceeded 60% of the observed time, and this of course allows an efficient cardiac recovery.

As the impact of physical load as predominating factor in garment and construction, the CVL-SWI corresponds significantly for the total measured period with respectively r = .463, P <,0.01 and r = .255, P <0.01, and the reliability increases when more intensive muscle work is involved**:** for example in construction, manual cement mixing r = 0.751, P = <0.01 and general labor (material handling, transporting etc.. r = 0.476, P = < 0.01. Treading in garment r = 0.557, P < 0.05. The highest anomaly in the CVL-SWI correspondence is found in nurses and in office employees from which can be concluded that both are not marked by a reduction in their physical capacities, but other factors affected their well being.

Conclusion & Recommendation

In Thailand, female work is quite well represented over the different industrial sectors and their quality of life is a main concern of managers, health and safety officers, human resource experts and ergonomists. In many cases industrial work and quality of life is associated with important physical workload of which it is thought that the most intensive jobs or the most risky activities are assigned to male operators, but since the last decades, this principle is not longer valid. The introduction of machinery reduced the physical intensity in jobs considerably, and physical work is no longer a privilege for male operators only, but concern female operators too.

Irrespective the gender differences, the most efficient prevention of occupational diseases, injuries and economic as socio-economic consequences can be reached by anticipating the risks, and this requires knowledge about pre-indicating signs in the working conditions creating an imbalance with the operators' capacities. The pre-signs have a mainly subjective character and the perceived annoyances and experiences should make part of a total assessment technique, as a complement to the objective risk screenings.

Introducing and efficient prevention strategy needs therefore a multi-factorial approach.

At first, the objective evaluation of the technical and organizational elements as on risky behaviors can be obtained via check lists or questionnaires as by observation and control. From confirmed negative outcomes technical solutions of risk eliminating measures or protective equipment (individual as collective) can be developed and implemented in working acts and good practices. This approach has a mainly technical character and is introduced in management strategies. However, to be successful, the policy must have figures and concrete information on the return-on-investment and cost-tags must be in balance with the results.

A second strategy, often going along with the previous technical policy, refers to the individual behavior, and is quasi imposed by the authorities. Guidelines, directives and legislative rules are imposed and are subject to controls: technical, medical, social, and concern employers as employees. The basic information of both techniques is found from the post-factum analysis of accidents/injuries and occupational diseases and the rates of incidence and seriousness determine the compulsory character.

In this way many obvious risks have been handled successfully but the time between observed risks and the development of preventive measures as described above, take too much time. At present the fast evolution of work systems and the needs for increased efficiency create new risks (for example musculoskeletal disorders) ask for new anticipating approaches, and in this the perceived experiences of the operators are the indicators by excellence to prevent such injuries. The individual subjectively observed problems of annoyance, discomfort, pain etc. announce possible injuries in the future and these should become part in an integrating assessment method.

The Subjective Workload Index uses the operators as an 'all-problems integrating' tool and as found in the results of this project, the subjective interpretation of workload confirms not only the objective criteria of fatigue (cardiovascular strain) when there is a dominant physical effort, but reveal other important factors which belong to the specific problems of the individuals, often undisclosed due to social barriers. Participative approaches may successful if implemented in a pragmatic strategy and the use of SWI or similar methods, in the existing prevention programs give ideas to bring in balance workload and capacity, which is in profit of all concerned. (Yoopat, Vanwonterghem, & Intaranont,1998; Yoopat, Deerod Rujipong, & Vanwonterghem , 2006; Strambi, Montoliu, & Vanwonterghem , 2009)

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