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Community Pharmacists' Subjective Workload and Perceived Task Performance: a Human Factors Approach

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There are an estimated 51.5 million medication errors dispensed from community pharmacies each year across the United States.[1] Workload, measured as the number of prescriptions dispensed per hour or day, or number of prescriptions per pharmacist, has been shown to be positively associated with dispensing errors.[2-5] In 2009, greater than two-thirds of pharmacists reported that their workload is high or excessively high, an increase of 14% compared to 2004. In addition, 61% of pharmacists reported that workload increased or greatly increased compared to the previous year.[6-7] The high proportion of pharmacists experiencing high workload is particularly concerning given the likely future increase in demand for prescription drugs due to the aging of the population, and the likely expansion of pharmacists' roles due to the addition of pharmacist-provided services, such as medication therapy management services and immunizations.

Workload has been conceptualized to have both objective and subjective dimensions.[8-10] Similar to pharmacy, nursing workload traditionally was quantified as, for example, nurse-to-patient ratios.[10] However, researchers recognized that this objective measure was insufficient, and characterized other dimensions (i.e. demands) of workload including physical, cognitive, and emotional workload.[11] Cognitive demands of nursing workload, such as being rushed, being interrupted, and having divided attention, were associated positively with the likelihood of errors and complications.[9,12]

A similar approach to pharmacist workload would suggest that instead of only quantifying the number of prescriptions dispensed (an objective measure of workload), the focus should be on understanding the pharmacists' subjective experience of work demands.[13-14] A weakness of previously conducted studies is that they have not assessed subjective measures (i.e. pharmacists' perceptions) of workload and how they are associated with pharmacist performance of various steps and tasks in the dispensing process.[13-14] Additionally, past research has not examined whether pharmacists' perceptions of workload differ across the various steps and tasks involved in dispensing a prescription. With the exception of one recent study conducted in the institutional setting,[15] pharmacist workload has not been explored using subjective measures of workload.

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To study perceived workload and task performance in pharmacy, we adapted a model of nursing workload derived from a human factors engineering approach (See Figure 1).[9] The model posits that perceived workload, separated into three categories, leads to various outcomes. In the model, perceived workload can be categorized into task-related, job-related, and organization-related workload demands. Task-related workload comes from individual activities (e.g. reviewing a patient profile) a pharmacist performs as part of their job. Perceived workload for individual tasks depends on the cognitive (e.g. requiring concentration and mental effort), physical, and temporal (i.e. feeling rushed) demands placed on the pharmacist while performing such tasks. Different tasks may have different demands.

Job-related workload is influenced by ***all*** of the tasks the pharmacist must accomplish either on their own or by coordinating with their staff to get the work done. Perceived job-related workload is related to the monitoring and multi-tasking demands placed on a pharmacist (e.g., reacting quickly to prevent problems, keeping track of more than one process at once). Organization-related workload is influenced by organizational or managerial characteristics such as perceived quantity and skill of pharmacists and technicians and perceived adequacy of the type and usefulness of pharmacy technology. The outcomes in the model can be patient related (e.g. safe and effective care, patient satisfaction) and/or pharmacist related (e.g. burnout, job satisfaction, perception of their performance). As it pertains to pharmacist related outcomes, errors are more likely to occur when perceived performance of tasks is low.

We used the model to measure subjective workload and to see what task-related, job-related and organization-related subjective workload demands were associated with pharmacist's performance of three common tasks in a community pharmacy. It is important to measure the association of workload with human performance of tasks, especially in jobs of a cognitive nature.[12,16] During the prescription dispensing process, pharmacists (and technicians) perform numerous tasks, from verifying a patient's birth date to “show and tell” during patient consultation. Two tasks which are required by OBRA ' 90 and the Wisconsin state pharmacy regulations to be performed by a pharmacist include conducting a patient profile review (or drug utilization review) and patient consultation. A third task, verifying the accuracy of a prescription, may be initially performed by a technician but must be confirmed by the pharmacist.[17-18] We hypothesized that the performance of each task may require different demands on the pharmacist and therefore the perceived performance of the task may be more or less sensitive to certain subjective workload demands. Understanding how perceived workload impacts the performance of each task is important due to the likelihood of an error occurring if any of these tasks are performed poorly.

Study Goals

This study had three goals. The first was to measure community pharmacists' subjective workload in three categories (task, job, and organization). The second goal was to measure community pharmacists' perceived performance of three tasks in the medication dispensing process: performing a patient profile review, checking the accuracy of a dispensed prescription, and providing a patient consultation for a new medication. The third goal was to measure the association of each category of perceived workload on perceived performance of each task.

Methods

Design and Sampling

A cross-sectional, descriptive survey design was used to collect data from pharmacists practicing in community pharmacies. A sample of 500 pharmacists licensed in Wisconsin and having addresses in Wisconsin was selected randomly from a list of pharmacists obtained from the Wisconsin Department of Regulation and Licensing. Subjects were mailed a letter describing the study and an opt-in form with three choices: 1) the respondent is a community pharmacist and would like to participate, 2) the respondent is a community pharmacist but does not want to participate, or 3) the respondent is not a community pharmacist. Respondents were asked to report their practice setting since the sampling frame did not contain practice setting information for each licensed pharmacist. If respondents reported they would like to participate, they reported their preferred survey format (paper via postal mail or electronically via an online link contained in an email). Respondents returned the opt-in form either via fax or postage paid return envelope.

This study was approved by the Institutional Review Board at the institution employing the authors.

Measures

Dependent Variables—The dependent variables were pharmacists' self-reported perceived performance of three different tasks in the medication dispensing process. The three tasks were conducting a patient profile review, verifying the accuracy of a dispensed prescription, and counseling a patient on a new medication. Perceived performance was assessed using a single item for each task (e.g. “To what extent are you confident that the patient profiles you conduct are complete?”, “To what extent are you confident that you dispense prescriptions with 100% accuracy?”, and “To what extent are you confident that patients understand how to correctly take their new medication(s) after your consultation?”). We focused on perceived performance of these three tasks because they are tasks that if performed poorly could lead to errors, and we hypothesized performance of the tasks required different cognitive and temporal demands on pharmacists.

Independent Variables—Based on the conceptual model, workload was assessed in three categories: task, job, and organization. Workload measures in the three categories were constructed from survey instruments previously used to measure workload in other disciplines and settings. Task-related workload was defined as task-specific mental demands and was conceptualized to have two dimensions: internal task demands and external task demands. Internal task demands focused on the degree of concentration and mental effort required to complete a task and were measured with two items from Hart and Staveland (1988) and Reid and Nygren (1988) (e.g. “To what extent does the process of conducting a patient profile review require your concentration?” and “To what extent is mental effort required of you while conducting a patient profile review?”).[19-20] External task demands focused on the effect of interruptions, being rushed, and having attention divided and were measured with four items from Hart and Staveland (1988) and Reid and Nygren (1988) (e.g. “To what extent are you rushed while counseling a patient on a new medication?” and “To what extent is your attention divided between multiple tasks while counseling a patient on a new medication?”).[19-20] Since task-related workload was associated conceptually with each task, we measured internal and external task demand separately for each dispensing task: conducting a patient profile review, assuring the accuracy of a prescription, and counseling a patient on a new medication.

Job- and organization-related workload were conceptualized as independent of the specific tasks pharmacists performed. Job-related workload was conceptualized as the demands associated with simultaneously managing all of the tasks and responsibilities of pharmacists. The responsibilities may include dispensing prescriptions efficiently, managing pharmacy personnel, addressing inventory concerns, etc. General job demands were conceptualized to have two dimensions: cognitive demands and volume demands. Cognitive demands were measured with three items from Karasek (1979) (e.g. “To what extent does your job allow you to use the skills and knowledge that you learned in school?” and “To what extent does your job have a clear definition of what others expect of you?”).[21] Volume demands are related to the pressure of output (or number of prescriptions dispensed), and were measured with four items from Karasek (1979) (e.g. “To what extent does your job require a great deal of work to be done?” and “To what extent do you NOT have enough time to finish your work?”).[21]

Specific job demands focused on attention demands of the job and were conceptualized to have two dimensions: monitoring demands and production responsibility demands. Monitoring demands are the passive monitoring activities that are required to prevent problems and were measured with four items from Jackson et al., (1993) (e.g. “To what extent do you have to concentrate all the time to watch for things going wrong?” and “To what extent do you have to react quickly to prevent problems from arising?”).[22] Production responsibility demands are related to the problems or negative patient outcomes that could occur and were measured with four items from Jackson et al., (1993) (e.g. “To what extent could an error on your part cause an adverse outcome to a patient?” and “To what extent could a lapse of attention cause an adverse outcome to a patient?”).[22]

Organization-related workload, categorized in the model as staffing composition and adequacy in the dispensing department of the pharmacy, was measured with questions asking about quantity (“To what extent are there enough pharmacists working with you to allow you to get your work done?”) as well as quality of staffing (To what extent are the pharmacists sufficiently skilled to allow you to get your work done?”).[23] Comparable questions pertaining to technician staffing also were included.

All measures were self-reported and asked respondents to answer each question by thinking about the last 30 days. Responses to all study measures were on a numbered 7-point scale ranging from 0 to 6 with the response category labels “not at all” (=1), “just a little”(=2), “a moderate amount”(=3), “pretty much”(=4), “quite a lot”(=5), and “a great deal,”(=6) as well as a “don't know”(=0) option.

Data Collection

The survey instrument contained 63 items, including the study measures, and pharmacist and pharmacy characteristics. Surveys were either mailed to subjects or a link to the web-based survey was sent via e-mail. Subjects receiving mailed surveys were asked to either fax or mail back the survey using an included postage paid return envelope. One electronic or mailed reminder was sent to non-respondents after two weeks of initial mailing.

Data Analysis

Principal Components Analysis was used to assess the proposed dimensionality of the measures. (See Appendix A) Descriptive statistics (means and standard deviations) were calculated for each scale. Three models were estimated using multiple regression analysis to determine the association of study variables on perceived performance of the three tasks. An a priori significance level of 0.05 was established.

Results

Of the 500 mailed opt-in invitations to complete the survey, 443 (88.6%) were returned. A total of 266 respondents reported that they were community pharmacists and 224 of the community pharmacists agreed to participate. A total of 169 (75%) surveys were completed and returned by the 224 study subjects. A total of four surveys were missing more than 80% of the requested data and were removed from analysis. Approximately 50% of respondents were male, and 75% of respondents had a BS Pharm degree. Respondents had an average of 24 years of experience. A little more than half (52%) of respondents worked in a chain pharmacy. The characteristics of the respondents were similar to the characteristics of community pharmacists in Wisconsin in 2009.[24]

Table 1 contains descriptive statistics for the scales used to measure the variables in the study. In the task category, there were differences in perceptions of external demands on pharmacists while performing the three tasks. Perceptions of external demands, such as being interrupted, rushed, and having divided attention, was greater when pharmacists were conducting a patient profile review (32% of respondents in the upper range reporting “quite a lot or “a great deal”) and lowest when counseling on a new medication (14% of respondents in the upper range). In terms of internal demands, the perceptions of the extent that concentration and mental effort were needed to conduct a patient profile review and provide counseling on a new medication were similar (49% and 47% of respondents in the upper range of the scale, respectively).

In terms of general job demands, approximately one-third of respondents (32.5%) reported that the extent to which they, for example, did a large volume of work and did not have enough time to complete their work was in the upper range of the scale. Respondents' perceptions of the cognitive demands of their jobs were somewhat similar to volume demands as 29% of respondents reported that the extent to which, for example, they used skills and knowledge learned in school and that their job had a clear definition of what others expected of them was in the upper range of the scale.

Pharmacists reported high levels of specific demands related to attention demands. Approximately one-half of respondents (48.9%) reported that the extent to which their job required them to watch for things going wrong or act to prevent problems from occurring (i.e. monitoring demands) was in the upper range of the scale. Over one-half of respondents (55%) reported that the extent to which their job required them to be careful in what they did to prevent an adverse outcome to a patient (i.e. production responsibility demands) was in the upper range of the scale. In the organization category, 27% of respondents reported being in the upper range of the scale in terms of the extent to which pharmacist and technician staffing was adequate.

Over 80% of respondents reported they were in the upper range of the extent to which they had confidence that they dispense prescriptions with 100% accuracy. A lower proportion of respondents were in the upper range for confidence in performing the patient profile review task (44%) and the counseling task (54%).

Table 2 contains results of the multiple regression analysis. For the accuracy of dispensing task, 80% of respondents were in the upper range of the scale. As a result, this variable was dichotomized (into very confident and not very confident) and multiple logistic regression was used. The perceived performance of each task was significantly associated with different types of workload demands. The completeness of a profile review was significantly positively associated with specific job demands related to monitoring demands (i.e. watching things to prevent errors) and significantly negatively associated with external task demands (e.g. being interrupted). Odds ratios from logistic regression showed that

respondents were significantly more likely to report being very confident in dispensing accurately as specific job demands related to monitoring demands (i.e. watching things to prevent errors) increased and were significantly less likely to report being very confident in dispensing accurately as general job demands related to volume demand (i.e. having a large amount of work to do) increased. Patient counseling performance was significantly positively associated with general job demands related to cognitive demand (e.g. using skills learned in school), to specific job demands related to monitoring demands (e.g. watching things to prevent errors). Patient counseling performance was significantly negatively related to external (i.e. being interrupted) demands.

Discussion

This study set out to measure various aspects of pharmacist subjective workload using a model derived from a human factors approach, and to determine the relationship between subjective workload and community pharmacists' perceived performance on three tasks associated with dispensing medications. The study findings, which measure subjective workload in three categories, go beyond previous studies that demonstrate a relationship between medication errors and workload measured using an objective measure in a single dimension.[2-5] Similar to studies in nursing and medicine, the results suggest that task performance is associated with workload demands in different categories, corresponding to a conceptual model derived from a human factors approach to workload.

Specific job monitoring demands, which measure such things as watching for things to go wrong and reacting to prevent problems, were positively associated with all tasks, suggesting that pharmacists who recognized and focused on preventing problems throughout the pharmacy were more confident in their individual task performance . Regardless of the task pharmacists currently are focusing on, their comprehension of the interactions and events unfolding in the pharmacy appears to impact their confidence in performing task-specific activities. This is consistent with human factors research in other health care settings that show that the ability to maintain the “big picture” and think ahead to plan for contingencies has been associated with patient safety.[25] Pharmacists need to be performing their jobs in work systems in which they can effectively monitor all of the activities in the pharmacy, so that they may confidently perform specific tasks.

Similar to previous studies, our results show the negative relationship between task specific external mental demands and pharmacist perceived performance in reviewing patient profiles and counseling on a new medication.[15,22] Pharmacists were less confident performing tasks when their attention was divided or when they worked in a rushed environment. The feeling of being rushed is a common feeling among pharmacists as more than 70% of pharmacists experience role overload, a measure that relates time available to the performance of organizational work demands.[26]

Previous research has focused mainly on the association of external interruptions (which may occur at different points of the dispensing process continuum) on medication errors.[27] Our results expand the type of tasks performed by pharmacists that are subject to the impacts of external task-related mental demands. Our results suggest that pharmacists should not be interrupted, have their attention divided or be rushed specifically when conducting profile reviews and providing medication consultations. Nursing researchers, having identified similar performance issues associated with cognitive tasks that are subject to being interrupted, have found that designing processes that minimize the impact of interruptions can improve patient safety.[28] These processes include signage to remind workers not to interrupt, a physical quiet zone, checklists to help nurses keep track of where they are in the process, and other visual cues used to indicate when an individual was performing a

cognitive task. Pharmacy researchers should work with pharmacists to develop and study similar interventions to decrease subjective workload caused by task specific external mental demands, especially as it relates to pharmacists conducting profile reviews and providing consultations on new medications.

Consistent with Holden et al. (2007),[9] internal task demands (the need for concentration and effort) were not associated with perceived task performance. This suggests that pharmacists recognize the need for concentration and effort, and that a high level of internal task demand for pharmacists results in wanted effects. This also suggests that workload, in and of itself, does not result in poor performance, supporting results by Grasha et al (2001) who suggests that being mindful and consciously focusing on work improves pharmacist performance.[13] A challenge for pharmacy managers is providing a work system in which pharmacists are able to concentrate and use their mental skills optimally in accomplishing tasks

Patient counseling performance appears to be associated with different workload demands compared to the other tasks. In addition to monitoring demands, cognitive demands and external mental task demands were associated with patient counseling performance. Our results suggest that pharmacists whose jobs allow them some flexibility to control the pace of their work, use the skills they feel necessary to do their work, and work in environments where there is a clear understanding of the pharmacists role will be more successful at providing patient consultations. In other words, our results suggest that when pharmacists cannot control the pace of their work and are not engaged in activities that utilize their cognitive skills, they perceive poorer performance providing patient consultations on new medications.

Interestingly, organization-related items, such as quantity and quality of pharmacists and technicians, were not associated with perceived task performance. This is consistent with workload studies in nursing and medicine that suggest that simply adding staffing and automation, which could be considered an organization-related characteristic, to a problem that is not well understood may not provide the value and efficiencies desired.[9,15] One implication of these findings is that when pharmacy workplace problems are being solved, we need to think beyond staffing adequacy as a means to improve task performance. We may need to expand our thinking of organization-related items to include other staffing characteristics such as the level of coordination, communication, and teamwork in a given pharmacy.[29]

The small sample of community pharmacists in Wisconsin limits generalizability. Task performance measures were single item measures, thus they have limited construct validity. However, the single performance items did correlate highly with each other. A number of pharmacists did not respond to the survey, which suggests some potential non-response bias. Another limitation is that subjective workload and perceived task performance were self-reported. Objective measures may help validate future subjective measures of these variables.

Future research may include the expansion of this study to examine how pharmacist and pharmacy characteristics are associated with subjective workload. Specifically, the question of how workload demands differ in pharmacies with and without automation or other technology, and how subjective workload differs across practice settings could be evaluated. From a practice management perspective, the question of possible interventions that may improve monitoring and reduce task-specific external workload demands can be explored. Results can be used to target solutions to promote the mental/cognitive side of work that are specific to a particular setting's workload challenges to improve pharmacist performance.

Conclusion

This project was the first study to measure subjective categories of workload in community pharmacists rather than objective measures of workload such as prescription counts. It revealed the importance of measuring subjective workload separated into different categories and how they are associated with task performance. A key result is that different sources of subjective workload are associated with performance of various tasks. This implies that no one solution will improve pharmacist performance on tasks, since solutions need to consider how pharmacists' specific work environments impact work demands.

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Appendix A

Testing Measure Dimensionality

To assess the hypothesized dimensionality of the measures, a principal components analysis (PCA) of the 37 study items was conducted. Parallel analysis was used to determine the optimal number of factors to extract.[1-2] An oblique rotation was then performed to determine which items loaded most highly on which factor. Following the guidelines of Comrey and Lee (1992), items were conservatively retained only if they achieved rotated factor loadings of 0.55 or greater on their primary factor.[3] Also, items with factor cross-loadings of 0.32 or greater on any secondary factor were discarded. [4] A final PCA was then conducted on the subset of retained items. Finally, internal consistency reliabilities (Cronbach's alpha) or correlations for scales with two items (Rho) were calculated for each set of subscale items.

Based on the PCA, 29 study items (of the original 37 items) were retained. The Cronbach's alphas and Pearson correlation coefficients (Rho) show good inter-item reliability for the variables that were assessed with more than one survey item. (See Table A) Organization level workload consisted of one dimension contained three items related to the quantity of pharmacists and technicians and the training adequacy of technicians. In general, the measurement of job level workload was consistent with past literature in terms of dimensionality and items within each dimension. The results of the factor analysis showed that there was not an internal task-level workload dimension for the task of assessing the accuracy of dispensed medications. Factor analysis showed that the other two tasks, conducting a patient profile review and counseling a patient on a new medication, had both external and internal dimensions to task-level workload.

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Table A

	Original # of Items	Revised # of Items	Reliability Statistics
Unit Level			
Staffing Adequacy	4	3	α=.73
Job Level			
General			
Cognitive	3	2	ρ=.35
Volume	4	3	α=.82
Specific			
Production Responsibility	4	3	α=.90
Monitoring	4	3	α=.73
Task Level			
Patient Profile Review			
External Demands	4	4	α=.87
Internal Demands	2	2	ρ=.81
Accuracy of Dispensing			
External Demands	4	3	α=.85
Internal Demands	2	0	*
Counseling on a New Medication			
External Demands	4	4	α=.90
Internal Demands	2	2	ρ=.88
Task Performance			
Patient Profile Review	1	1	
Accuracy of Dispensing	1	1	
Counseling on a New Medication	1	1	

* No items loaded onto this construct

Note: Items assessed using a numbered 7-point scale ranging from 0 to 6 with the response category labels “not at all”(=1), “just a little”(=2), “a moderate amount”(=3), “pretty much”(=4), “quite a lot”(=5), and “a great deal,”(=6) as well as a “don't know”(=0) option.

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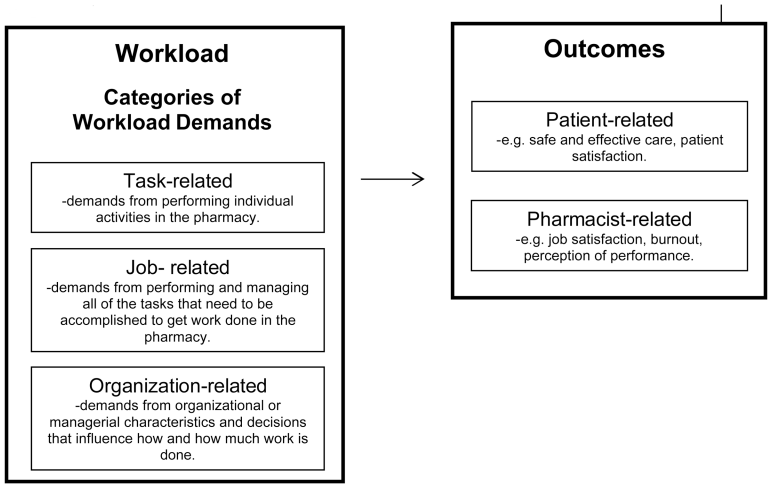

Figure 1. Model of community pharmacist workload, depicting categories of workload demands and outcomes[9]

Table 1
Descriptive Statistics for Study Variables (N = 165)

	Per Item Mean (SD)	Scale Range[b]	% Lower[c]	% Upper[d]
Task Level				
Patient Profile Review				
External (4 items)	4.13 (1.13)	7-24	4.8	32.1
Internal (2 items)	4.61 (1.02)	3-12	2.4	49.7
Accuracy of Dispensing				
External (3 items)	3.87 (1.16)	5-18	7.9	27.2
Internal[a]	--			
Counseling on a New Medication				
External (4 items)	3.35 (1.26)	4-24	18.1	14.4
Internal (2 items)	4.56 (1.11)	2-12	3.0	47.3
Job Level				
General				
Cognitive (2 items)	4.13 (.97)	3-12	3.0	28.6
Volume (3 items)	4.27 (1.09)	6-18	1.2	32.5
Specific				
Production Responsibility (3 items)	4.63 (1.24)	6-18	4.2	54.6
Monitoring (3 items)	4.77 (.95)	6-18	0.6	48.9
Organization Level				
Staffing Adequacy (3 items)	3.97 (1.05)	5-18	3.0	27.1
Task Performance				
Patient Profile Review (1 item)	4.29 (1.06)	2-6	4.9	43.9
Accuracy of Dispensing (1 item)	5.08 (.99)	1-6	1.8	81.2
Counseling on a New Medication (1 item)	4.61 (.99)	2-6	2.4	55.8

[a] No items loaded onto this construct

[b] Items assessed using a numbered 7-point scale ranging from 0 to 6 with the response category labels “not at all”(=1), “just a little”(=2), “a moderate amount”(=3), “pretty much”(=4), “quite a lot”(=5), and “a great deal,”(=6) as well as a “don't know”(=0) option.

[c] The percentage of respondents reporting the lower bound of the scale (i.e. “not at all” or “just a little”).

[d] The percentage of respondents reporting the upper bound of the scale (i.e. “quite a lot or “a great deal”).

Table 2

Association between study variables and task performance (N = 165)

	Patient Profile Review			Accuracy of Dispensing			Counseling on a New Medication		
	B	**95% CI**		**OR**	**95% CI**		**B**	**95% CI**	
Task - External demand	**-.06***	**-.11**	**-.01**	.96	.85	1.10	**-.04***	**-.08**	**-.01**
Task - Internal demand	.002	-.10	.11		*b*		-.06	-.14	-.01
General Job – Cognitive	.07	- 01	.16	1.01	.83	1.20	**.08***	**.01**	**-.17**
General Job – Volume	.02	-.05	.09	**.86***	**.74**	**.99**	-.03	-.10	.03
Specific Job – Monitoring	**.10***	**.02**	**.19**	**1.23***	**1.05**	**1.44**	**.10***	**.04**	**.18**
Specific Job – Production Responsibility	-.02	-.07	.03	.99	.89	1.10	.03	-.02	.07
Organization - Staffing Adequacy	.02	-.04	.08	1.03	.91	1.16	-.01	-.07	.05
R^2		.07			.07[a]			.12	

B = standardized partial regression coefficient; OR=odds ratio; 95% Cl=95% Confidence Interval

*Statistically significant at $p < 0.05$.

[a]Cox & Snell R^2

[b]No items loaded onto this construct