ACADEMIC STRESS AND ACTIVE LEARNING OF NURSING STUDENTS A CROSS-SECTIONAL STUDY.

NicolaMagnavita[a]

CarloChiorri[b]

[a] Occupational Health Unit, Institute of Public Health, Università Cattolica del Sacro Cuore, Roma, Italy

[b] Department of Educational Sciences, University of Genoa, Genoa, Italy

Abstract

Background: The active role of nursing students is particularly important in the delivery of health care, since playing an active role at the bedside and the use of active and collaborative engagement of students in the nursing activities has been associated with improved student learning. This is consistent with Karasek's learning hypothesis, but it has never been tested on nursing students. This study aimed at investigating whether nursing students in high control conditions reported lower levels of work impairment than students in the conditions with low control, compared them with a group of healthcare workers (HCWs), and tested the moderating role of social support at work. Methods: 633 nursing students and 160 HCWs completed the Nursing Work Functioning Questionnaire (NWFQ), and the Demand-Control-Support questionnaire (DCS). Findings: Results showed that nursing students reported higher levels of work impairment and were less likely to be classified as active (high demand/high control) or low strain (low demand/high control) than HCWs, and that social support at work moderated the association between being in active or low strain condition and work impairment. Conclusions: Programs to enhance the learning of nursing students must not only

fight strain and isolation but must also promote active learning, by increasing the control over the job, team work, and support from teachers.

Keywords: nurse education, active learning, nursing, academic stress, work functioning, iso-strain, social support, passive behavior.

Background

Research across many countries has identified a number of stress factors in nursing education (Burnard et al. 2008), especially in new students during their clinical training (Alzayyat & Al-Gamal, 2014). While some amount of stress is necessary to stimulate learning, excessive or prolonged stress can interfere with the normal learning process, thereby delaying a student's development of clinical and academic skills. In the extreme, excessive stress (distress) may have consequences at the individual level (e.g. illness and mental health, poor academic performance, etc.) and at the level of the organization (e.g. sickness absence, program attrition, etc.), potentially impairing functioning and inhibiting growth and development (Freeburn & Sinclair, 2009), and even precluding a student's successful attainment of educational goals (Kless, 1989).

Academic stress may also be associated with immunological reaction (Guidi et al. 1999; Sarid et al. 2004) and mental health problems (Brandy et al. 2015; Chernomas & Shapiro 2013, Xu et al. 2014). Therefore, a thorough knowledge of the stress process in nursing students is crucial for designing effective interventions aimed at preventing it. Specifically, as teaching is not possible without a certain degree of commitment, and therefore of stress, we need to understand the relationship between the students' perceived psychological pressure and their ability to cope with it and to grow.

The active role of nursing students is particularly important in the delivery of health care, since playing an active role at the bedside and the use of active and collaborative

engagement of students in the nursing schoolroom has been associated with improved student learning (Spencer & Jordan 1999; Ward et al., 2013). In fact, it has been reported that the behaviors that nursing students found not useful to their learning were often passive rather than active and they made students feel severely aware of being poorly placed in the clinical area (Jackson & Mannix, 2001). However, active practices, as opposed to traditional lecture-based instruction, require increased effort on the part of both teachers and students (Sand-Jecklin, 2007).

The Demand-Control-Support model (DCS, Karasek, 1979), a well-known model of interpreting job stress, is also useful to evaluate the active/passive learning style. Karasek and Theorell (1990) observed that the acquisition and development of problem-solving capabilities is the consequence of "active" working conditions, characterized by high demand (e.g, workload, time required to perform tasks) and high control (e.g., autonomy in decision-making on the job). Active learning creates a continuous improvement spiral, because individuals acquire the feedback of their learned behaviors, and this leads to more learning and personality positive changes. In the classic Karasek's model, Demand and Control variables are ideally orthogonal and allow to distinguishing people into four categories: high strain (high demand, low control), low strain (low demand, high control), active (high demand, high control), passive (low demand, low control). Demerouti et al. (2001) observed that each of the four combinations of demand and control levels differentially affected the perception of strain or active learning. Job demand was the dimension most clearly related to health impairment, whereas job control was the dimension most clearly associated with active learning.

The learning hypothesis has been supported in a limited number of studies (Bergman et al., 2012; Häusser et al. 2014; Paulsson et al. 2005; Vanroelen, Levecque & Louckx, 2009; Phipps et al. 2012), but, to the best of our knowledge, no study had tested it on nursing

students. As a first working hypothesis, we expected that nursing students in the conditions with high control (active and low strain) should report (relatively) lower levels of work impairment than students in the conditions with low control (passive and high strain). As a (pseudo) control group, we also collected data on health-care workers (HCWs) from the same hospitals. Nursing students experience the same stress factors of other HCWs, such as clinical (excessive workload, fear of making mistakes, compassion fatigue, etc.) and personal/social stressors (economic issues, work/life imbalance, etc.), but also academic stressors (tests, exams, fear of failure in training, etc.) (Pulido-Martos et al. 2012). Thus, we expected that students should experience higher levels of work impairment and job strain (defined as the ratio between demand and control) than HCWs.

Moreover, while social support at work, defined in the Karasek's model as the quality of relationships among coworkers and with supervisors, is a known protective factor against stress-related disorders (e.g., Nieuwenhuijsen et al. 2010), very few studies considered its moderating effect. Phipps et al. (2012) reported that a high level of support combined with a low level of demand was associated with the most favorable scores for working conditions in retail pharmacists. We thus tested whether the effect of Karasek's categories on work impairment could be moderated by levels of perceived social support at work, i.e., whether support had a different impact in reducing work impairment depending on the combinations of demand and control in nursing students and HCW workers.

Methods

Participants

Six-hundred thirty-three (60.8% females, mean age 25.13 ± 6.88 years) nursing students, at the end of their clinical training, were invited to complete measures of perceived clinical ability and job stress. One-hundred and sixty health care workers (HCWs; 69.4% females;

mean age 49.24±7.76 years; 15.6% physicians, 66.3% professional nurses, 7.5% careworkers, 3.1% technicians, 3.1% employees, 4.4% other health-care-related job) from the hospitals where the students were performing their training were invited to complete the same questionnaires before their periodical medical examination at the workplace.

Measures

Nurse Work Functioning Questionnaire (NWFQ, Gärtner et al., 2012; Italian version in Magnavita & Chiorri, submitted). The NWFQ is measure of nurses' perceived clinical ability, i.e., their individual experiences of their own behavior while at work. While the original Dutch version comprised 50 items, referring to seven subscales [(i) Cognitive Aspects of Task Execution and General Incidents; (ii) Impaired Decision Making; (iii) Causing Incidents at Work; (iv) Avoidance Behavior; (v) Conflicts and Annoyances with Colleagues; (vi) Impaired Contact with Patients and Their Families; (vii) Lack of Energy and Motivation], the Italian validation study, after removing statistically redundant items, showed support for a single-factor measurement model with 34 items. Each item is rated on a 5- or 7-point, Likert-type scale, and operationalises common aspects of the health-related work functioning. The final raw score is standardized in order to obtain a 100-point scale, with higher values indicating higher work impairment. The scale has a very good internal consistency (Cronbach's alpha = .91).

Demand-Control Support Questionnaire (DCS, Magnavita 2007). The DCS is derived from the longer Job Content Questionnaire (Karasek, 1979) and comprises 17 items to be rated on 4-point, Likert-type scales. The questionnaire provides scores on three subscales: The Demand subscale (5 items, range 5-20) refers to the job's psychological demands, such as work overload, difficulties in tasks, pace of activities, and occurrence of contradictory or controverting orders. The Job Control, or Decision Latitude, subscale (6 items, range 6-24)

assesses the use and development skills and autonomy in decision-making on the job. The Demand/Control weighted ratio is often used as a synthetic indicator of self-perceived job strain. The Social Support at Work subscale (6 items, range 6-24) taps into the quality of relationships among coworkers and with supervisors). A job strain measure is defined as the ratio between the demand and control mean scores. The three scales showed acceptable to good internal consistency (Cronbach's alphas .60, .76 and .87 for control, demand and support, respectively). Participants were classified in one of the Karasek's categories (high strain [high demand, low control], low strain [low demand, high control], active [high demand, high control], passive [low demand, low control]) using the normative scores reported in PAPER

Data analysis

First, we compared the scores of the nursing student and the HCW groups on the NWFQ and the DCS scores using independent samples *t*-tests. As we performed multiple comparisons on the same groups of participants, this could have inflated the familywise error rate, i.e., the probability of incorrectly rejecting the null hypothesis in at least one case (Type I error). Hence we used the Benjamini-Hochberg (2000)'s adaptive step-up correction of *p*-values for false discovery rate. Given the relatively large sample sizes, we also had a high a priori statistical power, which made it easier to detect significant effects. We thus computed measures of effect size (Cohen's *d*, Cohen, 1988).

We then compared the two groups with respect to the four categories of Karasek's model using a chi-square test for the independence of categorical variables. Chi-square tests are known to be sensitive to sample size: the value of the calculated chi-square is directly proportional to the sample size, regardless of the strength of the association between the variables. In this case, it would therefore be very likely to reject the null hypothesis of

independence with a total sample size of 793 cases. We thus computed a measure of effect size (Cramér's *V*) to address this issue. We also inspected adjusted standardized residuals (ASRs). ASRs are a standardized (*z*-scores) measure of the size of the difference between observed and expected values, namely, how each cell contributes to the chi-square value and, consequently, to the significance of the test. Since each ASR can be tested against a null hypothesis of it being zero in the population, a multiple comparison situation occurs. The Benjamini-Hochberg correction procedure of *p*-values was used in this case, too.

Finally, we submitted the NWFQ and DCS-Support scores to a 2 × 4 (Group [Students, HCWs] × Karasek's Category [Passive, High strain, Low strain, Active]) to a completely between factorial analysis of covariance, using the DCS-Support score as a covariate and the NFWQ score as the outcome variable. If statistically significant, omnibus tests were followed by post-hoc tests in order to investigate the pattern of mean differences. Again, the Benjamini-Hochberg correction procedure of *p*-values was used to control for the inflation of Type I error rate. Eta-squared (η^2) was used as a measure of effect size.

As we aimed at investigating the moderator role of social support at work, we specified the two-way interactions of mean-centered DCS-Support score with the factors and the three-way interaction term. In additional analyses, we also specified the main effects of age, gender, and university. These control variables did not have any significant effect, nor entering them in the model modified the significance of the other effects, hence we report here only the results of the models not involving such control variables.

Results

Results of the comparisons of the scores of the nursing student and the HCW groups on the NWFQ and the DCS are reported in Table 1. They show that, after correction for

multiple comparisons, nursing students obtained significantly higher scores than HCWs on the NWFQ and on job strain, while their scores were significantly lower on all DCS scales.

[Table 1]

Effect sizes were large for NWFQ (d = 1.69), DCS-Control (d = –0.87), and DSC-Support (d = –1.01), and small for DCS-Demand (d = –0.21) and Job Strain (d = 0.45).

The crosstabulation and within-group (row) proportions that we used to test the independence of group membership (student vs HCW) and Karasek's categories are depicted in in Figure 1.

[Figure 1]

The chi-square test was significant, with a moderate effect size ($\chi^2(3) = 72.95$, $p < .001$, Cramer's $V = .30$[1]). The inspection of ASRs revealed that students were more likely than HCWs for being classified as passive and high strain ($Z = 6.08$, $p < .001$, and $Z = 3.41$, $p < .001$, respectively) and less likely to be classified as low strain and active ($Z = –4.16$, $p < .001$, and $Z = –5.74$, $p < .001$, respectively).

As for the completely between factorial analysis of covariance, the main effect of group was significant ($F(1, 777) = 136.48$, $p < .001$, $\eta^2 = .08$[2]), with students generally scoring higher than HCWs. The main effect of Karasek's categories was also significant ($F(1, 777) = 5.68$, $p = .001$, $\eta^2 = .01$). Post-hoc comparisons revealed that, regardless of being a HCW or a student, the difference between Passive (M = 43.10, SD = 15.25) and High Strain (M = 38.22, SD = 16.43) groups, and the difference between Low Strain (M = 28.82, SD = 20.02) and Active (M = 23.63, SD = 17.08) were not significant ($t(777) = 0.25$, adjusted p = .804, d = 0.02; and $t(777) = 0.77$, adjusted p = .529, d = 0.03, respectively). All other

[1] Cramér's V can be interpreted using the guidelines for Pearson's r: $V < .10$ negligible effect size; $.10 \leq V < .30$: small effect size; $.30 \leq V < .50$: moderate effect size; $V \geq .50$: large effect size (Cohen, 1988).
[2] η^2 can be interpreted as follows: $\eta^2 < .01$ negligible effect size; $.01 \leq \eta^2 < .06$: small effect size; $.06 \leq \eta^2 < .14$: moderate effect size; $\eta^2 \geq .14$: large effect size (Cohen, 1988).

comparisons were significant at least at $p < .025$, albeit with small ($.17 < d < .24$) effect sizes. The main effect of DCS-Support was significant ($F(1, 777) = 141.77$, $p < .001$, $\eta^2 = .08$), since higher levels of social support at work were associated with lower levels of work impairment, independent of group and Karasek's category.

The DCS-Support by Karasek's categories interaction ($F(3, 777) = 0.66$, $p = .579$, $\eta^2 < .01$), and the Group by Karasek's categories ($F(3, 777) = 2.16$, $p = .092$, $\eta^2 < .01$) were not significant, while the DCS-Support by Group interaction was significant ($F(1, 777) = 10.62$, $p = .001$, $\eta^2 = .01$). This result suggests that the slope of the regression line of NWFQ score on DCS-Support significantly differs between students and HCWs. Figure 2 shows a stronger negative association of social support at work with work impairment in students, as indexed by the steeper regression line.

[Figure 2]

The three-way interaction was also significant ($F(3, 777) = 5.02$, $p = .002$, $\eta^2 < .01$). Given the cross-sectional nature of the study, the interpretation of this effect is manifold, hence the one we propose here is just one of those possible. In Figure 3 we show how the slope of the regression line of work impairment on social support at work of students and HCWs varies differently across Karasek's categories.

[Figure 3]

While in HCWs the (ubiquitously) negative association of NWFQ score with DCS-Support score is stronger in workers classified as Passive, in students it is stronger in the Low Strain and the Active groups.

However, the significance of this effect also suggests that, once taken into account the moderator effect of social support at work, the pattern of differences in NWFQ scores across Karasek's categories differed between groups (Figure 4).

[Figure 4]

Post-hoc tests revealed that work impairment levels did not significantly differ across Karasek's categories in HCWs (with effect sizes ranging from 0.04 to 0.16), whereas within the student group all comparisons were statistically significant at least at $p = .009$ (with effect sizes ranging from 0.20 to 0.51), with the only exception of the High Strain vs Low Strain comparison ($t(777) = 0.77$, adj-$p = .441$, $d = 0.06$).

Discussion

In this study we tested in a large sample of nursing students one of the core hypotheses of Karasek's job demand-control model, i.e., the active learning hypothesis, which assumes that high job demands in combination with high job control increase learning and development in the job, and hence less work impairment. Initially we compared the scores of nursing students with those of HCWs from the same hospitals on measures of work impairment (NWFQ) and job demand, control, and support, and found, as expected, that students had higher scores of work impairment and job strain, and lower scores in the other scales. This result is consistent with previous studies (e.g., Pulido-Martos et al., 2012), that identify academic stressors as an additional source of job stress for nursing students with respect to other HCWs. We also found that nursing students were more likely to be classified as Passive and High Strain (the two Karasek's categories with low control), and less likely to be classified as Low Strain and Active (the two Karasek's categories with high control) than HCWs. When we compared groups on scores of a work impairment measure, we found that nursing students classified as Passive had significantly higher scores than the other students, while the same result was not found in HCWs, where group differences were not significant and, in any case, showed a substantially lower effect size.

In this study we also investigated the role of (perceived) social support at work. We found that it had both a direct, negative association with work impairment (i.e., higher

perceived levels of social support at work are associated to lower self-reported levels of work impairment), and could moderate the association of work impairment with being a nursing student or a HCW and Karasek's categories. Specifically, we found that while social support at work seems to be more strongly associated with work impairment in Passive HCWs, in nursing students the association is stronger in Low Strain individuals. These results are consistent with Phipps et al. (2012)'s findings that working conditions with low demand (as in the Passive and in the Low Strain condition) and high support are those more favourable. However, since this is a cross-sectional study, no causal interpretation of these effects is warranted.

Taken together, our findings are consistent with previous studies that showed that high stress levels in nursing students may affect memory, concentration, and problem-solving ability, and may compromise learning, coping, and academic performance (Goff, 2011). A longitudinal cohort of Swedish nursing students suggested that burnout development during higher education interfered with learning and psychological well-being. Aspects related to work skills and intention to leave the profession were also affected (Rudman & Gustavsson. 2012). However, it has also been found that social support is an effective way to decrease nursing student stress (Lou et al., 2010), and that support seeking is an important predictor of future academic performance (Ofori & Charlton, 2002). Social isolation may prevent the development of communication skills and team working of nursing students.

It is also worth noting that less than one in five (18%) nursing students were classified as Active, the condition in which the motivation to develop new behavioral patterns, i.e., the contemporary perception of high demand and high control, is associated with lower levels of work impairment at the end of the clinical training. Conversely, 37% of nursing students were classified as Passive, and endorsed the highest scores on the NWFQ. Although we could not address this issue with this cross-sectional study, future studies should test whether this can

be the result of the traditional academic educational method, mainly based on passive lectures, and not on active and cooperative engagement. Actually, previous studies suggested that traditional teaching methodologies might discourage student learning because of passive exchange of knowledge. Active engagement appears to be the best method to transfer knowledge into clinical inquiry (White, 2015). It is therefore desirable that university teachers be knowledgeable about innovative teaching strategies that focus on enhancing student learning and address the integration issues associated with the theory vs practice gap.

Many studies have shown that nursing students may report difficulties in applying theory learned at university to clinical practice. Students need to be assisted in developing self-assessment skills, learning outcomes, and strategies to improve performance, and in overcoming barriers to clinical practice improvement (Calleja et al. 2015). Learning improvement seems also to be fostered by encouraging the development of student autonomy through an iterative process (Haraldseid et al. 2016). Active learning principles, through direct participation of nursing students in their education (Bakon et al. 2016), problem-based learning (Gould et al. 2015), and personal confrontation are recognized by students as significant learning opportunities (Grealish & Ranse, 2009). Introducing creative activities may also promote students to think in unconventional ways about the traditional learning models (Rankin & Brown, 2016). Innovative teaching techniques, like gaming (Day-Black et al. 2015), team based learning (Hemmati Maslakpak et al. 2015), and social networking sites including Facebook (Watson, Cooke, & Walker, 2016) have been proposed as efficient learning strategies to stimulate active and collaborative learning approaches. Of course, putting in practice these techniques requires a lot of effort to teachers, but the result may be rewarding.

The results of this study also suggest that dealing with academic stress alone, without considering the degree of activity in clinical activities, it is not enough. A number of

programs that assists nursing students in developing stress management strategies have been proposed (e.g., Delaney et al., 2015). A recent quantitative review of these programs showed that the most effective interventions provided skills for coping with stressful situations (typically relaxation) and skills for changing maladaptive thoughts (Galbraith & Brown, 2011). Recommendations of these programs include reducing academic demands during clinical placements and extending and promoting existing support services (Galvin et al. 2015). The results of the present study mainly support the latter recommendation, while we observe that the best choice is looking for an increase of teachers' support and of student's control on their job, which can reduce the occurrence of passive behavior.

One of the limitations of this study is that we could not control for relevant personality traits, due to the limited available assessment time. For instance, previous studies revealed the role played by emotional intelligence (EI, Salovey & Mayer, 1990). It has been observed that nursing students with higher levels of learned creativity and emotional intelligence develop greater self-confidence, motivation, and academic diligence, and are less likely to become anxious, depressed, and discouraged (Goff, 2011). Specifically, emotional intelligence appears to have the potential to enable individuals to cope better and experience less stress thus contributing to a healthy and reliable staff (Jones-Schenk & Harper, 2014; Miri et al. 2013; Salovey & Mayer 1990; Van Rooy & Viswesvaran 2004). Increased feelings of control on work activity and emotional competence assist nursing students in adopting active and effective coping strategies when dealing with stress, which in turn increases their subjective well-being (Por et al. 2011).

Another possible limitation might be linked to the instrument chosen to measure work impairment. We used the NWFQ, a tool specifically developed to assess the work functioning of nurses, and recently validated in Italian. Although the subjectivity of the assessment may be open to criticism, we noted that this tool is specific to the clinical work of nurses and can

therefore be suitable for this application. In any case, a recent review of instruments that measure learning outcomes in healthcare students concluded that no instrument is currently displaying adequate validity (Cadorin et al., 2016).

In conclusion, this study supports the claim that the teaching of nursing must have an active approach. Teachers must encourage the active inclusion of nursing student in clinical activities and fostering team work. Hopefully, future longitudinal studies will investigate whether this effort will actually improve the learning of clinical skills by nursing students.

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Figure captions

Figure 1 Frequency distribution of cases in Karasek's categories by group (HCW: health-care workers)

Figure 2 Scatterplot, regression lines, and standardized regression coefficients of the association between scores on the Nurse Work Functioning Questionnaire (NWFQ) and scores on the Support scale of the Demand-Control-Support (DCS) questionnaire in the student and the health care worker (HCW) groups.

Figure 2 Scatterplot, regression lines, and standardized regression coefficients of the association between scores on the Nurse Work Functioning Questionnaire (NWFQ) and scores on the Support scale of the Demand-Control-Support (DCS) questionnaire in the student and the health care worker (HCW) groups by Karasek's categories.

Figure 4 Estimated marginal means (M) and their standard errors (SE) on the Nurse Work Functioning Questionnaire (NWFQ) by Karasek's categories in the nursing students and health-care workers (HCW) groups, once adjusted for the moderating effect of the social support at work level. Error bars represent 95% confidence intervals.

Conflict of interests

No conflict of interest has been declared by the authors.

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Figure 1

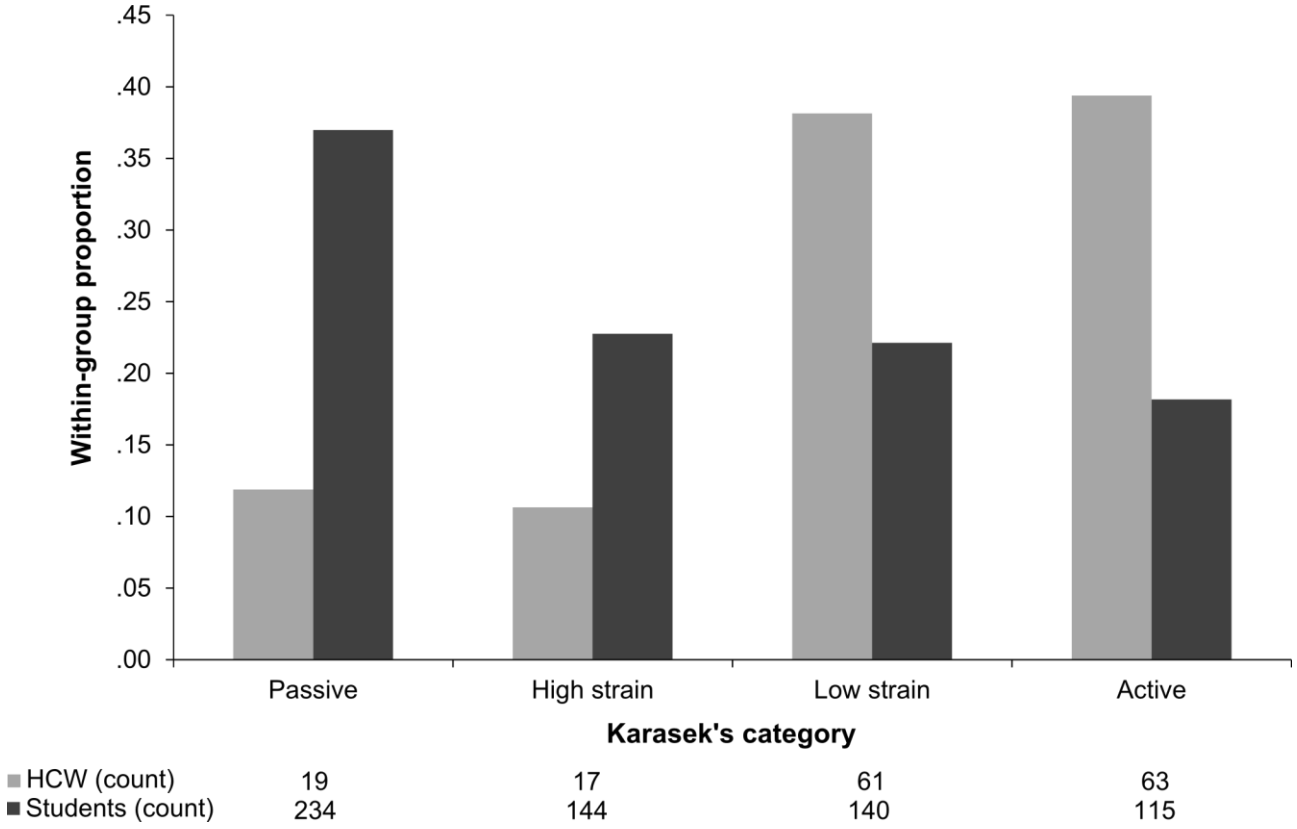
.45
.40
.35
.30
.25
.20
.15
.10
.05
.00
Within-group proportion
Passive
High strain
Low strain
Active
Karasek's category
HCW (count) 19 17 61 63
Students (count) 234 144 140 115

Figure 2

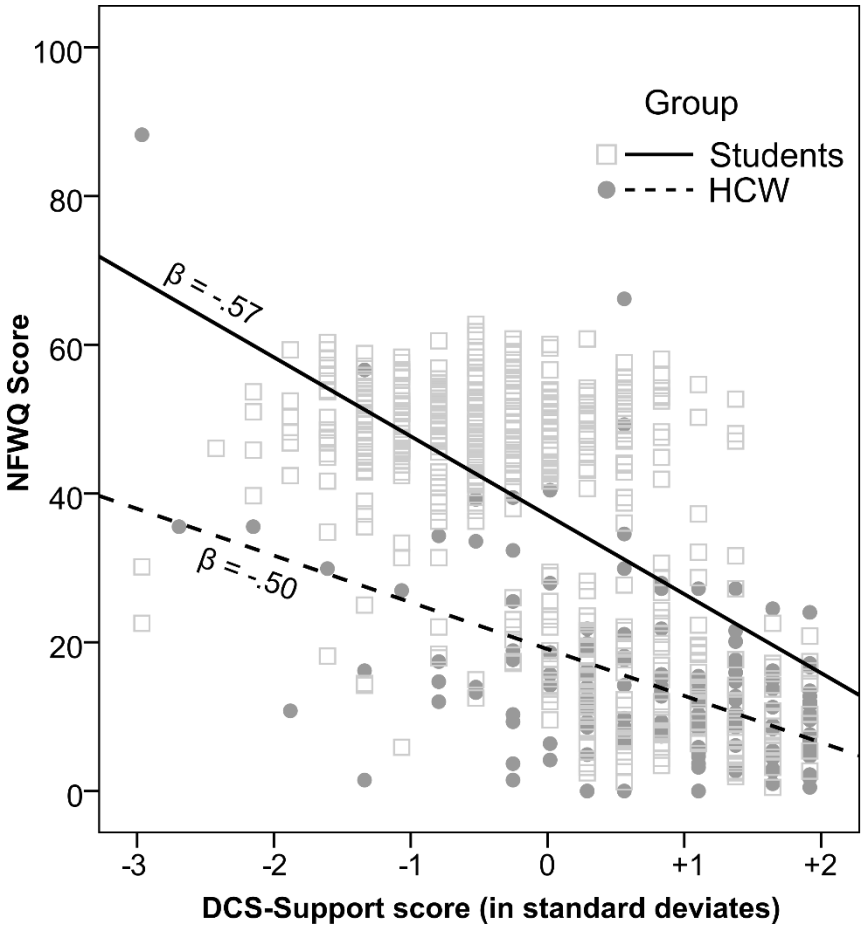
Group
Students
HCW
β = -.57
β = -.50
NFWQ Score
100
80
60
40
20
0
-3
-2
-1
0
+1
+2
DCS-Support score (in standard deviates)

Figure 3

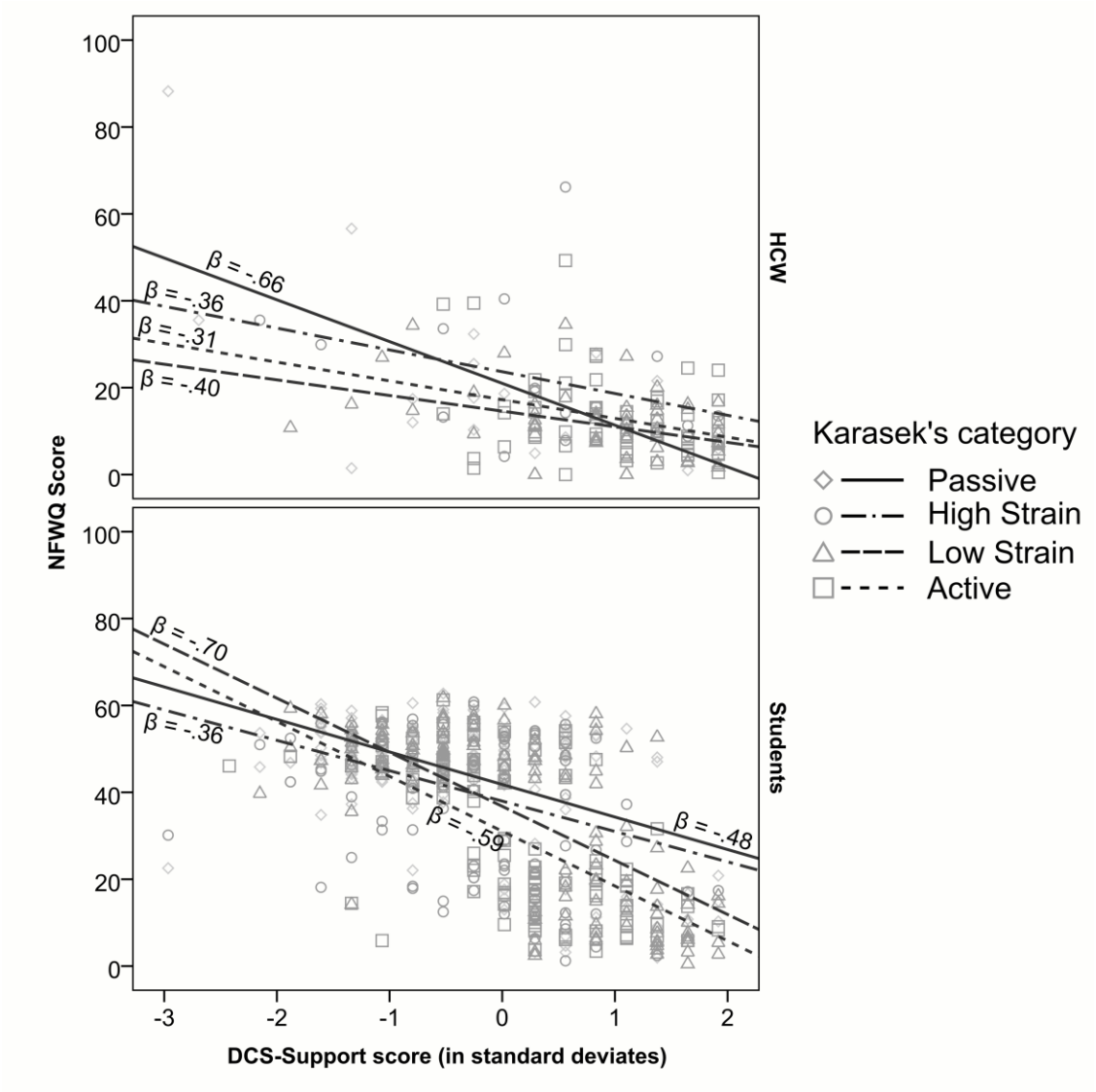
NFWQ Score
HCW
Students
β = -.66
β = -.36
β = -.31
β = -.40
β = -.70
β = -.36
β = -.59
β = -.48
DCS-Support score (in standard deviates)
Karasek's category
Passive
High Strain
Low Strain
Active

Figure 4

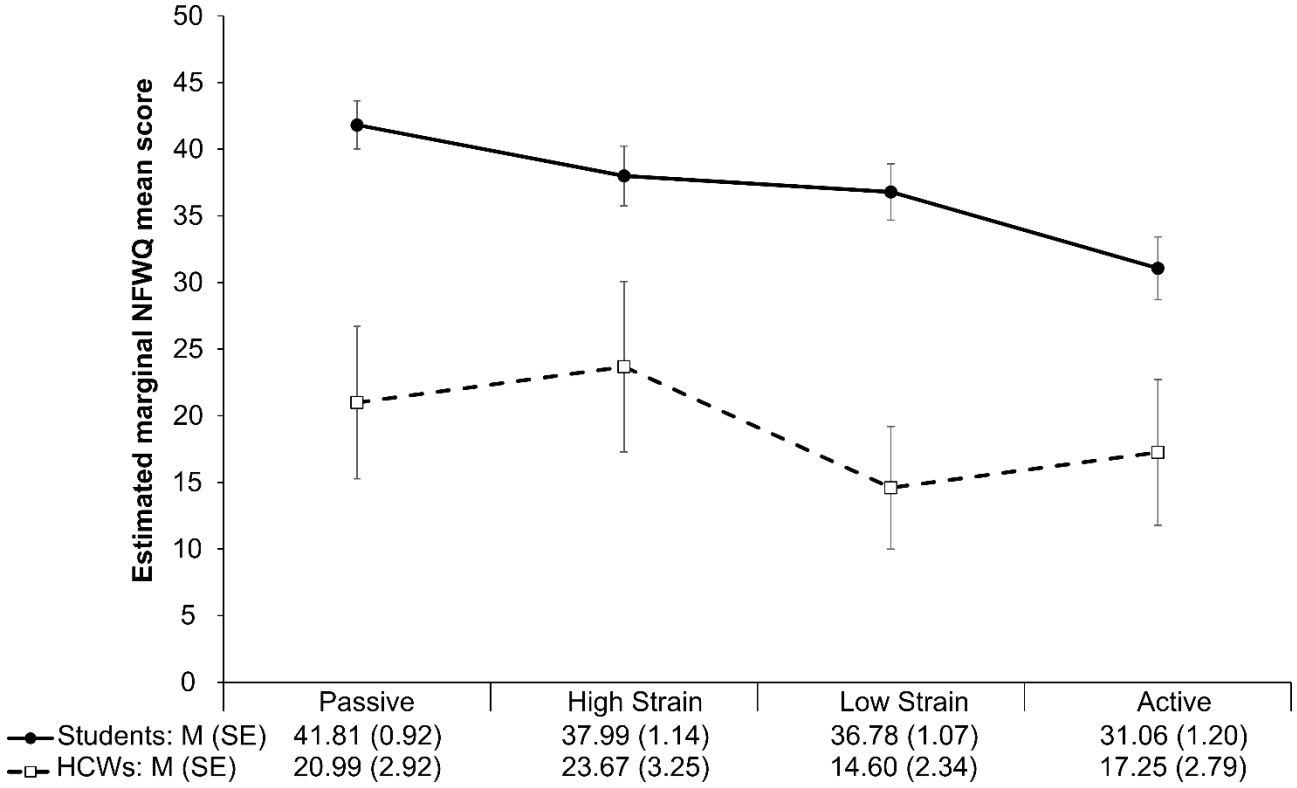
Estimated marginal NFWQ mean score
50
45
40
35
30
25
20
15
10
5
0
Passive
High Strain
Low Strain
Active
Students: M (SE) 41.81 (0.92) 37.99 (1.14) 36.78 (1.07) 31.06 (1.20)
HCWs: M (SE) 20.99 (2.92) 23.67 (3.25) 14.60 (2.34) 17.25 (2.79)

Table 1.

Descriptive statistics (mean±standard deviation) and results of the independent sample t-tests performed to compare the scores of nursing students and health-care workers (HCW) on the Nurse Work Functioning Questionnaire (NFWQ) and the Demand-Control-Support questionnaire.

Variable	Nursing students (n = 633)	HCW (n = 160)	*adj-p*	*d*
NWFQ (range 0-100)	39.13±16.85	14.31±12.23	<0.001	1.69
Demand (range 5-20)	12.75±2.56	13.31±2.73	.016	-0.21
Control (range 6-24)	15.60±2.79	18.05±2.82	<0.001	-0.87
Support (range 6-24)	16.22±3.36	19.73±3.59	<0.001	-1.01
Job Strain	1.01±0.28	0.90±0.21	<0.001	0.45

Note: adj-p: p-values adjusted for multiple comparisons using the Benjamini-Hochberg (2000)'s adaptive step-up correction for false discovery rate; d: Cohen (1988)'s measure of effect size. $|d| < .20$: negligible effect size; $.20 < |d| < .50$: small effect size; $.50 < |d| < .80$: moderate effect size; $|d| > .80$ large effect size.