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An assessment of nurses' experiences of work related stress through self-reporting and hair cortisol analysis, in a metropolitan hospital in Western Australia

Kim Oliver
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AN ASSESSMENT OF NURSES'
EXPERIENCES OF WORK RELATED STRESS
THROUGH SELF-REPORTING AND HAIR
CORTISOL ANALYSIS, IN A METROPOLITAN
HOSPITAL IN WESTERN AUSTRALIA

KIM OLIVER

This thesis is presented in total fulfilment of the requirements for
the award of the Degree of Doctor of Philosophy

School of Medical and Health Sciences

Edith Cowan University

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ABSTRACT

The aim of this study was to assess how years of experience and practice area influence work related stress amongst 1,200 nurses employed in a metropolitan hospital environment in Western Australia.

A combination of self-administered questionnaires and hair cortisol, an objective stress biomarker, was utilised to measure stress levels and to relate these to practice area, age and experience.

Questionnaire results indicated that there was a higher level of perceived stress for 40% of this cohort of nurses; the study methodology was able to unearth noteworthy factors within a local WA nursing population that impacted on their perceived stress. These being; inexperienced nurses suffer more work-related stress than the more experienced nurse. Leadership demands are a source of stress for nurse managers; and age and generational differences' were also noted.

Contrary to hypothesis two, this study could not determine a statistically significant effect relating to the practice area in which the nurses' worked.

Despite a weak correlation found between the hair cortisol level and results of the written questionnaires it is considered when used in conjunction with a stress questionnaire, that hair cortisol testing provides an effective diagnostic tool with adequate sensitivity to detect stress.

The 'curvilinear effect' as reported by Wells' (2014) postulated to be due to the physiology of the individuals coping mechanisms was replicated in this study, and therefore determined to be real. It is therefore considered that hair cortisol is a valid screening tool for stress in the occupational environment.

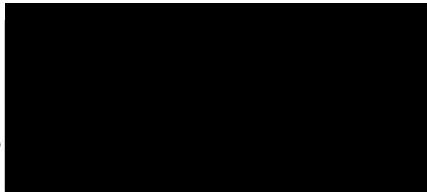
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TABLE OF CONTENTS

ABSTRACT	i
DECLARATION	ii
ACKNOWLEDGEMENTS	iii
PUBLICATIONS	iv
LIST OF FIGURES	ix
LIST OF TABLES	xi
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.1.1 Quality of work	1
1.1.2 Stress within the health sector.....	2
1.1.3 Biomarkers and measurements of stress	4
1.2 Research aims and objectives.....	6
1.2.1 Research questions	7
1.3 Methodology	7
1.4 Organisation of thesis.....	7
1.5 Chapter summary	8
CHAPTER 2 LITERATURE REVIEW	9
2.1 Introduction	9
2.2 Popular models and theories of general stress	9
2.2.1 The General Adaptation Syndrome	9
2.2.2 Person-Environment Fit Theory.....	10
2.2.3 Job Demands-Control Model.....	10
2.2.4 Transactional Models of Stress	11
2.2.4.1 Stage one - Source of demand.....	11
2.2.4.2 Stage two - Cognitive appraisal.....	12
2.2.4.3 Stage three - Stress response	12
2.2.4.4 Stage four - Consequences of the coping response	12
2.2.4.5 Stage five - Feedback	12

2.3 Literature review	14
2.3.1 Stage one - The perceived and actual demands.....	14
2.3.1.1 Sources of demand	14
2.3.1.2 External demands.....	15
2.3.1.3 Internal demands.....	18
2.3.1.4 Blurred demands	19
2.3.2 Stage two - Cognitive appraisal	20
2.3.3 Stage three - Stress response	22
2.3.3.1 Behavioural responses	23
2.3.3.2 Emotional responses	24
2.3.3.3 Cognitive responses	25
2.3.3.4 Physical responses.....	26
2.3.4 Stage four - Consequences of the coping response	28
2.3.5 Stage five - Feedback.....	30
2.4 Chapter summary	30

CHAPTER 3 METHODOLOGY	31
3.1 Introduction.....	31
3.2 Research purpose	31
3.2.1 Research questions.....	31
3.3 The research design	31
3.3.1 Study setting	32
3.3.2 Sample 32	
3.3.2.1 Sample size, calculation and sampling method	33
3.3.3 Participant recruitment.....	33
3.3.4 Inclusion criteria	34
3.3.5 Exclusion criteria	34
3.3.5.1 Additional exclusion criteria for supply of a hair sample.	34
3.4 Instruments used during data collection	34
3.4.1 Written questionnaires.....	34
3.4.2 Hair cortisol	37
3.4.3 Micro balance.....	38
3.4.4 Hair cortisol assay process.....	38
3.5 Data collection	39
3.6 Methods for data analysis	39
3.6.1 Questionnaire analysis	39

3.6.2	Hair sample analysis	40
3.6.3	Statistical analysis	41
3.7	Ethical considerations	41
3.7.1	Approvals	41
3.7.2	Information sheet to participants	41
3.7.3	Counselling available to participants	41
3.7.4	Confidentiality of participants	41
3.7.5	Data storage	42
3.7.6	Ethics	42
3.8	Chapter summary	42
CHAPTER 4	RESULTS	43
4.1	Introduction	43
4.2	The study sample	43
4.2.1	Sensitivity to outliers within the data	44
4.3	The PSS-10 results	45
4.4	Work Stress Profile questionnaire	53
4.4.1	The first category: Workplace inter-relationships	54
4.4.2	The WSP - Physical demands sub-category	59
4.4.3	The WSP - Personal interest, involvement of the job sub-category	66
4.4.4	The WSP - collective totals score	74
4.5	The PSS-10 results correlation with WSP questionnaire	78
4.6	A comparison of responses to both questionnaires with the hair cortisol levels	83
4.7	Chapter summary	90
CHAPTER 5	DISCUSSION	91
5.1	Introduction	91
5.2	A summary of the PSS-10 and WSP questionnaire scoring	91
5.3	The perception of stress in the study group	92
5.4	Age as a stressor	94
5.5	Stress and the years of experience of the nurse	98
5.6	Student nurses	101
5.7	Practice area	102
5.8	Personal attributes of the nurse	102

5.9 Hair cortisol analysis.....	103
5.9.1 Do the hair cortisol results correlate with questionnaire findings..	104
5.10 Recommendations.....	106
5.10.1 Recommendations for nursing practice	106
5.10.2 Recommendations for research.....	107
5.10.3 Recommendations for nursing education.....	107
5.11 Limitations	107
5.12 Conclusion	108
5.13 Personal reflection	111
 REFERENCES	 112
 APPENDIX A GPOWER ANALYSIS	 137
APPENDIX B STUDENT NURSES PARTICIPANT’S INFORMATION SHEET.....	138
APPENDIX C REGISTERED NURSES PARTICIPANT’S INFORMATION SHEET.....	142
APPENDIX D ONE MINUTE UPDATE	146
APPENDIX E SALIMETRICS – SALIVARY CORTISOL ENZYME IMMUNOASSAY KIT.....	147
APPENDIX F BACKGROUND INFORMATION TO THE PARTICIPANT	168
APPENDIX G CONSENT FORM	175
APPENDIX H HAIR CORTISOL LEVELS AND CLASSIFICATION.....	176
APPENDIX I OUTLIER TABLE.....	178
APPENDIX J TOM COX CONSENT	181
APPENDIX K PSS-10 CONSENT.....	182
APPENDIX L WORK STRESS PROFILE CONSENT	184

LIST OF FIGURES

Figure 1: Transactional Model of Stress.....	13
Figure 2: The PSS-10 score frequency distribution	45
Figure 3: The PSS-10 scores plotted against the age of the participants	46
Figure 4: PSS-10 scores plotted against the years of experience as a nurse	47
Figure 5: PSS-10 scores plotted against the level of education.....	48
Figure 6: PSS-10 scores plotted against the service domain	49
Figure 7: PSS-10 score plotted against each area of practice.....	50
Figure 8: PSS-10 score plotted against the level of nurse.....	53
Figure 9: Workplace inter-relationships plotted against age	54
Figure 10: Workplace inter-relationships and level of education obtained	55
Figure 11: Workplace inter-relationships score and years of experience.....	56
Figure 12: Workplace inter-relationships and service domain	56
Figure 13: Workplace inter-relationships score and ward area of practice	57
Figure 14: Workplace inter-relationships score and level of nurse	57
Figure 15: WSP workplace inter-relationships frequency	58
Figure 16: Physical demands score and the participants age	59
Figure 17: Physical demands score and educational background.....	62
Figure 18: Physical demands score and the years of experience as a nurse	62
Figure 19: Physical demands score and the service domain.....	63
Figure 20: Physical demands and the area of practice.....	64
Figure 21: Physical demands and the level of the nurse	65
Figure 22: WSP physical demands frequency score	66
Figure 23: Personal interests score and the age of the participants	67
Figure 24: Personal interest or involvement score and educational background	68
Figure 25: Personal interest or involvement score and experience as a nurse..	69
Figure 26: Personal interest or job involvement and service domains.....	70
Figure 27: Personal interest score and area of practice	71
Figure 28: Personal interest or involvement of the job score and level of nurse	72
Figure 29: WSP personal interests or involvement of job frequency score	73
Figure 30: WSP collective totals score and the age of the participants	74
Figure 31: WSP collective totals score and the education level	75
Figure 32: WSP collective totals score and the years of experience as a nurse	76
Figure 33: WSP collective totals score and level of nurse	76

Figure 34: WSP collective totals score and area of practice	77
Figure 35: WSP collective totals frequency score	78
Figure 36: PSS-10 scores correlation with workplace inter-relationships score	79
Figure 37: PSS-10 scores correlation with the WSP physical demands score...	80
Figure 38: PSS-10 correlation with the personal interest or involvement of job	80
Figure 39: PSS-10 scores correlation with the WSP collective totals score	81
Figure 40: PSS-10 frequency distribution, and cortisol levels	84
Figure 41: Workplace inter-relationship score and cortisol levels	85
Figure 42: WSP physical demands score and cortisol levels.....	86
Figure 43: Personal interest or involvement in the job and cortisol levels	87
Figure 44: WSP collective totals score and the level of cortisol in hair	88
Figure 45: Mean HCC against categories of the Perceived Stress Scale	89
Figure 46: Individual HCC against categories of the Perceived Stress Scale	90

LIST OF TABLES

Table 1: An overview of the study participants	44
Table 2: PSS-10 multiple comparisons with area of practice.....	51
Table 3: Workplace inter-relationship results lack of correlation with variables .	58
Table 4: WSP 'physical demands' multiple comparisons with age	60
Table 5: Physical demands results lack of correlation with variables	63
Table 6: Area of practice.....	71
Table 7: WSP collective totals score lack of correlation with variables	77
Table 8: Tests of normality.....	79
Table 9: Pearson correlations for parametric testing	82
Table 10: Spearman's correlation for non-parametric testing	83
Table 11: Overview of outliers (n=21)	178

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Within any working environment, people are exposed to various sources of stress. While the precise definition of stress and perceived stress remains elusive (Donovan, Doody, & Lyons, 2013). Goodnite (2014) supports the notion that stress is the end result of an “individual’s perception to a stimulus, interpreting this as overwhelming, and the inability to meet the challenge” (p.72). Boals and Banks (2012) offer the definition of perceived stress as the “perception that one’s life is unpredictable, uncontrollable, and overloaded” (p.1336). Whenever an individual perceives the presence of negative stressors, their cumulative stress levels rise (Rice, 1999). The Australian Institute of Health and Welfare (2010) notes that the way people perceive and interpret their own health is a good indicator of the health of the population, which impacts financially on the larger community through increased medical and legal expenses, and decreased productivity and morale. Moreover, adverse factors in an individual’s professional and private life increase the likelihood of sustaining a work related injury (Australian Institute of Health and Welfare, 2010).

Whilst there have been numerous studies exploring stressors for student and graduate nurses (Labrague, 2013; Lo, 2002; Pulido-Martos, Augusto-Landa, & Lopez-Zafra, 2012; Zyga, 2013), not many studies have focused on nurse managers and those in leadership roles (Brown, Fraser, Wong, Muise, & Cummings, 2013; Kath, Stichler, Ehrhart, & Sievers, 2013). Looking at the broad spectrum of perceived stressors within the workplace, Zhao et al. (2013) noted a positive correlation between quality of work, attachment to the organisation, and staff turnover within China’s nursing profession. The authors suggest that management should consider these findings when developing strategies, which aim to strengthen workplace attachment, job satisfaction, and initiatives to aid staff retention.

1.1.1 Quality of work

Butterworth et al. (2011) utilised a household survey to investigate whether the quality of work had a detrimental impact on the wellbeing of workers. They assessed perceived quality of work, job security, autonomy and achievability of workload expectations. Findings suggest that gained employment does not necessarily lead to improved health for the individual. Rather, if they perceive the quality of their

employment as poor, or the workload unachievable, then from a psychological perspective, their health can be less optimal than that of an unemployed person.

It is not only the work environment and workload which impacts on the individual's perceived level of stress, individual personal circumstances can also significantly contribute to stress perception (Krantz, Berntsson, & Lundberg, 2005). To assume that each individual will react to single or multiple stressors, either work related or personal in the same way would be incorrect and naive (Sharpley, Kauter, & McFarlane, 2010); rather individuals react differently due to their individual personality, temperament, and life stage (Segerstrom & O'Connor, 2012). In the modern culture of the workplace, stress tends to be inescapable due to longer working days, frequent organisational restructuring and lack of lifetime career pathways (Malikeh & Rahele, 2013). Part of the challenge for organisations now, is to develop strategies, which invest in the health of the company's workforce by introducing stress reduction programs, such as relaxation courses, or psychosocial programs, which address perceived stress, and ensure psychosocial wellbeing. Even if initially productivity is negatively impacted, the long-term gains will positively impact on absenteeism, work place accidents and staff retention (Backwith & Munn-Giddings, 2003).

1.1.2 Stress within the health sector

Over half of Western Australian (WA) nurses reportedly intend to leave the profession within the next 10 years, many within the next five years, which will cause a skills shortage in WA hospitals (Twigg, Duffield, Thompson, & Rapley, 2010). The opening of the new Fiona Stanley Hospital and the need to have approximately 30% more nurses, as well as the retirement of the baby boomers, is adding to an already overloaded WA nursing workforce (Twigg et al., 2010). From a slightly different perspective, nursing students report negative interactions with clinical staff due to a theory-practice gap as a major source of their stress; other stressors include academic demands such as fear of failing, assignments, workload and interaction with lecturers (Labrague, 2013). Teaching staff either in the university, or within the clinical setting need to be aware of the negative impact they can have on their students so that they are better equipped to support them. Students who may be juggling financial stressors as well as academic and emotional stressors should be a high priority, rather than solely focusing on the knowledge and skills the student needs to develop (Timmins & Kaliszer, 2002), otherwise this can lead to student nurses leaving the profession before they complete their studies further adding to the predicted nursing shortfall.

Laal and Aliramaie (2010) interviewed 100 nurses within Iran, their findings showed a significant association between their job experience, age and tenure of the nurse, as well as their personal circumstances, which impacted on the health of the nurse. They conclude that the way a nurse responds to stress is not totally reliant on personality alone; rather the work environment such as different practice areas (emergency department, intensive care unit, rehabilitation department) can exacerbate stressors leading to stress becoming multi-faceted. Johansson, Sandahl and Hasson (2013) are supportive of these findings in a comparative study evaluating the stress of nurse managers. The authors found that the self-reported stress levels of nurse managers was less than that of registered nurses, which may be due to the fact that they have greater autonomy over their workload. Furthermore, they found that the experienced nurses were able to cope with workplace stressors better when compared to novice nurses, a finding the authors attributed to their age rather than the experience of the nurse. McNeely (2005) reported that nursing is ranked amongst the most vulnerable professional groups for occupational injury and illness, and often due to the complexity of stress, easier quantifiable issues such as needle stick or musculoskeletal injuries are investigated, so the number of nurses experiencing workplace stress maybe higher than initially thought. Moreover, Australia has one of the highest rates of workers compensation claims for work-related mental disorders associated with stress (Safe Work Australia, 2010). Symptoms such as headaches, depression, decreased energy levels, and insomnia all negatively impact on the health of the nurse and the organisation in the form of increased absenteeism and staff turnover, ultimately raising the perceived stress levels for the remaining nurses who may struggle to continue to work until such time as they are no longer able to cope (Shivaprasad, 2013).

A study by Opie et al. (2011) compared occupational stress between remote and hospital-based nursing within Australia. They found similarities in stressors raised by both nursing groups, for example job demands, workloads, along with conflicts relating to other nurses or supervisor, lack of developmental opportunities and job satisfaction were common stressors for both remote and hospital based nurses. They concluded that research, which focuses on workplace interventions to address such stressors, is needed to minimise the negativity on work outcomes for nurses, and patient care. Light and Bincy (2012) agree and note that stress management interventions such as stress awareness training, exercise and muscle relaxation techniques have been shown to reduce occupational stress from 60% to 20% in intensive care nurses. Light and Bincy (2012) point out that just like other nursing audits, a stress audit should be completed periodically to enable the identification of stressors amongst nursing staff. This could

lead to effective interventions such as counselling, relaxation training and techniques being implemented, which could positively impact on quality of work and patient care.

A review of stress management interventions conducted by Edwards and Burnard (2003) report that a wealth of information is already known about the sources of stress relating to nursing, but not many interventions are implemented into specific practice areas to minimise these stressors. In agreement, Smith (2014) suggests that the elimination of work-related stress for nurses is unrealistic due to the nature of their work but rather interventions which help nurses cope and manage their stress effectively should be recommended, as this may assist the nurse to focus or concentrate, regaining feelings of empowerment, job satisfaction and accomplishment. If these interventions are not sustainable for long periods of time due to personal constraints, then Mackenzie, Poulin, and Seidman-Carlson (2006) suggest that even a short period such as four weeks, may prove beneficial to the individual in reducing the perception of stress and burnout, enhancing relaxation and improving a sense of overall wellbeing.

1.1.3 Biomarkers and measurements of stress

The bodies' response to stress is the release of a hormone called corticotrophin (CRH) from the hypothalamus, (the main centre for the regulation of the hypothalamic-pituitary-adrenal axis (HPA)); this stimulates the anterior pituitary gland to release the adrenocorticotrophic hormone (ACTH) into the systemic circulation (Liang et al., 2011). ACTH in turn stimulates the adrenal gland to release cortisol. Increased levels of cortisol lead to an increase in gluconeogenesis, which produces a heightened level of alertness. Also, it suppresses the immune and digestive functions, including decreased motility, and sphincter constriction and decreased secretions. The generalised physiological response to stress includes an increased heart rate, cardiac output, increased breathing and blood pressure, with an elevated level of glucose and lipids, resulting in an altered immunity and suppression of pain (Craft & Gordon, 2015). Fukuda and Morimoto (2001) identified other hormones such as serotonin, melatonin and beta-endorphins which are released during stress; however, analysis of these markers is difficult when using a non-invasive technique such as saliva sampling due to the large amount of saliva required for analysis. Saliva sampling can be equally as accurate as urine or plasma cortisol levels, but reliability depends on the collection process and preservation technique (King & Hegadoren, 2002).

Identifying a biological marker to complement and validate the self-reporting of stress levels is of interest to many researchers (Australian Institute of Health and Welfare, 2010; Sanjog, Einarson, Karaskov, Van Uum, & Koren, 2007). The secretion of daytime salivary cortisol levels has been associated with higher stress levels within the workforce (Hagger-Johnson, Whiteman, Wawrzyniak, & Holroyd, 2010). The salivary method for sampling cortisol has drawbacks, such as individual variation and fluctuation challenges. Research into the variability of cortisol levels associated with gender, age, time, and day of the week have been investigated (Evans, Hucklebridge, Clow, & Thorn, 2004). It was identified that the levels of awakening cortisol released by individuals are part of the circadian cycle, but its primary role is yet to be fully explained. It was suggested that methodological inconsistencies might explain the variability in the results found throughout the literature. Thus using salivary cortisol analysis to determine chronic stress is susceptible to error, and factors such as lasting awakening cortisol responses (ACR) for premenopausal females, shift changes, age range, day of the week, and month of the year require attention during data analysis (Evans et al., 2004).

More recently Karlén, Ludvigsson, Frostell, Theodorsson and Faresjö (2011) investigated whether cortisol levels detected within a person's hair could be used as a biomarker for perceived stress. They observed a significant relationship between hair cortisol levels and self-reported stress levels. By using this sampling method for the biomarkers, the fluctuations, and inconsistencies evident within saliva sampling were overcome. Karlén et al. (2011) therefore supports using hair sampling to quantify chronic stress levels as a valid method. Thus supporting the findings of Gow, Thomson, Rieder, Van Uum and Koren (2010) who reviewed current methods and usefulness of hair analysis as a tool in measuring cortisol levels, as it eliminates the subjectivity of questionnaires as a biomarker of chronic stress. Gow et al. (2010) notes that hair analysis is a unique tool allowing a non-invasive and accurate assessment with greater potential for research application.

As well as being a valid tool to estimate chronic stress levels Van Rossum, Manenschijn, and Feelders (2012) point out that as levels of cortisol in the hair reflects systemic plasma levels, disorders such as Cushing's Syndrome (raised cortisol levels) may need to be considered as a cofounder in stress related screening.

Faresjö et al. (2013) explored hair cortisol levels between two populations facing economic and financial crisis. Greek and Swedish university students were invited to complete a written questionnaire and undertake hair sampling to determine if either

sample had raised cortisol levels. The Greek sample reported significantly higher levels of perceived stress compared to the Swedish sample, although hair cortisol concentrations were lower in the Greek sample and did not reflect their perceived levels of stress. Faresjö et al. (2013) attributed this to the down regulation of the HPA axis as a result of long term exposure to a highly stressful environment. Gerber et al. (2012) partially attributed weak association between perceived stress levels and hair cortisol in part to the difference in timeframes when hair samples were obtained and questionnaires completed.

More recently, Faresjö, Jullander, Göttmalm, and Theodorsson (2014) compared two different occupational groups, assessing their perceived stress levels using Cohen's perceived stress scale. Results were validated by correlating questionnaire data with the individual hair cortisol level, as is the intention of this study. The two professions within this study were librarians and nurses; findings report statistical significance between high levels of self-reported perceived stress, poor health and hair cortisol levels for each of the two professions, although no correlation between both occupations was found. They conclude that this research and technique is of benefit to general research application and population-based research. This poses the question what are the perceived stress levels of nurses in WA?

1.2 RESEARCH AIMS AND OBJECTIVES

The aim of this study was to explore the perceived stress levels amongst a group of nurses in WA. Findings from this study adds to the body of knowledge in relation to the perceived stress levels within the nursing profession utilising a combination of tools, and exploring the reliability of hair cortisol as a reliable biomarker for stress amongst nurses in WA.

The objectives of this study were:

1. To determine if there was a correlation between the experience levels of the nurses' and their perceived stress levels.
2. To determine if practice area influences stress levels for WA nurses.
3. To determine if hair cortisol levels are correlated with self-reported perceived stress levels amongst WA nurses.

1.2.1 Research questions

1. Do inexperienced nurses perceive more work related stress than experienced nurses?
2. Does the practice area nurses are employed in influence their stress levels?
3. Is there a correlation between self-reported stress amongst nurses and hair cortisol levels?

It is hypothesised that:

H1: Inexperienced nurses are more stressed than their experienced counterparts.

H2: Practice area is a factor that influences stress levels for nurses.

H3: Hair cortisol levels correlate with self-reported perceived stress levels.

1.3 METHODOLOGY

Chapter three provides a detailed review of the research methods that were used in this study. However, in brief this study used a cross sectional, quantitative design which Zevia; Schneider, Whitehead, LoBiondo-Wood, and Haber (2012) suggest is appropriate for studies measuring one point in time, exploring the relationship between two variables, which in this study relates to perceived stress and the experience of the nurse.

1.4 ORGANISATION OF THESIS

This thesis consists of five chapters; the first of which gives the background and overview of the study. Chapter two reviews the literature pertaining to the relevant areas of this study. Firstly, the theoretical framework used as a best fit for this study is discussed. Secondly, the literature on perceived stress within nursing including literature on hair cortisol is explored. Chapter three presents the methodology used in this study, and specifically reiterates the research questions. The research design, study setting, samples and instruments used during data collection are also discussed, followed by the method for data analysis and ethical considerations. Chapter four reviews the research findings that emerged. The key findings are further discussed in detail and links made to the existing literature within Chapter five. This is followed by recommendations and limitations that have emerged from this study. Concluding this thesis with an overview of the study relating to perceived stress within the nursing

profession and the use of hair cortisol as a biomarker for stress, the future direction of this analysis, and a personal reflection of this research journey.

1.5 CHAPTER SUMMARY

The results from this study add to the research and understanding of the stressors perceived by nurses within WA, at various times in their careers. The hair technique used adds to the body of knowledge in relation to enabling a robust way of monitoring stress levels, which are accurate and valid, reducing the potential of subjectivity from utilising questionnaires only.

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION

Chapter one gave a general overview of the research project. The aim of this chapter is to discuss the literature around relevant general models of stress, and to demonstrate how the Transactional Model of Stress (Cox & Mackay, 1976) forms the theoretical framework for this study of stress amongst nurses.

2.2 POPULAR MODELS AND THEORIES OF GENERAL STRESS

The conceptualisation of stress and the stress response have been noted throughout the centuries. Even Florence Nightingale in *Notes on Nursing* believed that all patients were experiencing some 'stress' regardless of their illness (Nightingale, 1860). Approximately 70 years later during 1936, Hans Selye a medical student, spoke about a 'syndrome of just being sick...'. Selye can be considered as the founding father of the stress-response theory and has made one of the most significant contributions to the field of stress (Rice, 1999).

There are numerous models and theories of stress, such as the Person-Environment Fit Theory (Lewin, 1935), General Adaptation Syndrome (Selye, 1956), the Job Demands-Control Model (Karasek, 1979; Karasek & Theorell, 1990) and Lazarus (1976) Transactional Model of Stress, as well as Cox and Mackay (1976) Transactional Model of Stress, to name a few. A brief description of these models and theories follow including any major criticisms, concluding with the rationale why Cox and Mackay (1976) Transactional Model of Stress is deemed to be the most suitable for use in this study.

2.2.1 The General Adaptation Syndrome

Hans Selye in 1956 described the stress response theory as an entire stress process, which occurred at the system level, and focused on the threat as well as the individual's reaction to this stress encompassing the external demands or forces placed upon the person by their environment, and was called the General Adaptation Syndrome (GAS), (Selye, 1956). Stress was simply viewed as the physiological reaction of the body to any demand; regardless of the nature of the stressor, and it was therefore interpreted as a natural response or defence mechanism and a consequence of normal living, providing a protective response by individuals (Cox, 1978; Murray,

Zentner, & Yakimo, 2009). A criticism of this model or syndrome is that it predominantly focuses on the physiological aspects of stress rather than taking into account the psychological processes such as emotions or feelings (Cox, 1978).

2.2.2 Person-Environment Fit Theory

This theoretical model has been in existence since 1935 (Dewe, O'Driscoll, & Cooper, 2012; Lewin, 1935). In terms of this theory, stress is not defined by the person or the environment rather it assumes that stress will occur when there is a mismatch between them both. According to this theory, when there is a mismatch between what the person wants and what they receive, in conjunction with a mismatch with their actual abilities, then stress occurs. A criticism of this model is that it does not take into consideration the subjective views held by the individual, such as their perception of their environment, their wants, emotions, and personal abilities. Furthermore, it is a very static model failing to take into account any ongoing contributing issues between the person and their environment (Dewe et al., 2012), and as such is not relevant to this study. In contrast the Job Demands-Control Model is one of the leading job stress models and focuses on the work environment and the impact this has on the individual's level of stress and overall health.

2.2.3 Job Demands-Control Model

The Job Demands-Control Model was first developed by Karasek in 1979 (Karasek, 1979), and later expanded on by Karasek and Theorell in 1990 (Karasek & Theorell, 1990). The model focuses on the workplace and looks at how demanding a person's job can be, and how much control they have over these demands. Jobs that are high on demands and low on control have the highest risk of illness and reduced wellness, in comparison with jobs, which have a low demand and a high level of control (Ha'usser, Mojzisch, Niesel, & Schulz-Hardt, 2010). A criticism of this model is its uncertainty over any emerging effects from these demands, or if they are singular rather than merging together or if they impact on each other. Furthermore, the model does not take into account any impact peer support may have, acting as a buffer to the stressor (Dewe et al., 2012). Although Cox and Mackay (1976) Transactional Model of Stress does not specifically mention peer support, rather the model places emphasis on the individual's perceptions of their work environment which includes support from others, their perception of control and personal ability to cope with the demands, otherwise known as stressors that are placed upon them.

2.2.4 Transactional Models of Stress

It must be acknowledged that the Lazarus (1976) Transactional Model of Stress, and the Cox and Mackay (1976) Transactional Model of Stress are very similar, although the Cox and Mackay (1976) model has increased clarity in relation to its structure, and acknowledgement of individualisation relating to coping, personality traits, behaviour, and emotional responses, as well as how stressors impact either negatively or positively on the individual's own health.

In terms of the Lazarus (1966) model, stress is regarded as an external concept, whereby; the individual interprets stress as a threat to their wellbeing during the primary appraisal stage. During secondary appraisal, the individual assesses if they have enough inner resourcefulness to respond with coping strategies to overcome the threat, if not, then the experience results in the activation of a stress response. A weakness of this model is that the primary and secondary appraisals worked in succession; whereas in the Lazarus (1976) model they work concurrently.

Employing the Cox and Mackay (1976) model for this study is favourable as it views the person and their environment as a fluid entity which is constantly changing and evolving. The Cox and Mackay (1976) Transactional Model of Stress stems from the individuals' cognitive appraisal of the source of the perceived demand, and their perceived capability and resourcefulness to meet that demand. Hence if the person perceives that the demand outweighs their ability to meet the perceived demand, which it must be noted, may not always be the same as the actual demand, an imbalance follows. In a hospital setting, a nurses work environment and patients' needs can change quickly or unexpectedly, requiring the nurse to adapt as the situation changes (Maxwell, Brigham, Logan, & Smith, 2011), but a problem arises if the nurse does not have the necessary skills to adapt, as this will initiate the start of an imbalance.

2.2.4.1 *Stage one - Source of demand*

Stage one of the Cox and Mackay (1976) model emphasises that stress is the individuals' perception of an experience which involves both internal sources such as fatigue which can lead to stress, or external sources originating from the work environment, an example within the nursing profession is working short staffed, or having a poor skill mix within the practice environment. Both internal and external demands and specifically how these demands are met, are important in determining the individual's behaviour and levels of stress (Cox, 1987).

2.2.4.2 *Stage two - Cognitive appraisal*

Although perceptions are an individual concept, and posited within stage two of the model, the nursing profession is noted for being a highly stressful profession (Breen & Sweeney, 2013). If the nurse does not feel that the demand is too great, they will continue working until such time as they feel they are no longer able to cope, or the demand becomes overwhelming.

2.2.4.3 *Stage three - Stress response*

An individual's coping method is unique to that individual, and various physiological and psychological responses occur during stage three of this model. They include emotional and behavioural responses in an attempt to reduce the perceived demand and occurrence of occupational work-related stress, which negatively impacts not only on the health and wellbeing of the individual, but also that of the remaining staff within the team (Bogossian, Winters-Chang, & Tuckett, 2014).

2.2.4.4 *Stage four - Consequences of the coping response*

Stage four focuses on the consequences of the coping response. Although this is not clearly identifiable within the Cox and Mackay (1976) Transactional Model of Stress diagram, it is implied that it is closely inter-linked with stage three of the model, and could be viewed as a weakness of the model (Whalen, 2008). Applying this fourth stage to the nursing profession and the behavioural and physiological strategies, which are activated in an attempt to reduce this stress, show that prolonged activation is detrimental to the health of the nurse and organisation (Suresh, Matthews, & Coyne, 2013).

2.2.4.5 *Stage five - Feedback*

During the fifth and final stage of the model, the nurse initiates a problem solving approach to decide how to deal with the occupational work-related stress. This problem solving approach is vitally important as it guides not only the outcome of the fifth stage, but this feedback assessment actually occurs during each stage of the model, and can change the intensity of the demand, or enhance an individual's ability to adapt, or to seek change in the future. Whether they choose to seek change by withdrawing from the profession or practice area whilst at stage five of the model or adapting their coping strategies and behaviour during feedback at the end of one of the other four stages

(Figure 1), is dependent upon the individuals interpretation of the stressor, demand and coping strategies utilised (Bogossian et al., 2014).

Cox and Griffiths (2005) make note that the Cox and Mackay (1976) Transactional Model of Stress (Figure 1) is stronger than other models as it has a very clear structure, as well as acknowledging that individual differences such as hardiness or problem solving strategies contribute to the buffering and level of stress perceived by the individual. Furthermore, having a feedback loop after each stage of the model enables continual feedback and adjustment to the situation unlike other models of stress (Mark & Smith, 2008), supportive of the view that Cox and Mackay's (1976) Transactional Model of Stress is the most suitable model for use in this study.

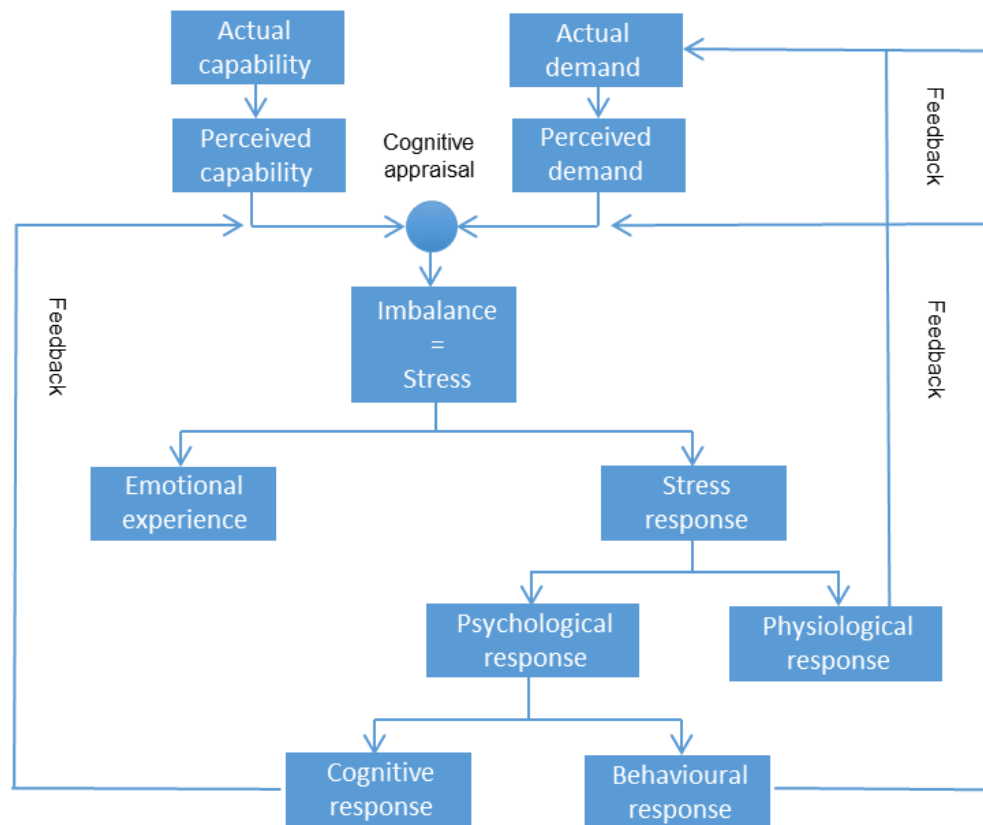


Figure 1: Transactional Model of Stress

(Cox & Mackay, 1976), cited in Cox, T. and Mackay, C. J. (1976). A psychological model of occupational stress. A paper presented to Medical Research Council meeting Mental Health in Industry. London, November.

Note. Taken from Cox, T. (1978). *Stress* / Tom Cox. London: Macmillan. Reproduced with permission from Palgrave Macmillan.

2.3 LITERATURE REVIEW

For this study the researcher explored this topic in detail, more than 313,919 scholarly publications were listed in the Edith Cowan University's library database. Cinahl, Medline and Google Scholar databases yielded more than 4,500 articles relating to perceived stress, when filtered for studies written in English, and using the key words 'nurse', nursing, stress, occupational stress, workplace stress, the numbers reduced dramatically to 668. Articles were excluded if they were not written in English, or did not focus on a workplace or occupational stress, or the full text was not available. The databases were further filtered by 'hair cortisol'; which yielded only one scholarly publication relating to perceived stress and hair cortisol levels relating to the nursing profession.

The literature regarding this topic is discussed below using the headings as set out in the five stages of the Cox and Mackay (1976) Transactional Model of Stress (Figure 1).

- i. Sources of demand
- ii. Cognitive appraisal
- iii. Stress response
- iv. Consequences of the coping response
- v. Feedback

2.3.1 Stage one - The perceived and actual demands

2.3.1.1 Sources of demand

As outlined above, stage one of the Cox and Mackay (1976) Transactional Model of Stress relates to the sources of demand. This stage looks at the person and their environment; it encompasses their perceived demands, as well as the actual demands placed on them by their environment and their ability to cope with these perceived demands.

Workplace stress is a global issue, which is not confined to a single profession, location or workplace (Spence Laschinger & Nosko, 2015). Long-term effects of workplace stress can lead to chronic mental fatigue and negatively impact on the general health and wellbeing of the individual, moreover this issue is not indicative of any particular age group, rather it spans the younger workforce who do not feel able to, or do not find the time to relax through to the mature workforce (Nekoranec & Kmosena, 2015).

Alarming, workplace stress continues to be overlooked within today's workplace, as noted in a study of 450 workers from a range of industries, which spanned manufacturing, construction, oil and gas and health. Stress was reported by 24% of respondents as lacking focus within the workplace, and was often overlooked or ignored as a hidden safety issue (Anonymous, 2014). This view is supported by Boyd, Tuckey and Winefield (2014) who note that workplace stress is rife in today's workplaces due to organisational downsizing and the push to "do more with less" which results in interpersonal conflict and tension between co-workers. From a slightly different perspective there are occupations such as police officers, teachers, air traffic controllers, health and emergency services personnel that are known as highly stressful occupations which report higher levels of work related stress albeit as a result of different stressors than other professions (Hyland, Boduszek, Shevlin, & Adamson, 2012; Losey, 2011; Naghieh, Montgomery, Bonell, Thompson, & Aber, 2015; Shivaprasad, 2013). The physical and mental stress encountered on a daily basis due to the environment in which they work can result in negative health outcomes for the individual if not addressed or adequate coping strategies implemented.

This literature review focuses on nursing, which as noted above is considered a highly stressful occupation due to the nature of the profession and the environment in which the nurse practices.

Within the nursing profession globally, nurses perceive the sources of external demand, either actual or perceived to include role ambiguity including unclear role expectations, shift work, excessive workloads, lack of autonomy and career progression opportunities (Li et al., 2013; Purcell, Kutash, & Cobb, 2011; Suresh et al., 2013), poor communication and working conditions (Li et al., 2013; Shahrzad, Masoumeh, & Hamid, 2015), job demands and lack of support (Gholamzadeh, Sharif, & Rad, 2011; McCarthy, Power, & Greiner, 2010), whereas, sources of internal demand encompass attitudes, thoughts, feelings, and emotions (Cox, 1978; Richardson, Rice, & Devine, 2014; Thunman, 2015).

2.3.1.2 External demands

Occupational stress within nursing has no geographical limitations, rather the perceived stressors nurses report are very similar with minor variations from country to country (Glazer & Gyurak, 2008). These sources of workplace demands, which nurses report on a day-to-day basis include; staff shortages, work environment, job demands, peer support, quality of patient care, role ambiguity, and shift work (Huntington et al.,

2011; McCarthy et al., 2010; Purcell et al., 2011; Toh, Ang, & Devi, 2012). Whether the source of demand is real, or perceived to be real, the potential for stress to escalate, negatively impacting on the individual and organisation is high (Santos & Cox, 2000).

The World Health Organisation's (WHO's) Nursing and Midwifery Progress Report 2008-2012 notes that nurses worldwide form the largest group of health care providers, with vast diversity between each role and region. The global challenge moving forward, is to address stressors perceived by nurses, with the aim of achieving better health outcomes for the nursing profession and patients globally (World Health Organisation, 2013). A challenge in achieving better health outcomes for nurses and patient care is the predicted staff shortages within Australia, with a predicted shortfall of 109,000 nurses, equating to a reduction of 27% of nurses practicing in Australia by 2025 (Beanland, 2013; Health Workforce Australia, 2012). This is exacerbated as nurses perceive their workloads will continue to spiral out of control (Twigg et al., 2010) as a result of the ageing workforce and retirement of the baby boomers (Duffield et al., 2015; Fragar & Depczynski, 2011). The perceived stress that nurses' report due to increased workloads continues to influence the level of dissatisfaction and intention to stay in the profession (Brunges & Foley-Brinza, 2014; Wright, 2014).

The sources of demand within nursing are not limited to the hospital environment; rather community and rural nurses also perceive stressors within their workplace environments. A study by Lenthall et al. (2011) examined perceived stressors amongst the nursing workforce in remote communities of Australia. Three hundred and forty-nine registered nurses participated in the study, which report on average that rural nurses work more than two days more per week than all registered nurses nationally. The author attributes this to staff shortages, preventing them taking time off to address physical and psychological concerns. Moreover rural nurses who are in an isolated setting are associated with increased workplace stressors such as professional isolation, role ambiguity and unclear role expectations. These findings are consistent with other studies, which have explored the challenges rural nurses face when practicing within a remote setting (Anderson, 2012; Opie, Dollard, Lenthall, & Knight, 2013; Stamatopoulou et al., 2014).

Lin, Liao, Chen, and Fan (2014) evaluated perceived demands focusing on shift work among 320 general ward nurses from four regional hospitals in Taiwan. All worked within the hospitals for more than three months, across different shift patterns. Findings showed that regardless of the irregularity of the shift work performed by the nurses (e.g. days, nights, and evening's shifts); they still perceived moderate levels of

job stress. The authors attribute these findings to the amount of overtime worked, in addition to the nurse's normal weekly hours, and their continuously high workloads, which far surpass that of nurses in other countries such as Australia or the USA. These findings are in contrast to those from a study of 607 Korean nurses, that found that nurses undertaking rotating shifts reported increased ill health compared to nursing staff who only worked day shifts (Koh et al., 2014), and this is consistent with previous findings (Bae & Fabry, 2014; Buja et al., 2013) that shift work has a negative effect on the health of nurses.

Tu vesson, Eklund, and Wann-Hansson (2011) evaluated the perceived demands reported by nursing staff working within a psychiatric inpatient care setting, although it must be acknowledged that this was only a small-scale study (n=93), conducted solely within one hospital setting. Findings suggest that nurses regarded a lack of clarity in relation to role boundaries as a significant factor in their stress levels.

This lack of role clarity has increased globally in recent years, fuelled by the governing bodies apparent variations on scope of practice, and guidelines for the nursing profession (Currie & Carr-Hill, 2013), and the subsequent ways in which nursing and non-nursing tasks are interpreted (International Council of Nurses, 2008a, 2008b). This has led to increased stress within the nursing profession as employers have sought to recruit nurses from overseas in an attempt to fill their staffing shortfalls. However, the nurses training and original scope of practice have not been taken into consideration or explored to ensure they are adequate (Hendson, Reis, & Nicholas, 2015; Kishi, Inoue, Crookes, & Shorten, 2014), which has led the migrating nurse questioning their skills and suitability to practice within these new practice areas (Malloy et al., 2014).

Many organisations globally are opting to recruit second level nurses (enrolled nurses) or unregistered health professionals (health care assistants), to work alongside registered nurses, in a bid to address staff shortages and the ever increasing healthcare costs (Jacob, McKenna, & D'Amore, 2015). This increases the perceived demands placed on the registered nurse, as the complexity of patient's needs and conditions are ever increasing, forcing them to delegate tasks, which they perceive they should complete. This poor skill mix negatively impacts on the quality of patient care (Dean, 2011; Eygelaar & Stellenberg, 2012), due to the differences in competency levels and scope of practice, and is also linked to increased length of stay and hospital costs (Clark, Moule, Topping, & Serpell, 2015; Goldstein, Braitman, & Levine, 2000).

The correlation between quality patient care, workloads, as well as nurse staffing levels and patient outcomes have been positively correlated as reported in numerous studies (Aiken et al., 2014; Bahadori et al., 2014; Bogaert, Clarke, Willems, & Mondelaers, 2013; Coetzee, Kloppe, Ellis, & Aiken, 2013). In a UK study of more than 2,000 nurses, over half of the participants' reported that they had felt unwell due to the high workloads within their work area as a result of an inadequate nurse patient ratio, which has resulted in an increase rate of absenteeism and level of perceived ill health (Davey, Cummings, Newburn-Cook, & Lo, 2009; Parish, 2013). A literature review conducted by Humphries et al. (2014) supports this view, and suggests that nursing workloads are part of an ever increasing spiral whereby there are fewer nurses caring for patients with more complex needs, leading to more nurses leaving the profession (Bogossian et al., 2014; Humphries et al., 2014). This situation will continue until policy makers globally implement the correct staffing levels for nurses, thus enabling quality patient care to occur (Carrigan, 2013). The global nursing shortages and poor staffing levels intensifies this lack of role clarity and merging of tasks, with the registered nurse still striving to provide quality patient care, leading to an increase in their perceived internal demands (Toh et al., 2012).

2.3.1.3 *Internal demands*

The need to feel valued, listened to, trusted, in control, and appreciated, along with a sense of pride, belonging, having a purpose, and in some cases perfectionism are all examples of internal demands that nurses globally report (Claxton, 2014; Cricco-Lizza, 2014; Mohamed, Newton, & McKenna, 2014). As perceptions are an individual concept; the values, beliefs and assumptions the nurses hold intertwine with the activities they perform in their daily lives, including their values, beliefs, assumptions, and past experiences (Ribeiro, 2014). When a person perceives that the psychological or physical demands of their jobs are too great, coping strategies are initiated to maintain a state of wellbeing (Goodnite, 2014). Ineffective or prolonged activation of an individual's coping strategies will inevitably result in increased stress and ill-health for the individual (Cox, 1978), resulting in increased absenteeism for the organisation, and the subsequent increase in external demands such as increased workloads and stress being experienced by the remaining nurses as they struggle to complete all the required tasks with a decreased number of staff members (Dawson, Stasa, Roche, Homer, & Duffield, 2014; Stodart, 2015).

2.3.1.4 *Blurred demands*

The sources of internal and external demands can become blurred as the person, and their environment encapsulate and intertwine their beliefs, thoughts, feelings and attitudes intertwine (Cox, 1978), Joice, Jones, and Johnston (2012) explored the beliefs nurses held whilst working in a rehabilitation stroke unit in Scotland. Findings from this study note that the nurses' personal beliefs about strokes, can negatively impacted on the care their patients received. If the nurse perceived their patient to be faced with numerous symptoms, that were highly emotional, they interpreted caring for that individual as highly stressful and emotionally draining. This finding highlights the fact that the nurses internal demands (emotions, culture, beliefs, life experiences) have the potential to blur their perceived external demands (Baccarani, Mascherpa, & Minozzo, 2013). It was reported that patients themselves, thought that nurses were over reacting and worrying unnecessarily, and this led to unnecessary lengthier hospital stays due to the nurses perception of the patient's condition, rather than their actual condition, a view which is supported in the literature, in as much as nurses perception's and beliefs can positively, or negatively impact on the patient care they deliver, and as such nurses must be mindful not to let their personal beliefs hinder the quality of patient care they deliver (Herisko, Puskar, & Mitchell, 2013; Mendes, 2015).

Although globally the nursing profession is faced with challenges, nurses generally strive to achieve good patient outcomes (Farrelly, 2014). Having a positive well-supported work environment encompassing peer support for staff, has been shown to be beneficial in retaining nurses and reducing the perceived source of demands (McCarthy et al., 2010; Scholes, 2015), although in the current climate having the time or staff to focus on peer support and a positive work environment can prove challenging, it is still something nurses and nurse managers should still aim to accomplish (Applebaum, Fowler, Fiedler, Osinubi, & Robson, 2010; Harker, Hahn, Banks, & Orr, 2015; Li et al., 2013). This view is demonstrated in findings of a study by Tuveson et al. (2011) who explored the perceived stress of 93 nurses working within 12 psychiatric inpatient care wards in Sweden. The results show a statistical significance between the ward atmosphere, positive work environment and perceived stress of the nursing staff. The authors conclude that findings from this study offer an important insight regarding the need to focus on the workplace environment and the creation of a positive and supportive atmosphere to address all sources of workplace demands perceived by nurses, and that further research is required to explore if there

are other influential factors impacting on stresses associated with the nursing profession.

Although there appears to be a wealth of literature related to the perceived stressors nurses report, research focusing solely on the WA nursing workforce is very limited and most are more than 10 years old, thus questioning its relevance in today's workforce. Findings of a study by Ross-Adjie, Leslie, and Gillman (2007) reported sources of demand to include excessive workloads, violence against nursing staff and poor skill mix, whereas Williams (1998) reported insufficient time to provide quality patient care as a major demand. A recent study conducted by Harrison, Hauck, and Hoffman (2014) explored the perceptions of mental health nurses practicing within WA, and why they chose and remained working in this area of the nursing profession. A noted limitation of this study was that it only focused on one mental health service at a single point in time, albeit, these findings give an insight into the perceptions held by the nurses working within this area. More research is needed to explore if these stressors are transferable to the wider WA workforce.

2.3.2 Stage two - Cognitive appraisal

Cognitive appraisal as described within section 2.2.4, acknowledges that the very nature of the nursing profession places demands upon people, however, it is not until the nurse cognitively appraises the situation and demands, that they move to the second stage of the Transactional Model of Stress (Cox & Mackay, 1976). Nurses' may feel that they are able to cope with these demands so will continue on regardless and stay at stage two of the model, until such time as they perceive the demands outweigh their ability or capabilities, when they will commence the next stage of the model, whereby a stress response will be activated (Cox & Mackay, 1976).

In Moore, Leahy, Sublett, and Lanig (2013) study, 82 nurses completed an on-line questionnaire which focused on positive working relationships, where results indicated that participants felt that nurse managers inadvertently added to their perceived level of stress by not encouraging them to voice their thoughts and opinions. The authors conclude that these findings give an important insight into the perceptions nurses' hold, and their intent to stay in their current role rather than transferring to another area or hospital. Whilst exploring the perceptions of nurses relating to speaking up and being heard, Garon (2012) confirms the findings of Moore et al. (2013) that nurturing a healthy work environment can attract and retain staff. Whereas silencing staff through fear of repercussions can lead to frustrations festering below the surface.

This can result in negativity, which has been shown to be a predictor of the intention to stay within the profession (Li et al., 2013).

The general public view nurses as being trustworthy (Bindon, 2015), and this trustworthiness needs protection as it is strongly linked with patient satisfaction and positive patient outcomes (Rutherford, 2014). Although a clear definition of trust remains elusive, the concept of nursing trust relates to the vulnerability of others such as patients and their families, and the positive expectation and reliance they hold about the nurse doing no harm (Dinç & Gastmans, 2012).

It is the cognitive appraisal of the situation or demand that moves the individual from stage one of the model whereby the individual identifies the stressor, to stage two of the model whereby they reflect and evaluate if they are able to cope with the situation or demand. If the individual perceives the demand too great or overwhelming then it will provoke a stress response such as frustration, anger or behavioural changes moving the individual to stage three of the model.

This point was demonstrated by McCabe and Sambrook (2014) when they examined the attributes and consequences of trust amongst 28 nurses and 11 nurse managers from an acute and community hospital within the United Kingdom (UK). The study found that poor communication was a major factor in undermining trust between nurses as a group, and between nurses and their managers. This negatively impacts on productive, effective teamwork and increases the perceived stress levels of the nurses. The participants felt that if they did not feel trusted, and were not given the autonomy to complete their tasks without their managers standing over them, their productivity decreased, which led to frustration and feelings of isolation, increased absenteeism and poor staff morale, all of which have been shown to negatively impact and increase the perceived demands of the nurse, decreasing levels of staff retention and their intention to stay in the profession (Bogossian et al., 2014; Haüsser et al., 2010).

Expounding the perceived demands nurses report, Castner, Ceravolo, Foltz-Ramos, and Yow-Wu Bill (2013) reiterate that effective teamwork requires the nurse to have autonomy and control over their workplace practices, to enhance a positive workplace culture amongst the staff, and to alleviate the perceived demands interpreted by the nurse. Supportive of this view, Peltomaa et al. (2013) notes that actively contributing and participating in multidisciplinary team meetings, as well as sharing their knowledge and expertise with other team members, dispels any oppressive or negative views. According to Toode, Routasalo, Helminen, and

Suominen (2014) if the individual shares the same personal values as the organisation, and they interpret their role as meaningful, a correlation manifests between the individual's internal motivation to strive for higher quality patient outcomes, and their intention to stay in the organisation. In a study of the perceived demands of 2,180 nurses and correlation of absenteeism rates, Pallesen et al. (2014) noted a significant three-way interaction between the perceptions of job control, perceived demands and peer support, as predictors of absenteeism. Similarly, Chakraborty, Chatterjee, and Chaudhury (2012) suggest that perceived workplace stress is a combination, not only of the individual's internal and external factors such as the individual's ability to adjust and adapt to changes in their work environment, but also the combination of the individual's coping ability and strategies. Supportive of this view, Trybou et al. (2014) advocates that an association exists between the nurse's role and level of absenteeism accrued due to sickness, the higher the perceived level of work demands, the higher the amount of absenteeism. Multiple short episodes of absenteeism are linked to the coping methods used by the nurse (Folkman, Lazarus, Pimley, & Novackek, 1987; Trybou et al., 2014), whereas long term absenteeism is considered an inability to be able to work, rather than a coping method (Trybou et al., 2014). This view is supported in numerous other studies linking levels of absenteeism and perceived stress due to perceived workplace demands within the nursing profession (Davey et al., 2009; Elstad & Vabø, 2008; Farquharson et al., 2012; Hallman, O'Connor, Hasenau, & Brady, 2014).

2.3.3 Stage three - Stress response

Following the realisation that some individuals are unable to cope with the continued perceived demands, Cox and Mackay (1976) suggest that individuals will experience an imbalance resulting in feelings of stress. Although stress is normal in everyday life and can be viewed by the individual as motivating, intense or repetitive stress can be detrimental to the individual's own health (Salilih & Abajobir, 2014). The psychophysiological responses as discussed on page 17, include the emotional experience of stress and are accompanied by cognitive, behavioural and physiological changes, and as such are an attempt by the individual to reduce the perceived demand. However, a good working relationship, ward atmosphere and engagement with other staff members and patients has been found to reduce their overall stress associated with the working environment. This view is supported by Currid (2009) who suggests that a good supportive work environment can be deemed as having a buffering effect which reduces the nurse's stress and feelings of isolation. This buffering effect by co-workers is also reported to reduce feelings of exhaustion,

although it is acknowledged that it does not occur in every organisation, practice area, or nurse (Mörelus, Gustafsson, Ekberg, & Nelson, 2013; Salilih & Abajobir, 2014).

It must be acknowledged however that the behavioural changes utilised by the individual are not always favourable, and not always confined to the workplace, as noted by Tucker, Weymiller, Cutshall, Rhudy, and Lohse (2012) who surveyed 2,106 nurses from a large medical centre in Iowa. Engagement in lifestyle choices outside of work, which lacked sufficient attention to health-promoting strategies, for example limited physical activity, poor diet and increased intake of alcohol, decreased a nurses' ability to cope with their perceived workplace demands, subsequently causing them to act as poor role models for junior staff and the general public (Sheard, Huntington, & Gilmour, 2014). Engagement in healthy leisure activities that incorporate a healthy diet has been linked with positive perceptions of self-worth. These activities provide a positive distraction from workplace demands, leading to a decreased level of perceived workplace stress (Cairney, Kwan, Veldhuizen, & Faulkner, 2014; Childs & de Wit, 2014; Kim, 2014; O'Connor, Armitage, & Ferguson, 2015).

2.3.3.1 Behavioural responses

Excessive alcohol consumption, increased smoking, resistance to change in the workplace, over reacting to situations, and outbursts of anger are all stress responses nurses exhibit as a result of workplace stress (de Boer, van Rikxoort, Bakker, & Smit, 2014).

In Australia and New Zealand 4,419 registered nurses completed a questionnaire, exploring their consumption of alcohol and the link to work place stressors (Schluter, Turner, & Benefer, 2012). Findings revealed that over 13.9% of nurses and midwives drank to excess on a daily bases and Servodidio (2011) suggests this is a coping strategy utilised by individual's to hide their perceived stress.

Due to the stigma and professional implications associated with excessive drinking among nurses at work, many cases are not reported (Sheard et al., 2014). Staff members ignore rather than confront unacceptable drinking behaviour, even though they are aware that the effects of alcohol negatively affect the individual's professional judgement and increase the risks to patient safety (Servodidio, 2011; Sheard et al., 2014).

Along with increases in alcohol consumption, outward displays of anger by alcohol-affected nurses within their work environment, is linked to the poor physical and

psychological wellbeing of the nurse. Han, Won, Kim and Lee (2015) point out that this can detrimentally impinge upon the nurses' productivity and delivery of quality patient care. Interviews with patients from 13 psychiatric wards suggest that patients acknowledge that nursing is a difficult role to undertake, although they report that nurses repeatedly expressed anger and negativity relating to their role whilst at work (Stewart et al., 2015). Feelings of anger are not related to any one practice area; rather lack of support from other nurses within the same practice area, or other members of the multidisciplinary team can fuel feelings of anger, which can range from a slight irritation or harshness, through to an intense verbal outburst, demonstrating a stress response rather than a personal attack on the recipient (Booth, 2010).

Although the number of nurses who smoke has declined in Australia, it remains high globally (Berkelmans, Burton, Page, & Worrall-Carter, 2011; Mujika et al., 2014). Research exploring the smoking habits of 1,027 nurses, in Victoria Australia, identified that many of the nurses' who smoke worked in areas they perceived as highly stressful such as the emergency department and psychiatry department, with less smokers reportedly working within midwifery and oncology departments. Participants' in the Berkelmans et al. (2011) study felt that smoking was an outlet, which enabled them to release their workplace stress, although they held mixed emotions over their health promotion role and the guilt they experienced as a result of their choice to smoke (Berkelmans et al., 2011).

2.3.3.2 *Emotional responses*

A link between workplace stressors, poor staff morale and lack of power or powerlessness has been observed in a study of 50 nurses practicing within the metropolitan and rural hospitals of WA. This was in part due to the perceived lack of control the nurse held in relation to rosters, patient load and support from senior staff (Bakker, 2012). The literature supports this view, and suggests that empowered staff are highly motivated and productive (Brown et al., 2013; Silvestro & Silvestro, 2000). It was also apparent that nursing staff perceived powerlessness as a result of patients having greater access to information from the internet relating to conditions and care options, which led to frustration at not being able to meet the patients expectations or demands (Bakker, 2012).

According to Baethge and Rigotti (2013) who surveyed 133 nurses practicing within the hospital settings in Germany, interruptions to the nurse's working day by other members of the multidisciplinary team or patients, are sources of major stress for

the nurse. Continual interruptions take the nurse away from the task they were completing, leaving them feeling pressurised or forgetful of the task still needing to be completed, whilst striving to maintain quality patient care. The perceived stress exhibits itself as irritability, short-temperedness, or depressiveness with the rest of the team (Donnelly, 2014; Littlejohn, 2012), which lowers productivity and has a detrimental effect on patient care (Gärtner, Nieuwenhuijsen, van Dijk, & Sluiter, 2012).

As well as irritability, episodes of crying and panic are well-documented responses to workplace stress (Edward, Ousey, Warelow, & Lui, 2014; Laal & Aliramaie, 2010; Pongruengphant & Tyson, 2000). Findings from a recent study conducted in WA, suggest that nurses perceive the causes of their stress to include unexpected allocation to different ward environments, which led to feelings of panic, due to the unfamiliarity of the ward layout, staff or patients. This led to an increased emotional response whereby the nurse felt like crying and was emotionally drained after the event (Drury, Craigie, Francis, Aoun, & Hegney, 2014). Continually feeling emotionally drained has been linked to work-related stress due to the depletion of the individual's emotional resources and inability to continue to cope with the stressor (Garrosa, Moreno-Jiménez, Rodríguez-Muñoz, & Rodríguez-Carvajal, 2011; Mendes, 2014).

2.3.3.3 *Cognitive responses*

As well as the emotional responses to workplace stressors, it has been recognised within the literature that forgetfulness, insecurity, indecisiveness, loss of control, and loss of humour are cognitive responses, which also occur as a result of workplace stress (Elfering, Grebner, & Dudan, 2011; Happell et al., 2013; Shirey, Ebright, & McDaniel, 2013). Combined with the emotional and cognitive responses to stress, the individual's own personality and their sense of coherence, which includes a positive disposition and problem-solving attitude positively correlates to protect against work-related stress and illness (Basińska, Andruszkiewicz, & Grabowska, 2011; Orly, Rivka, Rivka, & Dorit, 2012). It is accepted that the psychological response to stress is multidimensional comprising of emotions, thoughts, behaviour and beliefs (Mealer et al., 2012). The greater the individual's ability to perceive a balanced perspective, the more likely they are to adapt to, and manage the workplace demands placed upon them (Orly et al., 2012).

2.3.3.4 *Physical responses*

Jones, Hocine, Salomon, Dab and Temime (2015) explored the demographics and predictors of stress within the nursing profession, and note that a link was present between the workplace stress levels the nurses perceive and the physical demands they report. In a sample of 385 Iranian nurses, 61.8% of the sample population reported high levels of work place stress, which correlated with the reports of lower back pain. Thus supporting the view that high levels of perceived work place stress can result in increased work-related injuries such as back pain or the like (Barzideh, Choobineh, & Tabatabaee, 2014). From a slightly different perspective Healy and McKay (2000) suggest that the nurse may not recognise or relate any of their physical symptoms to work-related stress, Cox and Mackay (1976) interpret this as the individual remaining at stage two of the Transactional Model, whereby the individual feels in control of any stressors they are faced with, and note that individuals can remain at this stage indefinitely.

Nixon, Spector, Mazzola, Krueger, and Bauer (2011) conducted a meta-analysis of 79 studies exploring the relationship between work-related stress and the physical responses reported by individuals. Eight symptoms were explored, including backache, headache, eyestrain, sleep disturbances, dizziness, fatigue, changes in appetite and gastrointestinal problems. A relationship between work-related stressors and the eight physical symptoms was noted. The authors argue that the immediate physical response noted by the individuals' is due to an immediate stress response being initiated by the body by the sympathetic nervous system, and the subsequent increase in the levels of circulating stress hormones within the body (Karhula et al., 2015; Nixon et al., 2011).

When a stressor either physical or psychological exceeds an individual's ability to cope, their body responds by releasing sympathetic adrenergic catecholamine's, norepinephrine and epinephrine that increases the heart rate in a flight or fright response (Hannibal & Bishop, 2014). As a result of the activation of the flight or fright response the hypothalamic-pituitary-adrenocortical (HPA) axis signals the release of corticotrophin releasing hormone (CRH) and the subsequent release of adrenocorticotrophic hormone (ACTH) which stimulates the release of cortisol from the adrenal cortex in preparation for the management of stress predicted to occur within the body. Thus ensuring that increased levels of fuel, in the form of glucose are available within the tissues to cope with the stress producing stimuli (Hannibal & Bishop, 2014; Jankord & Herman, 2008).

Increased perceptions of work-related stress and raised cortisol levels are well documented within the current literature (Fujimaru et al., 2012; Karlson, Eek, Hansen, Garde, & Ørbæk, 2011), although the role of cortisol within the human body is twofold. Firstly, to routinely maintain blood glucose levels, as well as providing energy to the brain, neuromuscular system, and as a powerful anti-inflammatory hormone (Hannibal & Bishop, 2014). Secondly, as part of the stress response, cortisol is released when the individual perceives the demands placed upon them from their internal or external environment as being too great for them to manage. If the individual does not perceive the demands too great, then a surge of cortisol will not be activated (Shirtcliff, Peres, Dismukes, Lee, & Phan, 2014).

Thus far, the most common form of cortisol monitoring has included saliva, plasma, and urine, but all report numerous variables such as fluctuations of the HPA axis, circadian rhythm, food and alcohol consumption (Goldberg et al., 2014; Ostry, Demers, Wong, & Davies, 2012; Roseboom & Rooij, 2010). Due to only being able to identify the circulating cortisol at a specific point in time when using these methods, the identification of longer-term cortisol levels greater than 24 hours has proven problematic (Stalder & Kirschbaum, 2012). In contrast, retrospective hair sampling analysis enables the detection of long-term cortisol levels on the body, which do not appear to be influenced by food, alcohol, medications, smoking, or hair products (Wosu, Valdimarsdottir, Shields, Williams, & Williams, 2013). A coefficient's ranging from 0.53 to 0.79 ($p < .001$) denoting a strong association between hair cortisol levels and perceived levels of stress has been noted making this a reliable method of cortisol analysis when exploring perceived stress (Gow et al., 2010; Stalder et al., 2012).

It is known that human hair grows approximately 1cm per month (Davenport, Tiefenbacher, Lutz, Novak, & Meyer, 2006). The uptake of substances into the hair shaft is still not fully understood, but it is widely assumed that as the hair grows cortisol is incorporated into the bulb via the blood capillaries into the growing hair follicle, which then hardens and forms the hair shaft, locking the cortisol within its structure (Davenport et al., 2006; Etwel, Russell, Rieder, Van Uum, & Koren, 2014; Gow et al., 2010; Stalder et al., 2012). The timeframe for leaching of cortisol out of the hair shaft from the distal to the proximal end as a result of washing, ultraviolet rays, and chemical hair treatments is still under debate. Reliability has been shown in studies to vary from two months taken from a 2cm hair sample, up to one year with further research urged (Thomson et al., 2010; Wells et al., 2014; Wester, Staufenbiel, et al., 2014). This current study will draw data from a 1cm sample equating to the previous one-month timeframe, eliciting rich data, which can be correlated to the written questionnaire that

also focuses on the previous one-month period, in a bid to explore the physical and psychological responses to perceived workplace stress.

Currently studies exploring nurses' hair cortisol levels are very limited, although Faresjö et al. (2014) examined a cohort of 58 nurses' and 52 librarians in the southeast of Sweden, using a cross-sectional study, and the use of the PSS questionnaire. Levels of self-reported stress were correlated to their hair cortisol levels. The aims of the study were to explore if the different occupations perceived stress differently, as determined through the assessment of levels of hair cortisol in their hair. Although there was no link between the level of reported stress and the two occupations, levels of cortisol found in their hair did support their perceptions of workplace stress. This finding contributes to the body of literature that already supports the same view internationally (Faresjö et al., 2014; Wells et al., 2014; Wosu et al., 2013).

2.3.4 Stage four - Consequences of the coping response

Stage three and four of the Cox and Mackay (1976) Transactional Model of Stress are closely related. Stage three focuses on the realisation that demands are present and too great to cope with, or when negative consequences resulting from failure are anticipated. This leads to the activation of a cycle of psychophysiological responses to adjust to these demands. Rather stage four examines the actual and perceived consequences of this adjustment or methods of coping.

There are two broad strategies for coping which de Boer et al. (2014) notes an individual uses within the workplace. The first consists of an active problem focused strategy (Lazarus, 1966), which requires the individual to be aware of what the stressor is, and then implement a problem solve approach to reduce the perceived stress. This strategy requires focusing on ways to adjust to the situation, environment, or demand in order to reduce the negative outcomes to the person (Laranjeira, 2012). Implementing this strategy requires the individual to internalise, rethink and relive the episode or situation, to try and make sense of what happened. It may involve verbalising with friends or family to work through the situation, and to assist with moving forward with the recovery process and healing. If this recovery process is not complete before the individual perceives another overwhelming stressor, then ill health will occur (de Boer et al., 2014; Laranjeira, 2012; Lazarus, 1966).

A person's inner ability to effectively utilise a problem solving strategy, to cope and recover from the negative workplace demands is called utilising their inner resilience (Grafton, Gillespie, & Henderson, 2010). A person's inner resilience can

assist the individual to maintain a sense of health and wellbeing, and motivate them to problem solve the challenges they face. This leads to growth, personal development and learning from stressful situations or events (Grafton et al., 2010). Inner resilience can be viewed as a buffer or protective factor against perceived work place demands and positively impact on job satisfaction and intention to leave (Reyes, Andrusyszyn, Iwasiw, Forchuk, & Babenko-Mould, 2015). The personal attributes used by the resilient nurse include humour, an optimistic approach, flexibility, social support networks, positive emotions and confidence when facing obstacles within the workplace (Dean, 2012; Stephens, 2013; Zander, Hutton, & King, 2013).

Inter-linked with inner resilience is emotional intelligence, which requires the individual to identify their emotions and feelings and to regulate and channel them, to problem solve the perceived demands placed upon them within the context of their workplace environment (McKenna & Webb, 2013). Studies have shown that nurses who have the ability to develop and apply emotional intelligence into their work environment experience less emotional exhaustion, enjoy better health and wellbeing and increased job satisfaction (Austin, 2011; Towell, Nel, & Muller, 2013), facilitating effective team collaboration and quality patient care (Powell, Mabry, & Mixer, 2015).

In contrast to an active problem focused strategy, is the reactive or defensive coping method. Whereby the individual displays outwards signs and symptoms of denial, disengagement, withdrawal, impatience, aggression, even delusion, which at first may appear beneficial in coping with the perceived demand, although long term it will become an ineffective strategy, as the stressor or demand has not been reduced or addressed (Laal & Aliramaie, 2010; Lazarus, 1993).

In a study conducted by Ribeiro, Pompeo, Pinto, de Cassia, and Ribeiro (2015) it was revealed that emergency room nurses commonly used problem-focused strategies to cope with stress. Male participants employed a reactive style that included escape and avoidance techniques. The use of a combination of strategies, including both the problem-focused and defensive strategy appears effective, and this finding is supported in the literature (Lim, Bogossian, & Ahern, 2010). Combining effective coping strategies enables the nurse to reduce emotional tensions via the use of a reactive or defensive strategies, by initiating a problem solving strategy (Shirey, McDaniel, Ebright, Fisher, & Doebbeling, 2010; Umann, da Silva, Ticona Benavente, & de Azevedo Guido, 2015).

2.3.5 Stage five - Feedback

Stage five focuses on the feedback from the response, as this can enhance the individual's ability to adapt to the stressor. If during the feedback stage it is interpreted that the initiated response has been unsuccessful, it may intensify the perception of stress and cause greater damage to the individual. It may also alert the individual to reassess and proactively change their response with the aim of reducing the perceived stress, thus recommencing stage three of the model, if change is not instigated then ill-health will follow (Cox & Mackay, 1976). This point is reinforced within the literature as prolonged episodes of unrelenting stress are linked to depression, mood swings and burnout, affecting not only the wellbeing of the individual, but also that of other team members and family members (Healy & McKay, 2000; McFarlane, 2010; McGrath, Reid, & Boore, 2003), as well as the organisation in which the individual is employed, due to poor performance and loss of patient empathy (Donovan et al., 2013).

2.4 CHAPTER SUMMARY

It is evident within the literature that there are numerous models of stress that could have been used for this study, although it is suggested that the Cox and Mackay (1976) Transactional Model of Stress is the most suitable since it takes into consideration the psychophysical demands of the individual and their inter-relationship with the work environment, which is a fluid entity constantly changing and evolving. Although stress is a very individual and subjective phenomenon whereby no two people react the same to the same stressor at the same time, there are professions known to be highly stressful occupations such as nursing. Utilising a robust non-invasive technique to detect the level of cortisol as a biomarker for stress enables high-risk individuals to be offered support and education in relation to coping strategies to assist with their perceived stress and workplace demands. Up until recently it has been noted within the literature that saliva sampling has been the preferred method for detecting the stress hormone cortisol as a biomarker for stress. Although current research and sampling techniques indicate that hair sampling provides a more robust and reliable method, hence it is this technique which will be used for this study combined with a written questionnaire which again appears to be a routine technique documented within the literature to explore if there is a correlation between perceived stress and the levels of cortisol identified within the individuals hair sample.

CHAPTER 3 METHODOLOGY

3.1 INTRODUCTION

The previous chapter described the relevant models of stress, and demonstrated why the Cox and Mackay (1976) Transactional Model of Stress is the preferred model to be applied in this study. Furthermore, it was shown that cortisol levels could be used as a robust and valid biomarker of stress. The aim of this chapter is to describe the research design and methodology used for this study, with the purpose of correlating the perceived stress scale questionnaire with the work stress profile questionnaire and hair cortisol levels, in order to assess the validity of using hair cortisol levels as a biomarker for stress.

3.2 RESEARCH PURPOSE

The purpose of this study was to explore the perceived stress levels amongst a group of nurses in WA, and to test whether hair cortisol is a reliable biomarker for stress within the nursing profession.

3.2.1 Research questions

1. Do inexperienced nurses perceive more work related stress than more experienced nurses?
2. Does the practice area nurses are employed in influence their stress levels?
3. Is there a correlation between self-reported stress amongst nurses and hair cortisol levels?

It is hypothesised that:

H1: Inexperienced nurses are more stressed than their experienced counterparts.

H2: Practice area is a factor that influences stress levels for nurses.

H3: Hair cortisol levels correlate with self-reported perceived stress levels.

3.3 THE RESEARCH DESIGN

Research is broadly classified as either qualitative or quantitative, and it is this viewpoint, or belief held by the researcher, which guides the approach of the study

(Zevia Schneider, Whitehead, LoBiondo-Wood, & Haber, 2013). In this study a quantitative approach was used to explore the perceived stress levels amongst a group of nurses in WA, thus enabling a generalisation to the wider nursing population (Polit & Beck, 2012). The use of a descriptive design enabled the identification of trends within the data relating to the nurse and their perceived stress levels. This provided an understanding of areas, which require further research, and the targeting of relevant support strategies, that can be implemented to minimise the perceived stressors reported by the nursing profession. Descriptive correlational research was suitable for this study as it describes the relationships between variables, rather than exploring the cause, as this can be conducted in follow-up studies. Rather it is a starting point for future development and exploration at a later date (Polit & Beck, 2012; Zevia Schneider et al., 2013).

3.3.1 Study setting

The study setting was a hospital, which was located within the central business district (CBD) of Joondalup, and serves the northern suburbs of the Perth Metropolitan area. It is a 664-bed facility treating more than 67,000 patients annually, with plans to further expand. The services include emergency, paediatrics, maternity, aged care, rehabilitation and orthopaedics as well as pain management and trauma clinics (Ramsay Health, 2016).

3.3.2 Sample

The target population for this study consisted of 1,200 nurses employed within the hospital and first year nursing students undertaking a Nursing and Midwifery Course at Edith Cowan University. To ensure the sample was diverse and varied, both nurses and nursing students' were included in the cohort. However, it was recognised that although the nursing students' were completing a Nursing course at university, they were likely to be working in part time jobs within a hospital environment, or indeed elsewhere in a healthcare environment, so the data was analysed as a collective sample rather than as sub-groups.

3.3.2.1 *Sample size, calculation and sampling method*

The sample size was calculated using Yamane (1967) formula which is outlined below:

$$n = \frac{N}{1 + N(e)^2}$$

n = the sample size

N = the size of the population

e = the assumed error of 0.1

(Yamane, 1967)

$$\frac{1200}{1 + 1200 (0.1)^2}$$

= 92.3 rounded up to 93

An assumed error of 0.1 and a confidence coefficient of 95% were used to determine that a total sample of 93 participants was required to enable descriptive analysis to be conducted in this study. A Gpower analysis was also conducted with a moderate effect size and an alpha at 0.05 and a power of 80%, which suggested that a sample of 84 was adequate for this study (Appendix A).

3.3.3 **Participant recruitment**

Data collection commenced following approval from the Joondalup Health Campus Human Research Ethics Committee, and the Edith Cowan University Ethics Department.

- (1) All first year university nursing students were invited to participate in the study via email from the first year university unit coordinator. Contact details were provided to enable the student to contact the researcher for more information. The researcher explained the purpose and aims of the study as detailed in the participant's information letter (Appendix B). First year nursing students were recruited on commencement of their second semester prior to going on clinical placement to minimise any potential stressors as a result of their practicum.
- (2) All nurses employed by Joondalup Health Campus Hospital were invited to participate in the study. This study was promoted to all nurses via the use of a "One minute update", whereby a brief overview of the study and contact details of the researcher were displayed on a television screen located within

the staff dining room (Appendix D), for a period of one month. The researcher was present periodically throughout the month in the staff dining room whilst the “One minute update” was being displayed to discuss the study with any potential participants who wanted further information. The researcher also visited each ward, giving an overview to any nursing staff interested in participating (Appendix C). Recruitment was ongoing until the required sample size had been achieved.

3.3.4 Inclusion criteria

The inclusion criteria for the recruitment of participants for this study consisted of:

- First year nursing students enrolled in a Nursing and Midwifery Program within Edith Cowan University commencing their second semester.
- All nurses over 18 years of age employed within Joondalup Health Campus hospital located in Perth CBD.

3.3.5 Exclusion criteria

- Any traumatic event either physical or psychological (pertaining to shocking, distressing, hurtful, harrowing, painful, serious or life threatening illness, loss, grief, cancer to the individual or close family member), within previous three months.
- Any nurse not employed within the hospital.
- For the students’ cohort, any Edith Cowan University student not enrolled in their first year, second semester of the Nursing and Midwifery Program, or a student on a nursing practicum placement.

3.3.5.1 *Additional exclusion criteria for supply of a hair sample*

- Any individual not able to provide a hair sample due to a shaved, or a baldhead.
- Individuals who currently have hair extensions.
- Being pregnant.

3.4 INSTRUMENTS USED DURING DATA COLLECTION

3.4.1 Written questionnaires

Two written questionnaires were administered. The first questionnaire focused on the level of perceived stress. This data was captured using Cohen, Kamarck and

Mermelstein's Perceived Stress Scale Questionnaire (PSS-10) (1983), noting their age, gender, and job classification. This questionnaire had been validated in relation to the management of perceived stress (Chaaya, Osman, Naassan, & Mahfoud, 2010; Leung, Lam, & Chan, 2010; Saman, Armin, & Naseh, 2014) by predicting outcomes in relation to self-reported stress, and how the individual viewed these events in a given timeframe (Cohen et al., 1983). A Cronbach's alpha coefficient for the internal reliability of the PSS-10 of 0.78 demonstrates an acceptable reliability of the measurement of the tool (Spacapam & Oskamp, 1988). A Likert scale from 0-4 was used to measure the responses to all 10 questions. As the PSS-10 is not a diagnostic instrument and there are no cut-off limits, it enables a comparison to be made within a sample population, indicating varying levels of perceived stress.

The perceived stress scale questionnaire was developed by Cohen et al. (1983) as a 14 item questionnaire on a 5-point Likert scale aimed at enabling individuals to explore their own level of perceived stress and life events in an easy, none judgemental way. The questions are general in nature and enable the participant to assess the degree to which they believe their lives have been stressful in the month prior to taking the test.

The test was shortened to 10 items in 1988 following a factor analysis and was released as the PSS-10. A third version containing four items (PSS-4) was also released in 1988 as a short scale or to be used during a telephone interview (Cohen & Williamson, 1988). All three questionnaires have proved popular in enabling the exploration of self-perceived stress, however the psychometric properties of the PSS-10 have been shown to be superior to those of the PSS-14 and PSS-4 (Lee, 2012), and is recommended to be used to measure perceived stress both in practice and in research.

Moreover, when Lee (2012) reviewed the reliability and validity of the PSS questionnaires, they concluded that the PSS-10 was not only the preferred questionnaire rather than PSS14 or PSS4, due to its ease of use, but also its established acceptable test-retest reliability and validity. Furthermore, Cohen et al. (1983) reported that the PSS questionnaires only measures general stress, and does not target specific professions, populations or cultures. However validating this questionnaire on diverse populations is encouraged. Since this study focused on nurses perceived work related stress, another questionnaire specifically focusing on the work environment was used in addition, to collect data to overcome the broadness of the PSS-10.

The second (additional) questionnaire specifically focused on the work environment for the nurses, whilst the first year nursing students, their work environment related to their attendance at university. Rice (1999) defines work stress as “work demands that exceed the worker’s coping ability” (p.194), and goes on to note that half of one’s waking hours are spent at work, therefore, negative stressors not only affect a person’s performance and health, but significantly affects the organisation (Rice, 1999).

The Work Stress Profile questionnaire developed by Rice (1999) consists of a total of 57 questions spread across three domains: 26 questions concerning workplace inter-relationships; 22 questions concerning the physical demands of the job; and 9 questions on a person’s interest or involvement in their job. A Likert scale from 1-5 was used to measure all 57 questions. The reliability of this scale is quite high at 0.921, a perfect scale is indicated by a reliability of 1.00 (Rice, 1999), although this work stress profile has been used in numerous studies, Rice reports that validity has yet to be fully established.

The Work Stress Profile questionnaire (WSP) was developed in the 1990’s to assist individuals to identify their perceived stressors within the workplace. This instrument provides an overview of the level of perceived workplace stress as well as stratifies the stressors into four sub-categories:

1. Workplace interpersonal relationships,
2. Physical demands of the job
3. Personal interest or involvement of the job, and a
4. Collective totals score (Rice, 1999).

1. Workplace interpersonal relationships

The first sub-category within the WSP questionnaire explores perceptions in relation to the participants’ level of education and its relevance to the job, also relationships with their superiors, managers, administrative and support personnel, and perceptions of discrimination, job security and access to training.

2. Physical demands of the job

The second sub-category of the WSP measures the physical demands of the job on a daily bases, it explores if the workload is physically heavy or if there are long periods of high intensity concentration required. It also explores if the pace of the work

is too fast, or if there are too few support personnel, furthermore, if the job requirements are beyond the individual's abilities, or they are unable to relax after work or on their days off.

3. Personal interests or involvement of the job

The third sub-category of the WSP questionnaire focuses on the interests of the job, and the subsequent involvement and control the participant perceives they have over their role. It explores if the participants are excited by their job, if it keeps them interested, or whether they are uneasy about going to work each day, or they leave each day feeling burned out and trapped in their job.

4. The collective totals score

The final sub-category within the WSP questionnaire is the collective totals score, which indicates the overall perceived work-related stress level perceived by the participant. This section of the WSP does not focus on any specific stressors as this was explored in the previous categories; rather it gave a general overview of the individuals perceived stress level relating to their work environment.

The WSP questionnaire was originally tested on a sample of 275 school psychologists, but Rice (1999) notes that further testing on various occupations would be advantageous to establish stability across numerous occupations. Both questionnaires were used in combination for this survey, prior to completion of the questionnaires participants were informed that the PSS-10 had 10 items to be rated on a 5-point Likert scale that ranged from 0-4, whilst the WSP had 57 items to be rated on a Likert scale from 1-5, thus ensuring that there was no confusion when completing their questionnaires.

3.4.2 Hair cortisol

As the time lag between the hair cortisol sampling following completions of written questionnaires was determined to be a confounding factor by Wells et al. (2014) and previous work by Gerber et al. (2012). The experimental design for this present study ensured that hair sampling was conducted concurrently with the completion of the questionnaires. This was to address the issue of any "mismatch between time frames for self-reported stress and Hair Cortisol Concentrations" (p.340), resulting in a disparity between the participants perceived stress, and the actual level of hair cortisol (Wells et al., 2014).

Hair samples were obtained by cutting a slip of hair weighing approximately 50mg, and 1cm in length from the posterior vertex of the head as close to the scalp as possible without including the hair follicle using clean scissors. Human hair grows approximately 1cm per month, therefore taking a 1cm sample enabled a sufficient sample to record the previous months hair cortisol concentration (Davenport et al., 2006).

Once each sample had been obtained and weighed to ensure an ample amount was collected. Next the hair samples were individually wrapped in 4x4 inch foil packages, whilst indicating the scalp end of the hair sample using a sticky label. Each hair sample was then deposited in individual plastic bags ready for assay preparation (O'Brien, Tronick, & Moore, 2013). The samples were next stored in a dark dry box with a silica gel sachet added to absorb any moisture to prevent deterioration of samples prior to being received by the analytical laboratory.

3.4.3 Micro balance

A Nuweigh balance, Model AS220/X, Serial Number 420447/14 was calibrated prior to use, to weigh each sample of hair to be supplied for analysis at the NATA approved Laboratory, Stratech Scientific APAC Pty Ltd.

3.4.4 Hair cortisol assay process

The cortisol analysis method developed by D'Anna-Hernandez, Ross, Natvig, and Laudenslager (2011) was used. Stratech Scientific have since further developed this method to a NATA approved extraction and analysis technique for the measurement of human hair cortisol concentrations, which is a modification of the salivary cortisol method shown in Appendix E. Hence the hair samples were sent to Stratech Scientific for analysis. The methodology was as follows:

1. Hair is cleaned
2. Hair is dried
3. Hair is cut and weighed
4. Hair is milled to a powder
5. The sample is then weighed again, and goes through a number of extraction processes which involve Methanol, and Isopropyl alcohol
6. Extract is evaporated down
7. Extract is reconstituted in assay diluent

8. Sample is assayed for the cortisol concentration using Salimetrics ELISA Kits.

3.5 DATA COLLECTION

Following ethical approval the two questionnaires were administered at the convenience of each participant on a day and time that suited them, and at a location of their choice. To minimise any stress due to the first year nursing students' clinical placement, the administration of the questionnaires commenced during the second semester (July 2015). Data collection took approximately 20 minutes to complete (Appendix F). The recruitment of participants continued until the required sample size had been achieved. The National Research Council (2013) note that the reluctance by participants to complete a written survey is reflective of today's societal concerns over privacy and confidentiality, as well as a level of survey fatigue (Blackwell, 2016). Participants that consented to giving a hair sample were sampled immediately after completing their questionnaire, thus minimising the effect of different timeframes and stress perceptions with the different assessment tools. Gerber et al. (2012) identified this as a potential weakness within earlier studies (Dettenborn, Tietze, Bruckner, Kruschbaum, & Stalder, 2010; Yamada et al., 2007).

3.6 METHODS FOR DATA ANALYSIS

3.6.1 Questionnaire analysis

PSS-10 questionnaire

The responses to all 10 of the questions of the PSS-10 questionnaire results in a cumulative sum or total score, it has four positively worded questions, which need to have their score reversely scored before calculating a cumulative sum of all 10 questions. The outcome being, the higher the total score the greater the level of perceived stress (Cohen et al., 1983).

Work stress profile questionnaire

The work stress profile questionnaire has a total of 57 questions, which are split into three sub-categories resulting in three subtotals and a final cumulative total (Rice, 1999).

1. Inter-personal relationships within the work environment

The work stress rankings using the total score for question 1-26 for the inter-personal relationships within the work environment sub-category are:

- 39-46 as low stress,
- 47-61 as normal stress and
- 62-75 as highly stressed.

2. Physical demands of the job

The work stress score derived from questions 27-48 measure the physical conditions and physical demands of the work environment resulting in the following perceived stress rankings:

- 35-44 indicates low stress
- 45-57 normal stress
- 58-67 is highly stressed.

3. Personal interest or involvement of the job

The third sub-category assesses the individual's job interest and involvement.

The perceived stress rankings derived from questions 49-57 are:

- <13-17 indicating low stress,
- 18-22 normal stress levels and
- 23-27> highly stressed.

4. Collective totals score

Having three subtotals within the questionnaire enables the research to identify areas within the work environment that affect the individuals perceived work stress levels the most, thus enabling the individual to focus on strategies to reduce their workplace stress. Finally, each of the three scales is added together to give an overall workplace perceived stress level:

- <91-111 indicating low stress
- 112-140 normal stress and
- 141-167 highly stressed

3.6.2 Hair sample analysis

To maintain anonymity, a unique number was used to link the questionnaire response to the respective hair sample, and ultimately the results of the analysis. Stratech Scientific APAC Pty Ltd., Sydney, conducted the hair cortisol analysis, which is a National Association of Testing Authorities (NATA) accredited laboratory.

3.6.3 Statistical analysis

The statistical analysis was conducted using SPSS (IBM SOSS Statistics 23). This involved assessment of the normality of data, and conducting an Analysis of Variance (ANOVA) to test the study hypothesis. Post hoc comparisons, in line with Field (2013) post hoc flowchart, were also carried out to investigate patterns associated with experience, work stress profile scores, and perceived stress levels. The various independent variables were also compared to test their effect on the hair cortisol concentrations to explore if an association existed.

3.7 ETHICAL CONSIDERATIONS

3.7.1 Approvals

Ethical approval was gained from both the Joondalup Health Campus Human Research Ethics Committee and Edith Cowan University Human Research Ethics Committee prior to the collection of data.

3.7.2 Information sheet to participants

As well as promotion of this study by the researcher the potential participants were provided with a participant information sheet to inform them of the study. Participants were also required to sign a consent form prior to commencing data collection (Appendix G).

3.7.3 Counselling available to participants

It was a condition of this study that if at any point during the completion of the study the participant felt psychologically unwell, as a result of evaluating their own stress then the researcher would provide them with contact details for Beyond Blue (a counselling service provider). These contact details were provided on the information sheet, which they were given prior to commencing the study.

3.7.4 Confidentiality of participants

Participants were informed that data would be de-identified and the results of their hair cortisol levels and questionnaire data would be treated as confidential. Only the researcher had access to the data. Any information that could be used to identify a person was removed at the time of data entry into IBM SPSS Statistics 23. The university laptop computer used for data analysis was securely controlled and protected by firewalls and anti-virus software. It was secured with a personally

associated password login to restrict access and the computer screen was locked during breaks from working on the data.

The findings from this study will be published in appropriate peer reviewed journals and shared at professional meetings, as well as part of this doctoral thesis. No identifying information will be published and data will be reported in aggregate form only. By taking part in this study, participants agree not to restrict the use of any data even if they withdraw.

3.7.5 Data storage

The written questionnaire and hair sample results were only identified by a numeric code. Hard copy records were destroyed after data was uploaded into the IBM SPSS Statistics 23 database. Stratech Scientific a NATA approved laboratory destroyed the hair samples through the appropriate destruction of human tissue sampling following analysis. The study data will be retained for a period of five years after the submission of the PhD thesis for examination, as per Edith Cowan University records and management policy and NHMRC guidelines for research involving human participants.

3.7.6 Ethics

There was no conflict of interest between the researcher who collected all questionnaire data and hair samples, and had no relationship with any of the study participants.

3.8 CHAPTER SUMMARY

The methodology and design of this study enabled the researcher to follow a protocol that allowed for the collection of data deemed valid and reliable for the study population, which was confined to the Northern Metropolitan area of Perth, WA.

CHAPTER 4 RESULTS

4.1 INTRODUCTION

Chapter three described the research design and methodology used in this study to correlate the Perceived Stress Scale-10 questionnaire (PSS-10) with the Work Stress Profile questionnaire (WSP) and hair cortisol levels, in order to assess the validity of using hair cortisol levels as a biomarker for stress. Presented in this chapter are the descriptive statistics of the data collected. The data are presented according to the main outcomes measured, namely: the PSS-10 and WSP outcomes as well as hair cortisol levels.

4.2 THE STUDY SAMPLE

One hundred and seventy-seven participants took part in the study, with two questionnaires, deemed invalid, as they were not fully completed, leaving 175 to be analysed. Eighty-five participants provided both a questionnaire and a hair sample for analysis. All the collected hair samples were suitable for analysis, having met the sampling protocol requirements related to sampling collection and storage. This enabled direct correlation of 85 questionnaires with the corresponding hair cortisol levels.

Table 1 presents a summary of the number of participants, their gender, age ranges, the number of completed questionnaires, how many nurses worked in the public or private sector, the number of student nurses and registered nurses who participated, as well as the number of male and female participants who completed both the questionnaire and provided a hair sample. The cortisol levels for each participant who gave a hair sample and subsequent classifications are presented in Appendix H.

Table 1: An overview of the study participants

	Number of participants	%
Written Questionnaires (n=175)	Males 17	10
	Females 158	90
Designation (n=175)	Nurses 101	58
	Students 74	42
Age Ranges (n=175)		
18-24 yrs. old	50	29
25-30 yrs. old	41	23
31-40 yrs. old	36	21
41-50 yrs. old	32	18
>50 yrs. old	16	9
Nurses (n=101)	Public 75	74
	Private 26	26
Written Questionnaires in combination with a Hair Sample (n=85)	Males 5	6
	Female 80	94
Age Ranges (n=85)		
18-24 yrs. old	18	21
25-30 yrs. old	14	17
31-40 yrs. old	19	22
41-50 yrs. old	23	27
>50 yrs. old	11	13
Designation (n=85)	Public	57
	Private	12
	Students	16

4.2.1 Sensitivity to outliers within the data

Following analysis of the data, it was noted that within the 175 completed questionnaires there were 21 outliers with extreme scores, in comparison to the other participants in response to specific questions in the questionnaires. Therefore, those questionnaires were subsequently checked to ensure that no error in data entry had occurred. Pallant (2013) suggests this is an important step that can enable the error to be detected and corrected, and the analysis to be repeated. The visual checking of the written questionnaires, in this case highlighted that these questionnaires were indeed extreme scores as defined by Osborne and Overbay (2004). Osborne and Overbay (2004) explored the potential causes of extreme scores within a data set, also how a small number of outliers could negatively impact on the accuracy of data, and argued that when outliers are suspected of being as a result of an extreme score or illegitimate cases, as was the case in the current study. Field (2014) states that “by removing the

extreme scores, provides a more precise interval estimate of the population value” (p.74). Osborne and Overbay (2004) state there is an overwhelming argument for their removal. They conclude that their removal is beneficial, and overwhelming increases the accuracy of the results. In line with this view, the outliers within the current study were removed. Although not included in the statistical analysis, the outliers are not totally dismissed and are indicated in the appropriate graphs of the results section below, and the reasons for the removal of these outliers are presented in Appendix I.

4.3 THE PSS-10 RESULTS

Figure 2 is a histogram showing the range of PSS-10 scores for the participants (n=175). Given the range of respondents’ scores, it is reasonable to assume that the sample represents the typical stress levels experienced by nurses as the data was normally distributed.

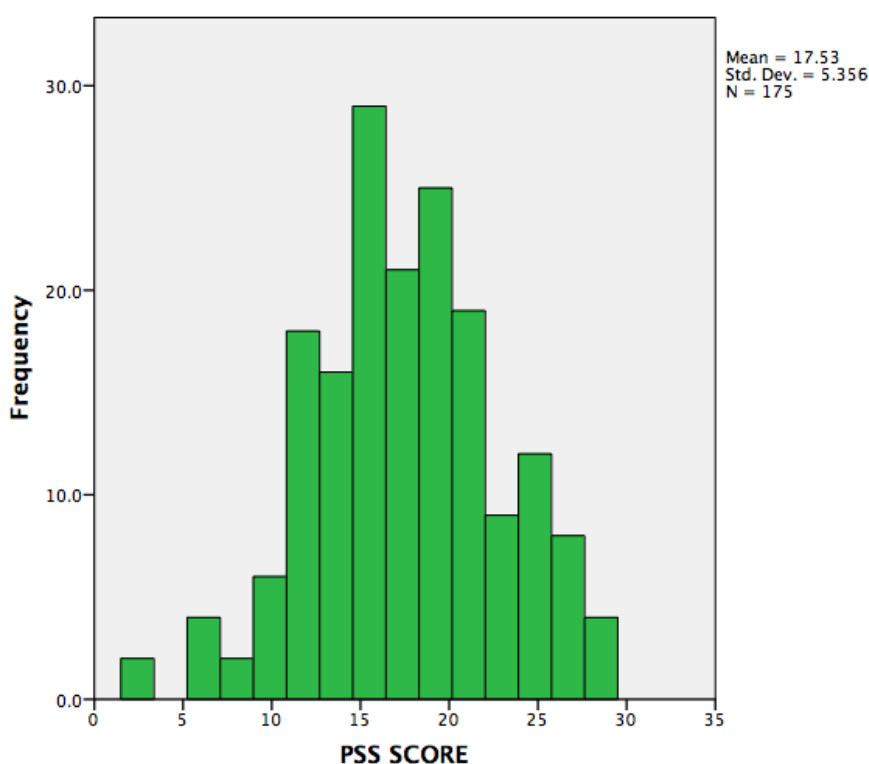


Figure 2: The PSS-10 score frequency distribution

The PSS-10 questionnaire comprised of 10 scored questions. A total score of 13 or less is indicative of a low level of perceived stress, whereas those with a score between 14 and 20 were considered moderately stressed. Scores above 20 indicate a high level of perceived stress.

The PSS-10 questionnaire results indicated that there was a higher level of perceived stress for 40% of this cohort of nurses.

The statistical analysis protocol used for analysis of the PSS-10 data below was initially to conduct an ANOVA test, then exploring these data further via post hoc statistical analysis for unequal group size, was the Levene's Test for Equality of Error Variances followed by a Hochberg test. The convection of the boxplots that follow reflects the first and third quartiles; within the box and whiskers the median is reflected as a line reflective of the range of values.

The effect the age of the participants' had on the PSS-10 totals score was investigated.

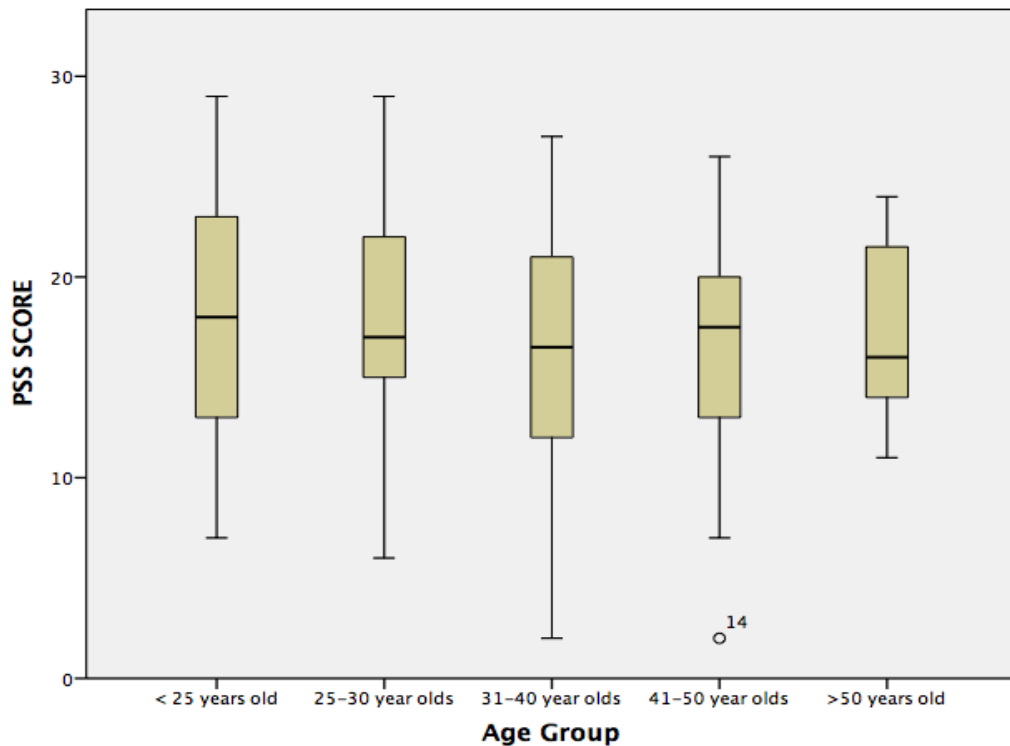


Figure 3: The PSS-10 scores plotted against the age of the participants

Figure 3 is a boxplot comparing the age of the participants (horizontal axis) against the PSS-10 scores. To verify the assumption that there is equal variance across the sample, a Levene's statistical analysis test for homogeneity of variances was conducted which showed no significant difference in variance. The Levene's Test for Equality of Error Variances was not significant at $\alpha = 0.05$, $F(4,170) = 0.671$, $p = 0.613$. The assumption of homogeneity of variance has not been violated.

Furthermore, an ANVOA test showed no significant effect on the PSS-10 outcomes across, or within the age groups $F(4,170) = 0.864, p > 0.0487, ns$.

The association of the PSS-10 totals score with the experience of the nurse (excluding any career breaks the participant may have taken) was analysed.

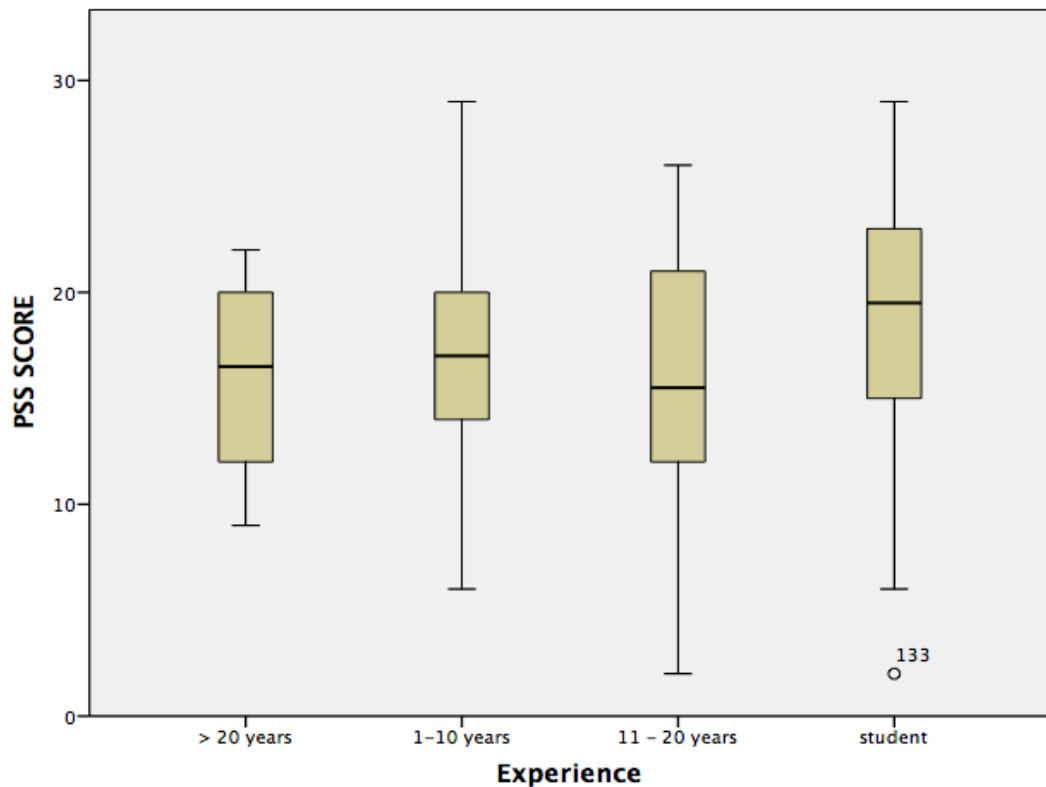


Figure 4: PSS-10 scores plotted against the years of experience as a nurse

Figure 4 shows that the perceived stress levels (indicated by the PSS-10 score) was not associated with the participant's years of experience as demonstrated by the ANOVA correlation $F(3,171) = 1.898, p = 0.132$ and the Levene's Test for Equality of Error Variances as it is not significant at Levene $\alpha = 0.05, F(3,171) = 0.944, p = 0.421$.

The significance between the PSS-10 totals score and the level of educational qualification the participant obtained was evaluated.

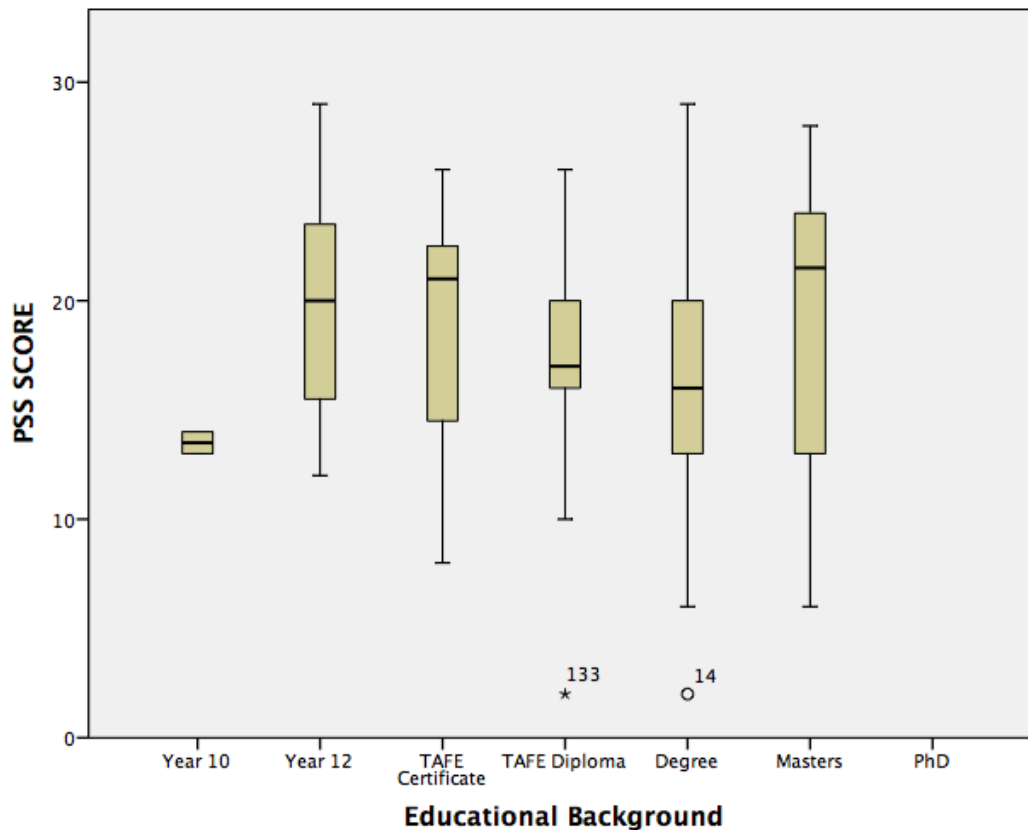


Figure 5: PSS-10 scores plotted against the level of education

The educational level of the participants ranged from secondary school year 10 to a Master's degree qualification (Figure 5). It is presumed that the 2 participants' with the educational background of year 10 are presumed to have completed a university preparatory course, and hence was included in the analysis. The result of analysis on removal of these data remained unchanged.

An ANOVA test showed a significant difference in PSS-10 score in relation to education $F(5,169) = 2.435, p = 0.037$. Exploring this further via post hoc analyses the appropriate statistical analysis for unequal group size, the Levene's Test for Equality of Error Variances and Hochberg test were applied and the outcome was not significant at Levene $\alpha = 0.05, F(5,169) = 1.763, p = 0.123$, and Hochberg testing (using $\alpha = 0.1, p = 0.192, M = 8.169$). Therefore concluding that there was no statistically significant difference between PSS-10 result and education background.

The influence of being either a nursing student, or a nurse working in the public, or private domain, and the level of perceived stress (derived from the PSS-10 totals score) was statistically analysed.

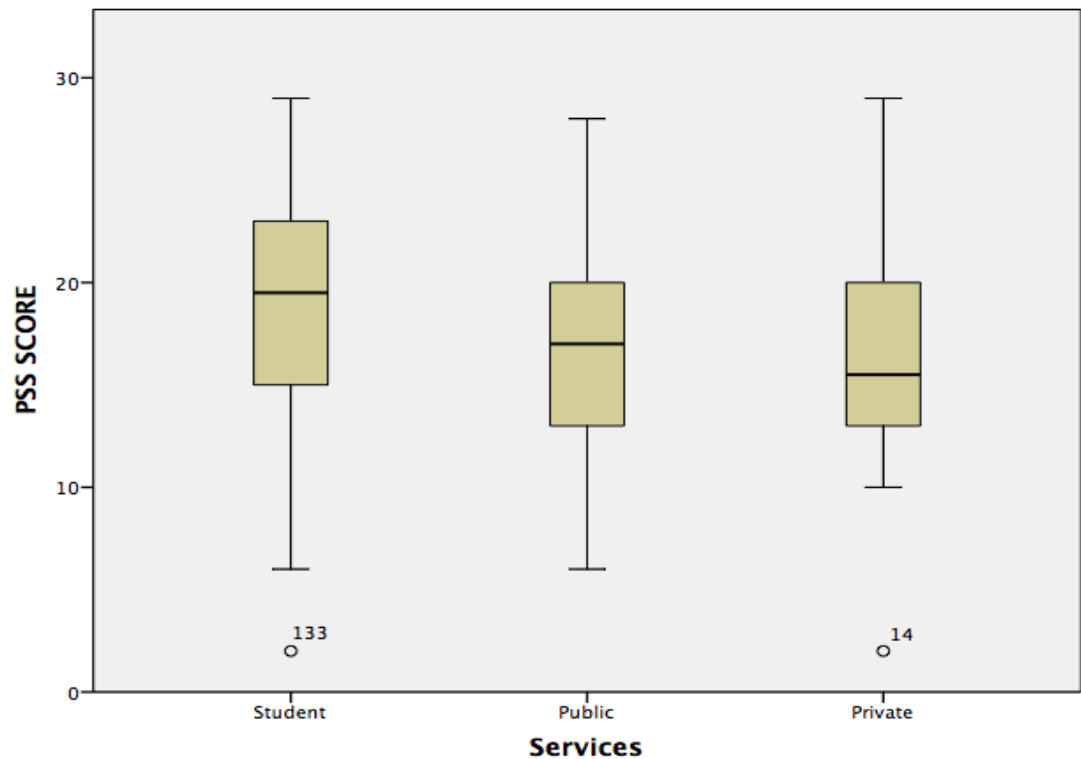


Figure 6: PSS-10 scores plotted against the service domain

A comparison of the service domain in which the participant worked (e.g. public or private section of the hospital, or for students the university environment) and the results of the PSS-10 questionnaire showed no statistically significant difference between groups, as demonstrated by an ANOVA, $F(2,172) = 2.519$ $p = 0.084$, and the Levene's Test for Equality of Error Variances not being significant at Levene $\alpha = 0.05$, $F(2,172) = 0.242$, $p = 0.786$.

The differences between the areas of practice (i.e. the ward area in which the nurse worked, or student who had no allocated specific work area (i.e. at university and possibly part-time within the health care environment, were coded as N/A) and the PSS-10 totals scores were investigated. The PSS-10 scores for the nursing students' were still relevant despite having no specific work area (coded as N/A).

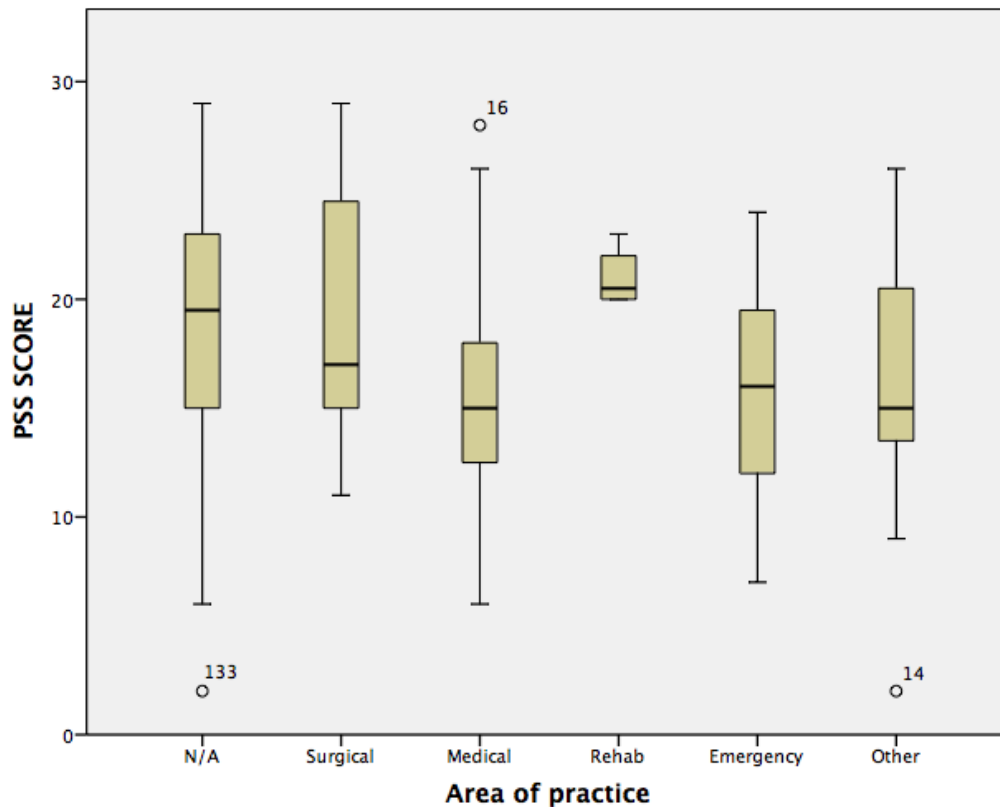


Figure 7: PSS-10 score plotted against each area of practice

The results from ANOVA testing exploring the area of practice and participants' PSS-10 scores indicated the differences were significant (ANOVA $F(5,169) = 2.728$, $p = 0.021$). It must be noted that there were small numbers within the rehabilitation group ($n=4$), which indicate the results were sensitive to low numbers and too small for further analysis. However exploring the remaining areas notably surgical, medical, emergency and other, showed no statistically significant difference between the PSS-10 scores and area of practice (Hochberg $\alpha = 0.1$, $p = 0.117$).

The detailed results of analysis are shown in Table 2.

Table 2: PSS-10 multiple comparisons with area of practice

Dependent Variable: PSS SCORE

	(I) Area of practice	(J) Area of practice	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
HOCHBERG	N/A	Surgical	-.211	1.228	1.000	-3.85	3.43
		Medical	2.877	1.175	.205	-.61	6.37
		Rehab	-2.419	2.684	.999	-10.38	5.55
		Emergency	2.729	1.175	.273	-.76	6.22
		Other	2.476	1.345	.639	-1.51	6.47
	Surgical	N/A	.211	1.228	1.000	-3.43	3.85
		Medical	3.088	1.467	.423	-1.26	7.44
		Rehab	-2.208	2.823	1.000	-10.59	6.17
		Emergency	2.940	1.467	.503	-1.41	7.29
		Other	2.686	1.605	.771	-2.08	7.45
	Medical	N/A	-2.877	1.175	.205	-6.37	.61
		Surgical	-3.088	1.467	.423	-7.44	1.26
		Rehab	-5.296	2.801	.598	-13.61	3.02
		Emergency	-.148	1.423	1.000	-4.37	4.07
		Other	-.402	1.565	1.000	-5.05	4.24
	Rehab	N/A	2.419	2.684	.999	-5.55	10.38
		Surgical	2.208	2.823	1.000	-6.17	10.59
		Medical	5.296	2.801	.598	-3.02	13.61
		Emergency	5.148	2.801	.642	-3.16	13.46
		Other	4.895	2.876	.750	-3.64	13.43
	Emergency	N/A	-2.729	1.175	.273	-6.22	.76
		Surgical	-2.940	1.467	.503	-7.29	1.41
		Medical	.148	1.423	1.000	-4.07	4.37
		Rehab	-5.148	2.801	.642	-13.46	3.16
		Other	-.253	1.565	1.000	-4.90	4.39
	Other	N/A	-2.476	1.345	.639	-6.47	1.51
		Surgical	-2.686	1.605	.771	-7.45	2.08
		Medical	.402	1.565	1.000	-4.24	5.05
		Rehab	-4.895	2.876	.750	-13.43	3.64
		Emergency	.253	1.565	1.000	-4.39	4.90

GAMES-HOWELL	N/A	Surgical	-.211	1.241	1.000	-3.92	3.50
		Medical	2.877	1.170	.156	-.59	6.34
		Rehab	-2.419	.952	.202	-5.75	.92
		Emergency	2.729	1.091	.142	-.49	5.95
		Other	2.476	1.439	.531	-1.93	6.88
	Surgical	N/A	.211	1.241	1.000	-3.50	3.92
		Medical	3.088	1.448	.288	-1.21	7.39
		Rehab	-2.208	1.278	.531	-6.24	1.83
		Emergency	2.940	1.385	.294	-1.18	7.06
		Other	2.686	1.673	.600	-2.34	7.71
	Medical	N/A	-2.877	1.170	.156	-6.34	.59
		Surgical	-3.088	1.448	.288	-7.39	1.21
		Rehab	-5.296*	1.209	.004	-9.14	-1.45
		Emergency	-.148	1.322	1.000	-4.06	3.76
		Other	-.402	1.621	1.000	-5.28	4.47
	Rehab	N/A	2.419	.952	.202	-.92	5.75
		Surgical	2.208	1.278	.531	-1.83	6.24
		Medical	5.296*	1.209	.004	1.45	9.14
		Emergency	5.148*	1.134	.004	1.48	8.82
		Other	4.895*	1.472	.035	.26	9.53
	Emergency	N/A	-2.729	1.091	.142	-5.95	.49
		Surgical	-2.940	1.385	.294	-7.06	1.18
		Medical	.148	1.322	1.000	-3.76	4.06
		Rehab	-5.148*	1.134	.004	-8.82	-1.48
		Other	-.253	1.566	1.000	-4.98	4.47
	Other	N/A	-2.476	1.439	.531	-6.88	1.93
		Surgical	-2.686	1.673	.600	-7.71	2.34
		Medical	.402	1.621	1.000	-4.47	5.28
		Rehab	-4.895*	1.472	.035	-9.53	-.26
		Emergency	.253	1.566	1.000	-4.47	4.98

*. The mean difference is significant at the 0.05 level.

The influence that the level (category) of the nurse e.g. first year post graduation through to nurse managers had on the PSS-10 totals score was analysed.

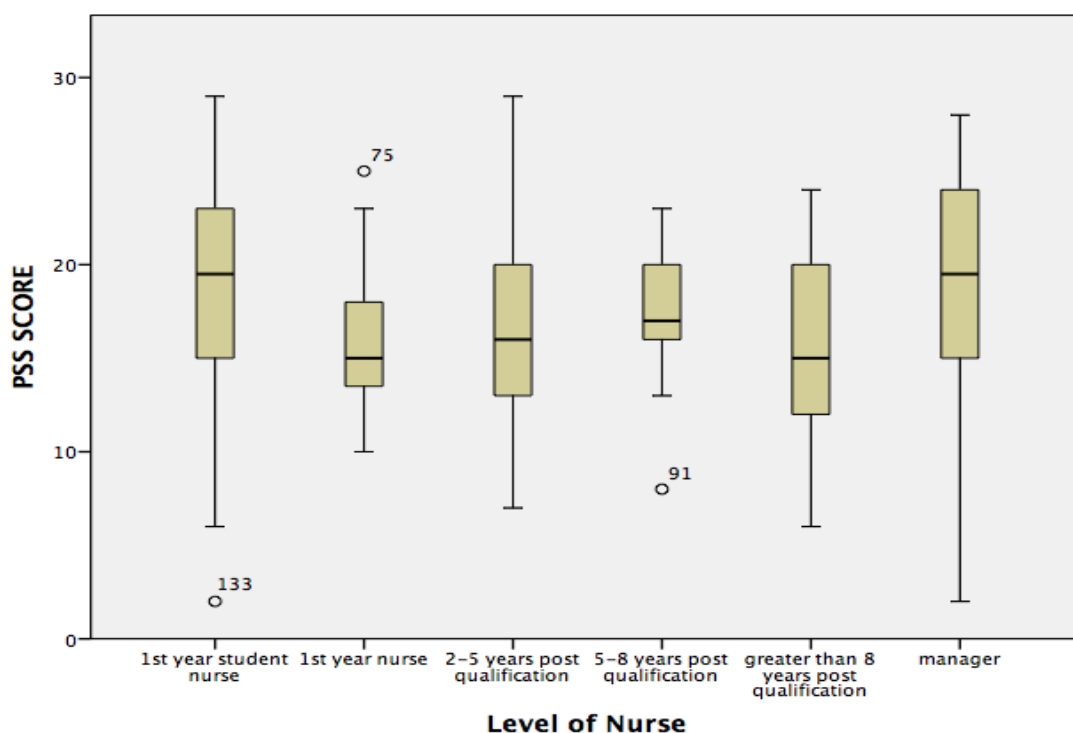


Figure 8: PSS-10 score plotted against the level of nurse

The boxplot shows the level of nurse, compared with the PSS-10 score. The results confirm there was no difference between the level of the nurse and the participants' PSS-10 score, as demonstrated by an ANOVA, $F(5,169) = 1.864$ $p = 0.103$, and a Levene's Test for Equality of Error Variances not being significant at Levene $\alpha = 0.05$, $F(5,169) = 1.208$, $p = 0.308$

4.4 WORK STRESS PROFILE QUESTIONNAIRE

The WSP has 57 questions divided into three sub-categories. The first explored the 'workplace inter-relationships' encompassing job satisfaction and dissatisfaction. The second sub-category focused on the 'physical demands' on a day-to-day basis, and the third sub-category explored 'job interest and involvement'. Finally, all three sub-categories scores were added together to give the 'overall WSP score' indicating a low, medium or high work related perceived stress outcome. The participants of this study were asked to complete the questionnaire in relation to their employment and for student nurses, their clinical placement experience.

4.4.1 The first category: Workplace inter-relationships

The first category of the WSP questionnaire focused on the problems relating to the social interaction and relationships within the work environment, including both the job satisfaction and dissatisfaction perceived by the individual. The perceived stress due to the social interaction and relations within the work environment are plotted against the age groups of the participants.

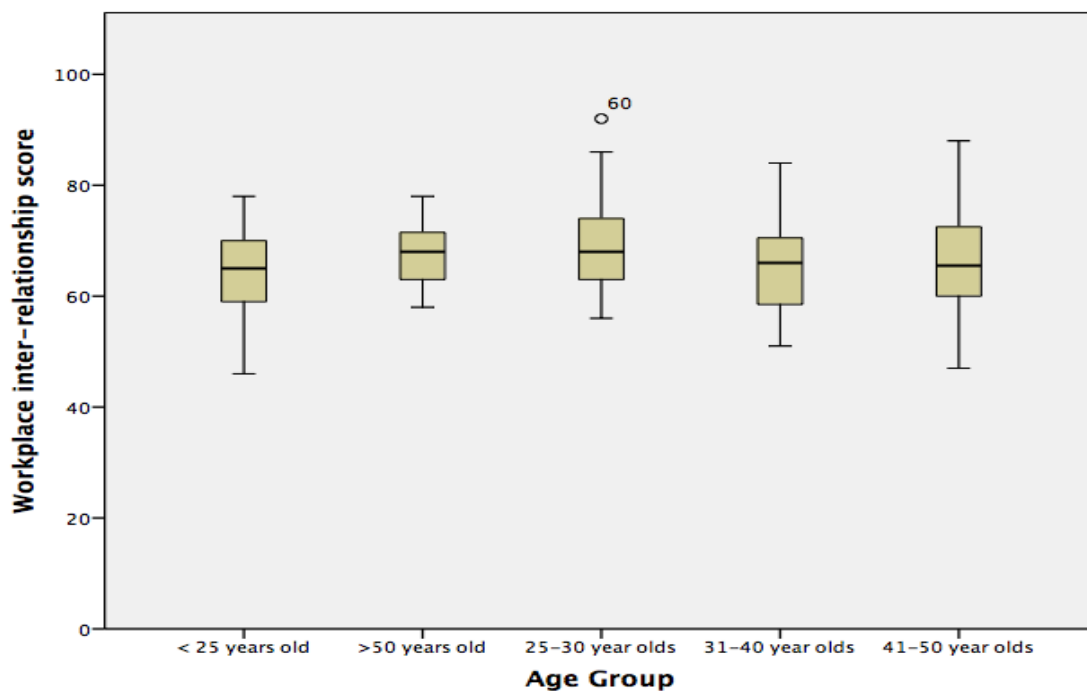


Figure 9: Workplace inter-relationships plotted against age

An ANOVA test comparing the score for 'workplace inter-relationships' and the participants' age showed no statistically significant differences between groups (ANOVA, $F(4,170) = 1.995$, $p = 0.098$). As the variances were unequal a Levene's Test for Equality of Error Variances was conducted that showed no significant difference - Levene $\alpha = 0.05$, $F(4,170) = 0.756$, $p = 0.556$.

A Hochberg test was performed which enabled multiple comparisons of unequal groups, which showed no significant difference overall (Hochberg $\alpha = 0.5$, $p = 0.239$). In addition, post hoc test showed no statistical significant difference between individual age groups at $\alpha = 0.05$. However significant differences were noted at $\alpha = 0.1$. Note that increasing α to 0.1 increases the risk of Type I error (identifying statistically significance when in reality none exists).

A Games-Howell test showed a statistically significant difference in the <25-year-old group (using $\alpha = 0.1$, $p = 0.053$, $M = -4.725$) and the 25-30 year old group (Games-Howell $\alpha = 0.1$, $p = 0.053$, $M = 4.725$).

Therefore, there was an apparent difference between the perceived stress due to the social interaction and relations within the work environment (i.e. 'workplace inter-relationship' score) and the participants aged <25 years old ($n=50$) and those 25-30 years old ($n=41$).

The influence on the perceived stress determined by the 'workplace inter-relationships' score with:

- the participants' level of education (Figure 10),
- their years of experience as a nurse (excluding career breaks) - (Figure 11),
- the service domain the participant worked in e.g. public, private sector or student nurse (Figure 12),
- ward area they practiced in (Figure 13), and
- level (category) of nurse e.g. first year post graduation through to nurse manager (Figure 14) were explored; as shown in the following series of graphs.

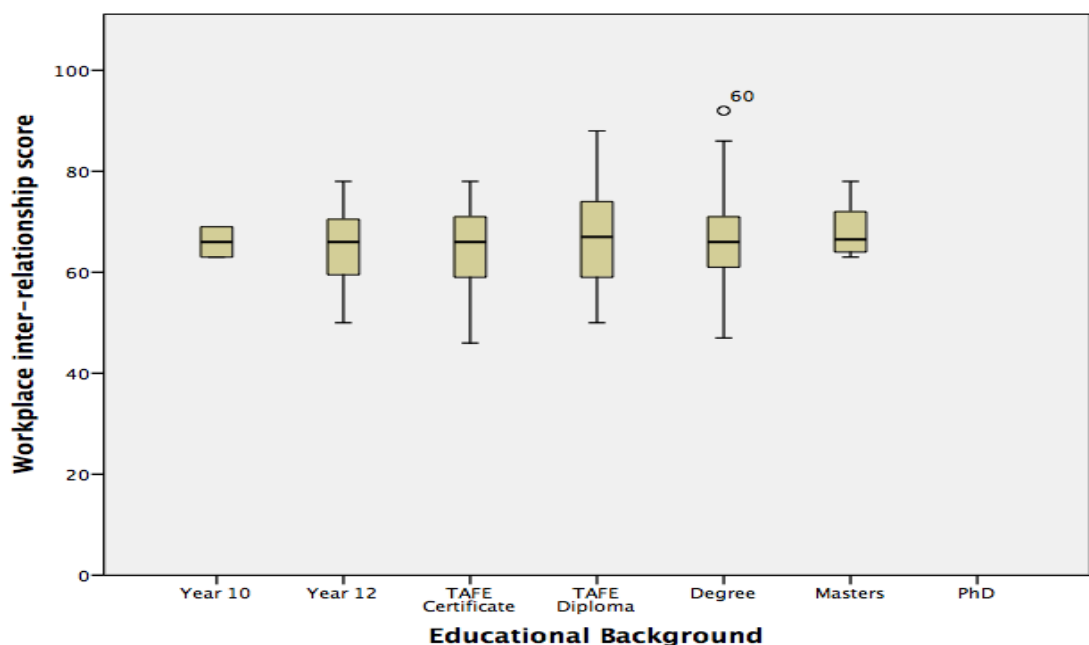


Figure 10: Workplace inter-relationships and level of education obtained

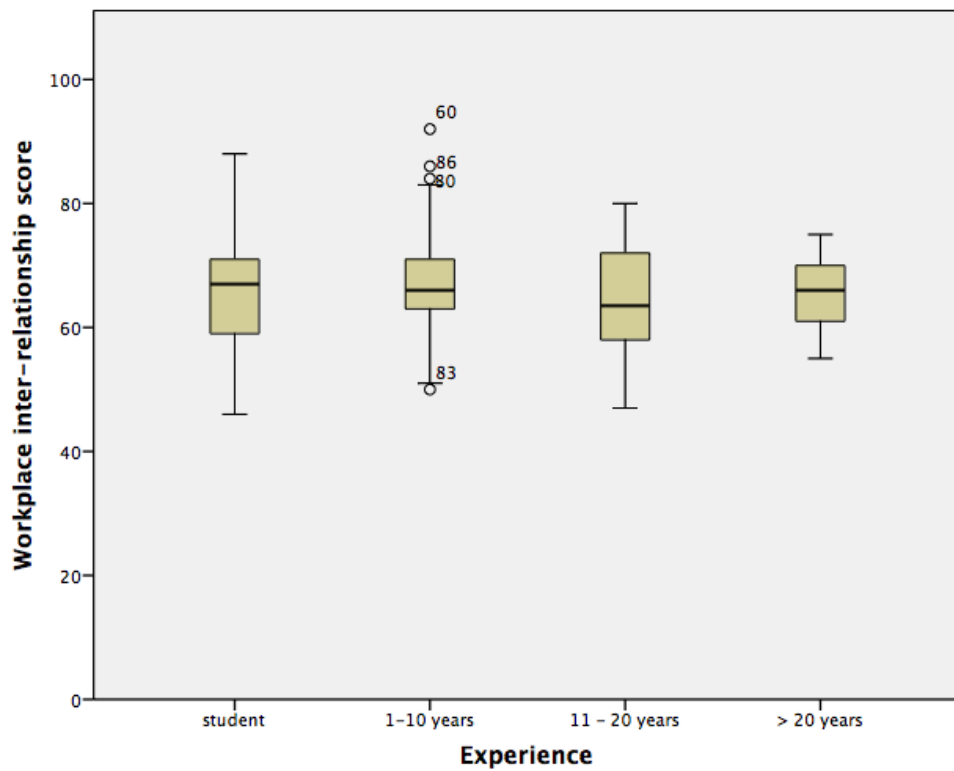


Figure 11: Workplace inter-relationships score and years of experience

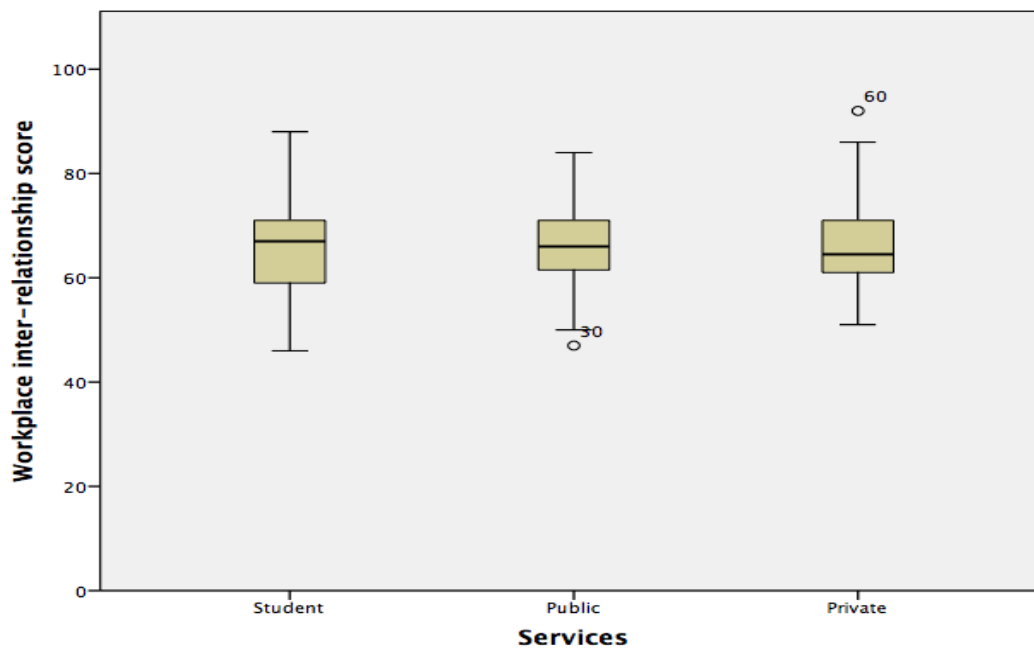


Figure 12: Workplace inter-relationships and service domain

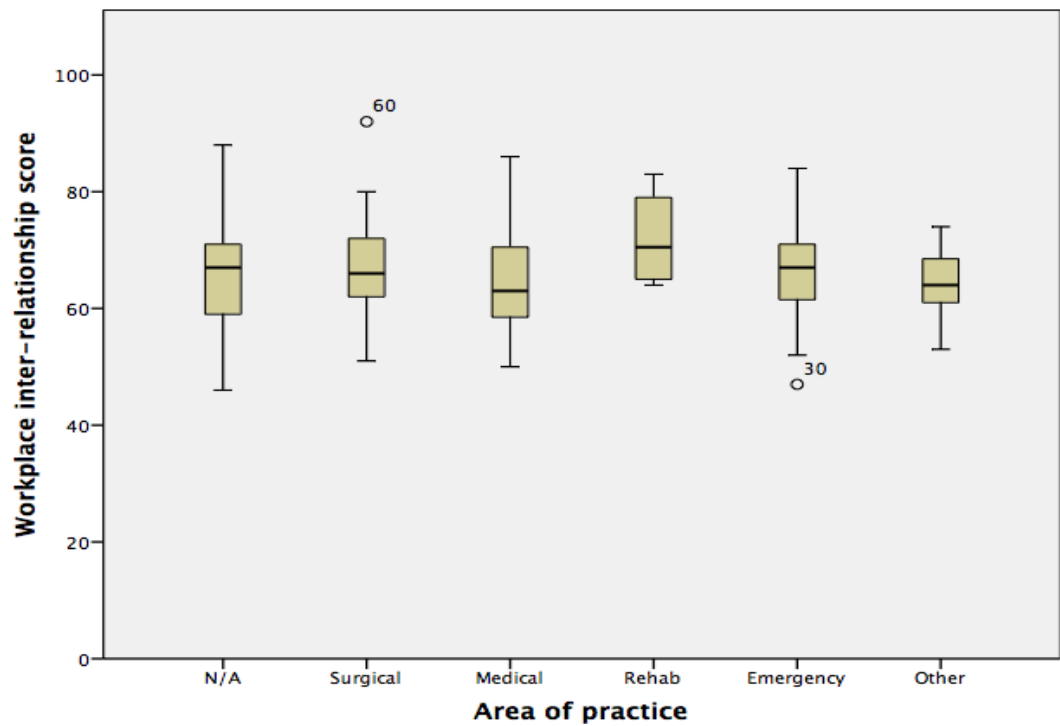


Figure 13: Workplace inter-relationships score and ward area of practice

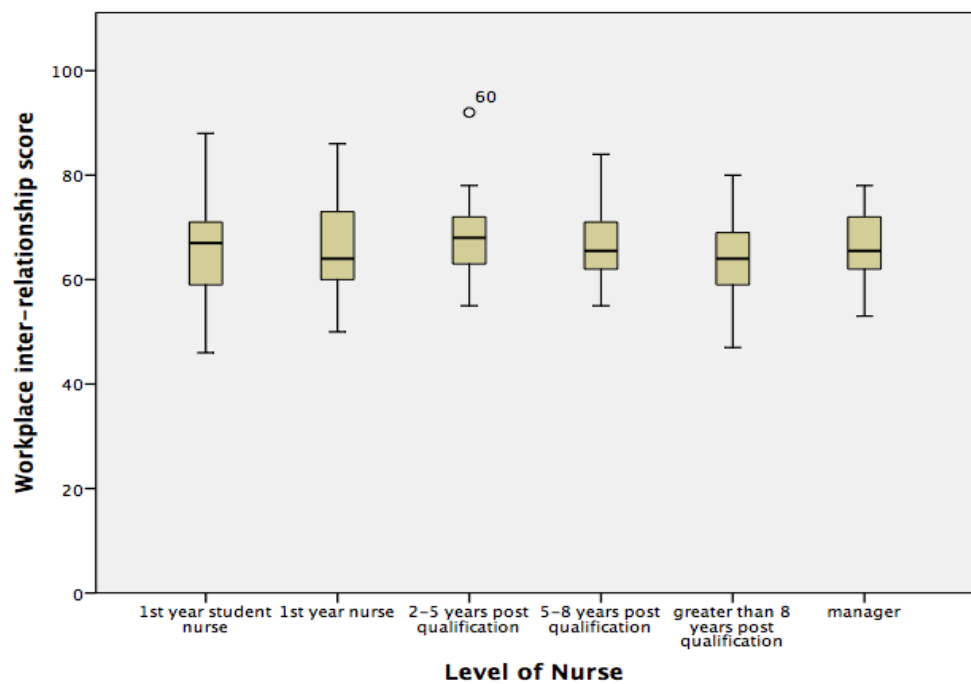


Figure 14: Workplace inter-relationships score and level of nurse

Table 3 summarises the ANOVA Test results for the previous figures (Figures 10-14) that show that there was no difference between ‘workplace inter-relationships’ and the variables tested (education, experience, service domain, area of practice, or level of nurse).

Table 3: Workplace inter-relationship results lack of correlation with variables

Figure	ANOVA Correlations
Figure 10 Workplace inter-relationships and education	$F(5,169) = 0.376, p = 0.865$
Figure 11 Workplace inter-relationships and years of experience as a nurse	$F(3,171) = 0.379, p = 0.768$
Figure 12 Workplace inter-relationships and service domain	$F(2,172) = 0.006, p = 0.994$
Figure 13 Workplace inter-relationships and area of practice	$F(5,169) = 0.643, p = 0.667$
Figure 14 Workplace inter-relationships and level of nurse	$F(5,169) = 0.399, p = 0.849$

The level of perceived stress indicated by the ‘workplace inter-relationships’ totals score is represented in a histogram (Figure 15). This indicates the levels of perceived stress due to the social interaction and relationship within the work environment for this studies population, ranging from low perceived stress to a high level of perceived stress.

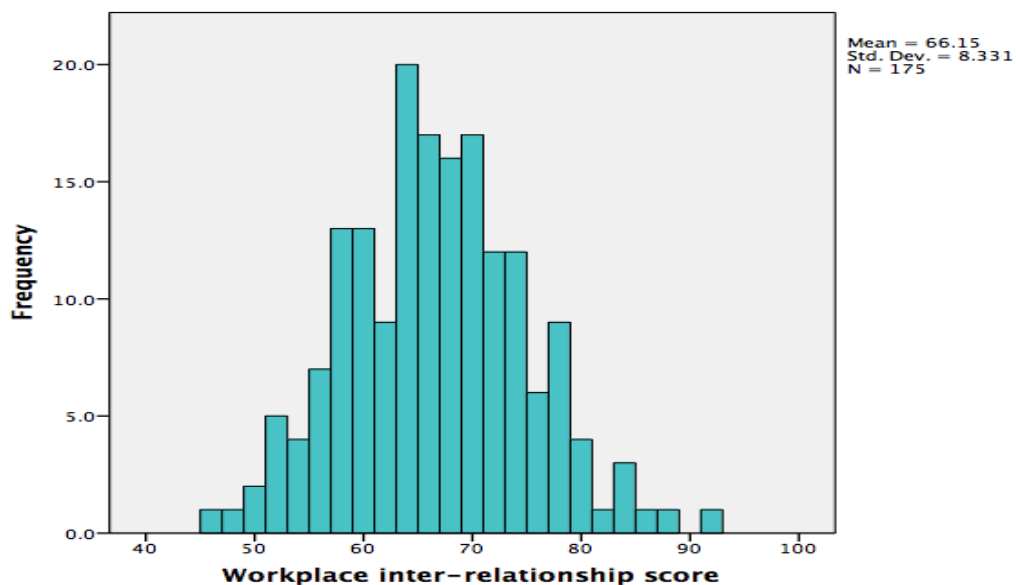


Figure 15: WSP workplace inter-relationships frequency

The histogram has a normal distribution resembling an inverted U with the greatest frequency of cases clustered around the mean ($n=175$, $M= 66.15$, $SD = 8.331$), with progressively fewer cases towards both tail ends of the histogram. Therefore indicating the perceived stress levels of this WA Nursing cohort (The scale on the horizontal axis being - Low stress <39-46, normal stress 47-61, to high stress 62-75> (Rice, 1999)).

4.4.2 The WSP - Physical demands sub-category

The second sub-category from the WSP questionnaire assesses the 'physical demands' the individual perceives to be placed upon them every day whilst at work. A comparison of this demand with the participants' age (Figure 16), educational background (Figure 17), experience (Figure 18), service domains (Figure 19), area of practice (Figure 20) and the years of practice as a nurse (Figure 21), are explored in the figures below.

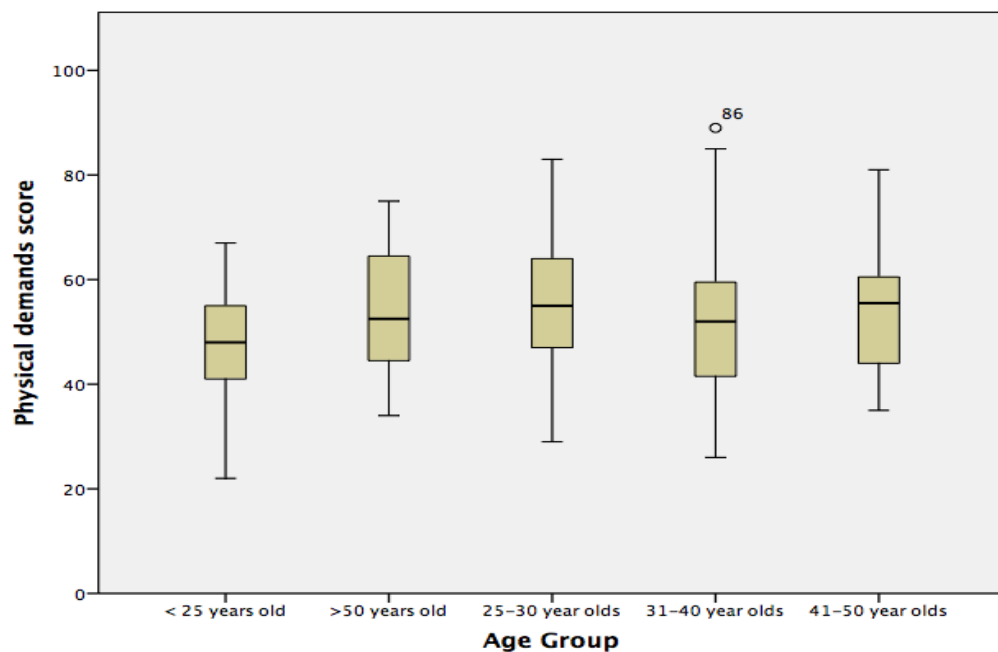


Figure 16: Physical demands score and the participants age

Following the Analysis of Variance (ANOVA) post hoc comparisons, in line with Field (2013) post hoc flowchart were conducted. The homogeneity of variances determined via the use of Levene's analysis indicated there was no significant difference in variances between the groups (Levene $\alpha = 0.05$, $F(4,170) = 0.532$, $p = 0.712$). Results from the ANOVA test indicated significant difference between the groups (ANOVA, $F(4,170) = 3.496$, $p = 0.009$). A Hochberg and Games-Howell test

also indicated a statistically significant difference in the <25 year-old group (Games-Howell $\alpha = 0.1$, $p = 0.005$) and the 25-30 year old group (Games-Howell $\alpha = 0.1$, $p = 0.005$, Hochberg $\alpha = 0.1$, $p = 0.08$), indicative that the 'physical demands' sub-category was statistically significant for the <25 year olds (n=50), and the 25-30 year olds (n=41).

The detailed results of analysis are shown in Table 4.

Table 4: WSP 'physical demands' multiple comparisons with age

Dependent Variable: Physical demands score

	(I) Age Group	(J) Age Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
HOCHBERG	<25 years old	25-30 year olds	-8.700*	2.539	.008	-15.90	-1.50
		31-40 year olds	-5.253	2.634	.382	-12.72	2.21
		41-50 year olds	-7.233	2.729	.084	-14.97	.50
		>50 years old	-6.920	3.462	.379	-16.73	2.89
	25-30 year olds	25-30 year olds	8.700*	2.539	.008	1.50	15.90
		31-40 year olds	3.447	2.753	.904	-4.36	11.25
		41-50 year olds	1.468	2.843	1.000	-6.59	9.53
		>50 years old	1.780	3.553	1.000	-8.29	11.85
	31-40 year olds	25-30 year olds	5.253	2.634	.382	-2.21	12.72
		31-40 year olds	-3.447	2.753	.904	-11.25	4.36
		41-50 year olds	-1.979	2.928	.999	-10.28	6.32
		>50 years old	-1.667	3.621	1.000	-11.93	8.60
	41-50 year olds	25-30 year olds	7.233	2.729	.084	-.50	14.97
		31-40 year olds	-1.468	2.843	1.000	-9.53	6.59
		41-50 year olds	1.979	2.928	.999	-6.32	10.28
		>50 years old	.313	3.690	1.000	-10.15	10.77

	>50 year olds	25-30 year olds	6.920	3.462	.379	-2.89	16.73
		31-40 year olds	-1.780	3.553	1.000	-11.85	8.29
		41-50 year olds	1.667	3.621	1.000	-8.60	11.93
		>50 years old	-.313	3.690	1.000	-10.77	10.15
GAMES-HOWELL	<25 years old	25-30 year olds	-8.700*	2.407	.005	-15.42	-1.98
		31-40 year olds	-5.253	2.733	.316	-12.93	2.42
		41-50 year olds	-7.233	2.658	.063	-14.71	.25
		>50 years old	-6.920	3.236	.238	-16.46	2.62
	25-30 year olds	25-30 year olds	8.700*	2.407	.005	1.98	15.42
		31-40 year olds	3.447	2.969	.773	-4.87	11.76
		41-50 year olds	1.468	2.901	.986	-6.67	9.60
		>50 years old	1.780	3.438	.985	-8.22	11.78
	31-40 year olds	25-30 year olds	5.253	2.733	.316	-2.42	12.93
		31-40 year olds	-3.447	2.969	.773	-11.76	4.87
		41-50 year olds	-1.979	3.176	.971	-10.89	6.93
		>50 years old	-1.667	3.674	.991	-12.24	8.91
	41-50 year olds	25-30 year olds	7.233	2.658	.063	-.25	14.71
		31-40 year olds	-1.468	2.901	.986	-9.60	6.67
		41-50 year olds	1.979	3.176	.971	-6.93	10.89
		>50 years old	.313	3.618	1.000	-10.13	10.76
	>50 year olds	25-30 year olds	6.920	3.236	.238	-2.62	16.46
		31-40 year olds	-1.780	3.438	.985	-11.78	8.22
		41-50 year olds	1.667	3.674	.991	-8.91	12.24
		>50 years old	-.313	3.618	1.000	-10.76	10.13

*. The mean difference is significant at the 0.05 level.

The effect of the participant's level of education (Figure 17), their years of experience as a nurse (excluding career breaks), (Figure 18), the service domain the

participant worked in (e.g. public, private sector or student nurse) (Figure 19) had on the participants' perceived stress due to the 'physical demands' was investigated and the resultant graphs are presented below.

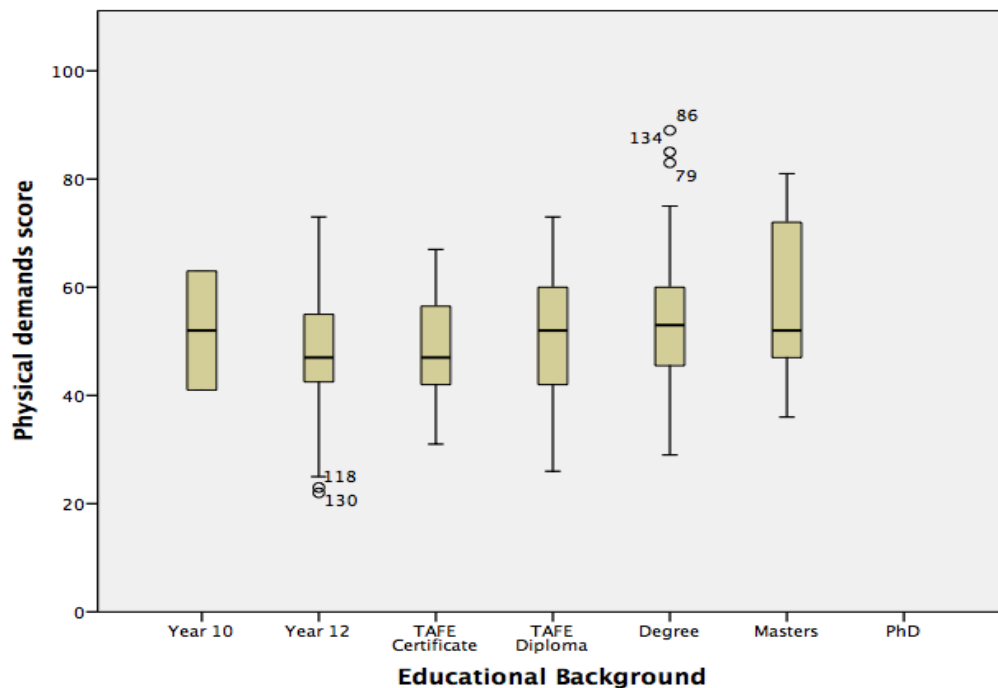


Figure 17: Physical demands score and educational background

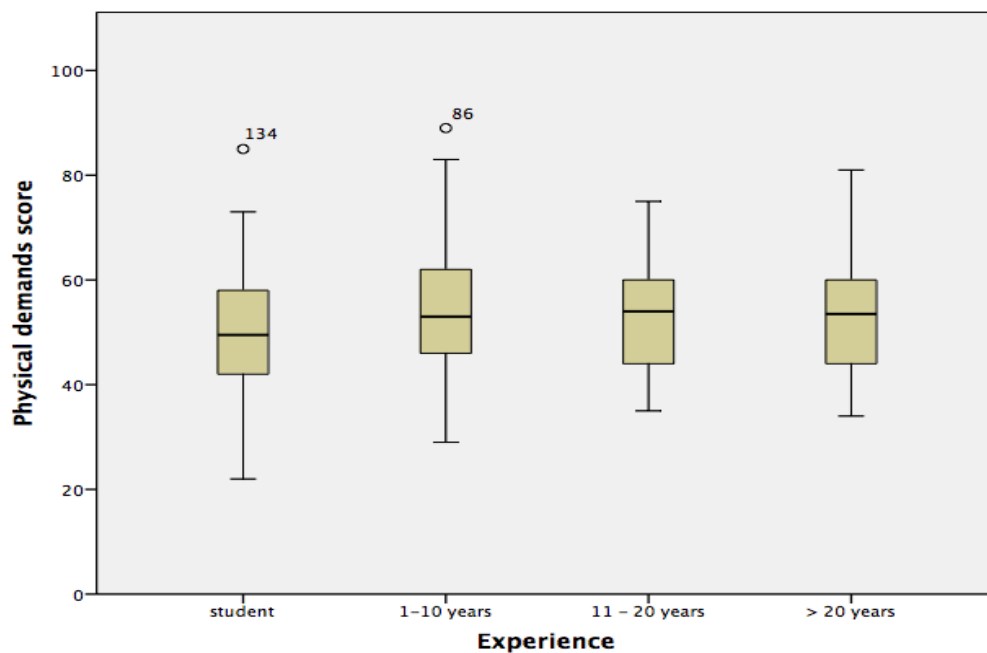


Figure 18: Physical demands score and the years of experience as a nurse

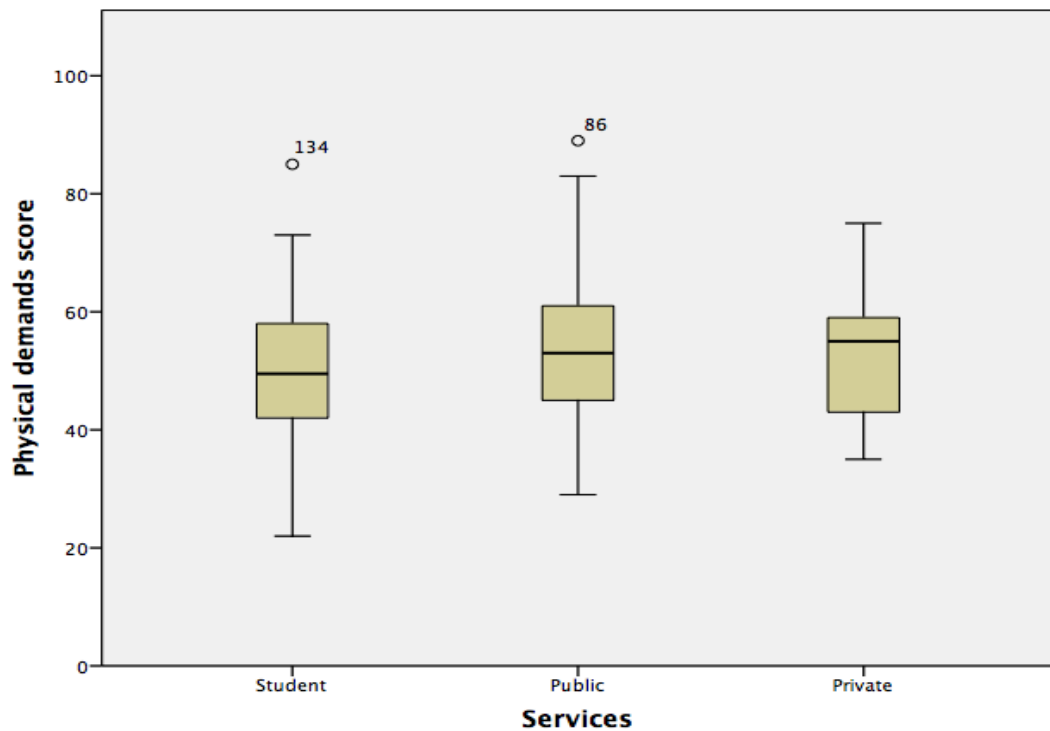


Figure 19: Physical demands score and the service domain

Statistical analysis indicated there was no difference between the perceived stress indicated by the 'physical demands' score and the nurses'

- educational background
- their experience
- the service domain (where the nurses worked)

As displayed in ANVOA Test results (Table 5).

Table 5: Physical demands results lack of correlation with variables

Figure	ANOVA Correlations
Figure 17 Physical demands and educational background of the participants	$F(5,169) = 1.690, p = 0.139$
Figure 18 Physical demands score and the years of experience as a nurse	$F(3,171) = 1.087, p = 0.356$
Figure 19 Physical demands and the service domains where the participants work	$F(2,172) = 1.659, p = 0.193$

The effect of the area of practice on the 'physical demands' scores (i.e. perceived stress due to the physical demands) is shown in Figure 20.

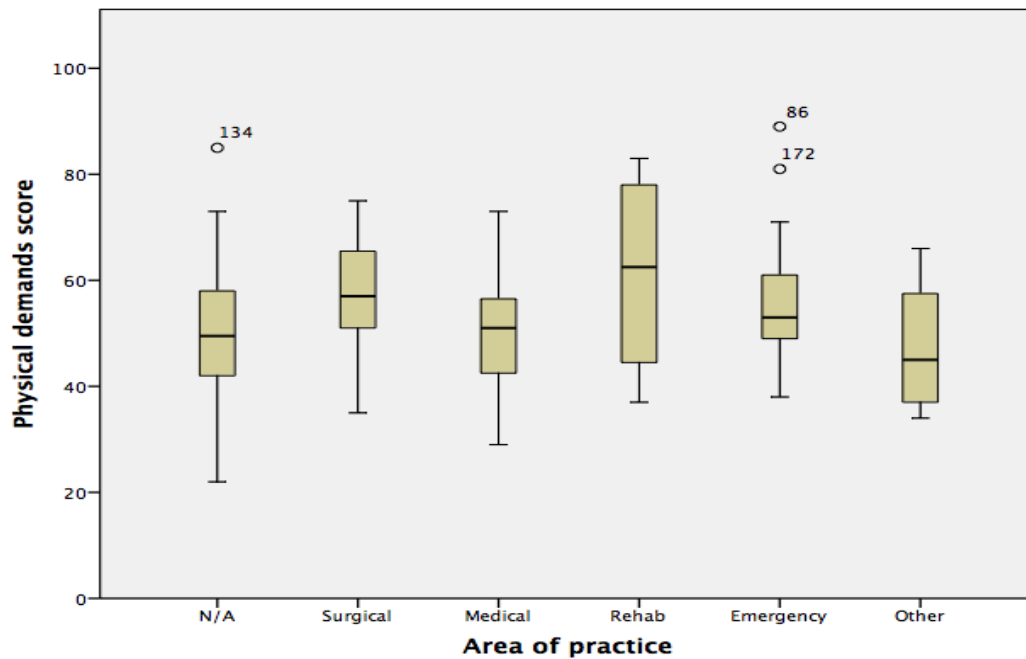


Figure 20: Physical demands and the area of practice

Although there was a statistical significant difference between the 'physical demands' and the 'area of practice' score in the ANOVA, $F(5,169) = 2.727$, $p = 0.021$, this was due to the sensitivity of low numbers in the rehabilitation group ($n=4$), rather than a significant difference between areas of practice and 'physical demands.'

A Levene's Test for Equality of Error Variances was carried out; this demonstrated that there was no significant difference (Levene $\alpha = 0.05$, $F(5,169) = 1.092$, $p = 0.367$). Similarly the Hochberg test also demonstrated no significant difference ($\alpha = 0.1$, $p = 0.056$, $M=13.893$) between the 'physical demands' and the area of practice score.

The effect that the level of nurse (e.g. first year post graduation through to nurse managers) had on the participant's 'physical demands' score was investigated and presented below.

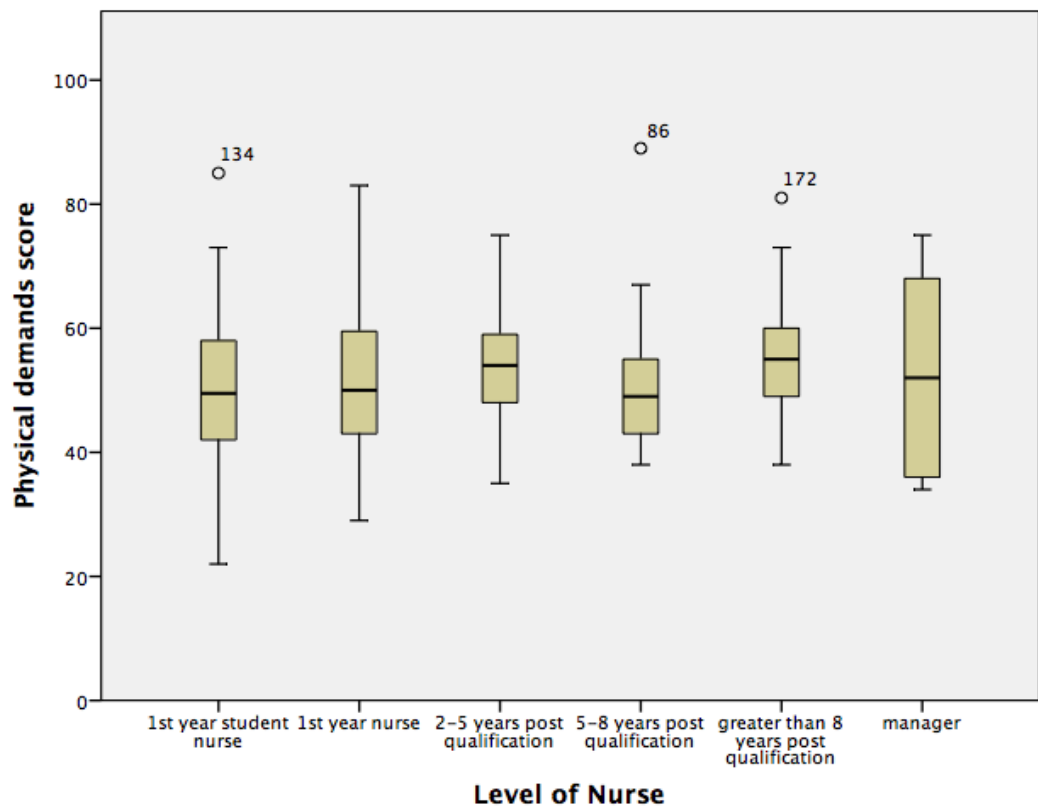


Figure 21: Physical demands and the level of the nurse

There was no difference between the level of nurse and the 'physical demands' scores as demonstrated by an ANOVA, $F(5,169) = 0.851$, $p = 0.516$, and the Levene's Test for Equality of Error Variances not being significant at Levene $\alpha = 0.05$, $F(5,169) = 1.229$, $p = 0.298$.

Figure 22 summarises the 'physical demands' frequency score within a histogram.

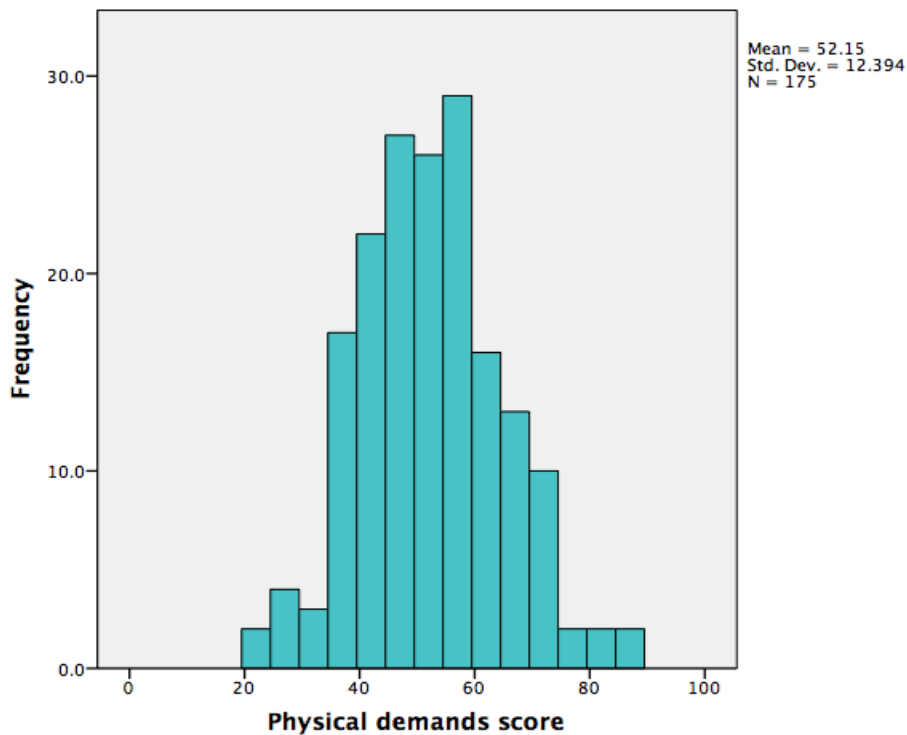


Figure 22: WSP physical demands frequency score

The histogram showing the spread of results for the ‘physical demand’ indicated a minimum score of 20 and an upper score of 89 ($n=175$, $M=52.15$, $SD\ 12.394$), with the highest frequency score of 55-60 indicative of a normal to high stress level perceived by the participants (The scale being - Low stress <35-44, normal stress 45-57, high stress 58-67> (Rice, 1999)).

4.4.3 The WSP - Personal interest, involvement of the job sub-category

The third sub-category of the WSP questionnaire focuses on the ‘personal interest of the job, and involvement the participant perceive they have over their role’; these findings are explored in the figures below.

The effect of the age of the participant on the 'personal interests or involvement in the jobs' total score is indicated in Figure 23.

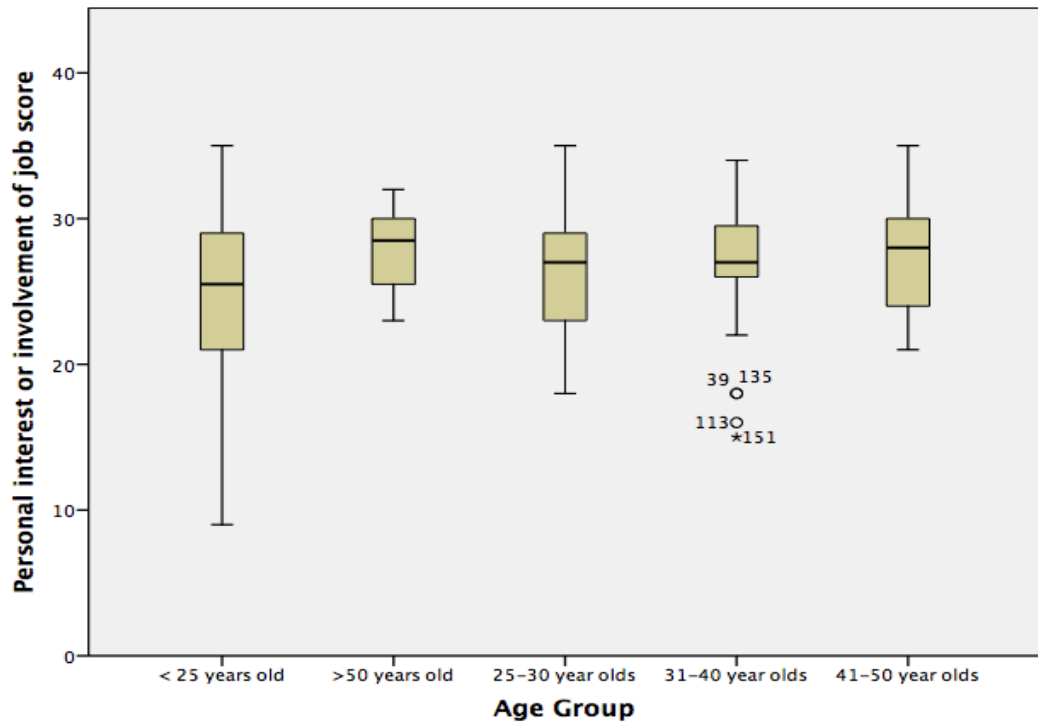


Figure 23: Personal interests score and the age of the participants

The results indicate a wider range of interest in the less than 25 age range compared to other age groups (Figure 23). Both the ANOVA, $F(4,170) = 2.589$, $p = 0.039$, and the Levene's Test for Equality of Error Variances shows statistically significant differences ANOVA, $F(4,170) = 2.589$, $p = 0.039$, and Levene $\alpha = 0.05$, $F(4,170) = 6.150$, $p = < 0.00$. However, the Hochberg test at $\alpha = 0.1$, $p = 0.073$, $M=30.135$ showed no difference. This may reflect the wider range of uncertainty in the interest of younger aged participants.

The effect that the educational background had on the 'personal interests or involvement of the job' score is depicted in Figure 24.

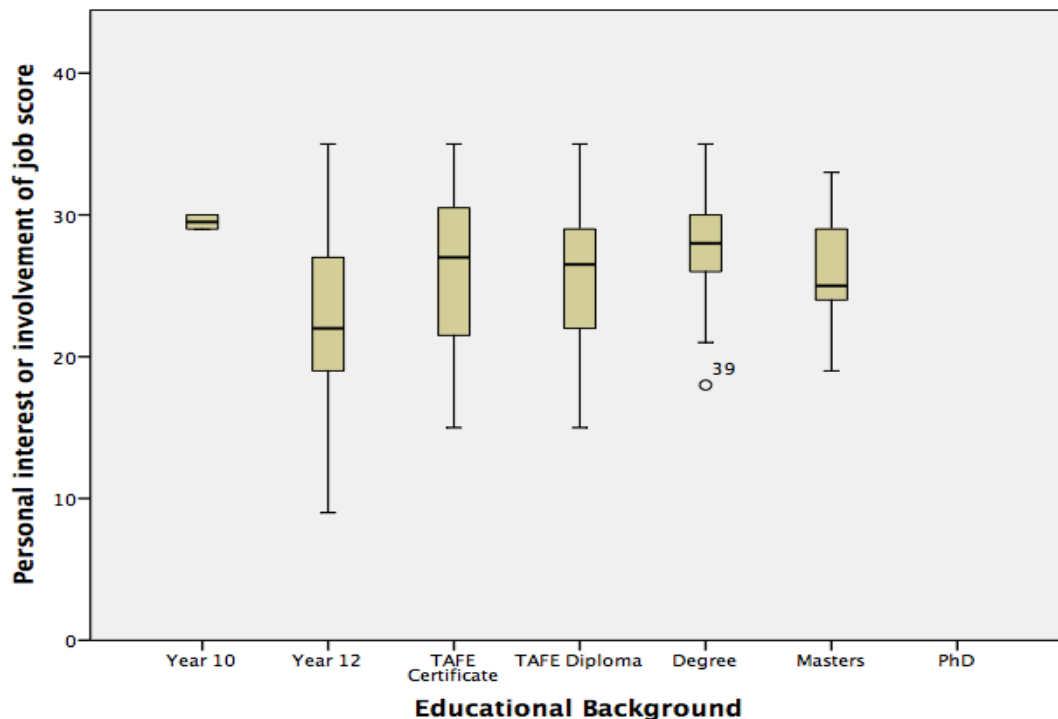


Figure 24: Personal interest or involvement score and educational background

Figure 24 showed that there was a significant difference as determined by the ANOVA, $F(5,169) = 5.043$, $p < 0.00$. A Levene's Test for Equality of Error Variances was significant at Levene $\alpha = 0.05$, $F(5,169) = 7.458$, $p < 0.00$. This can be attributed to the sensitivity of low numbers in the Year 10 group ($n=2$), rather than a significant difference between 'personal interest and involvement of the job' and participants' educational background, as explored via a Hochberg result of $\alpha = 0.1$, $p = 0.737$, $M = 8.169$. Therefore, it was concluded that there was lack of differences with the 'personal interest or involvement in the job' score and educational background.

(N.B. It is presumed that the 2 participants' with the educational background of year 10 are presumed to have completed a university preparatory course, and hence was included in the analysis. The result of analysis on removal of these data remained unchanged).

The graph below (Figure 25) shows the 'personal interest or involvement in the job' scores plotted against the number of participants' in each band of experience.

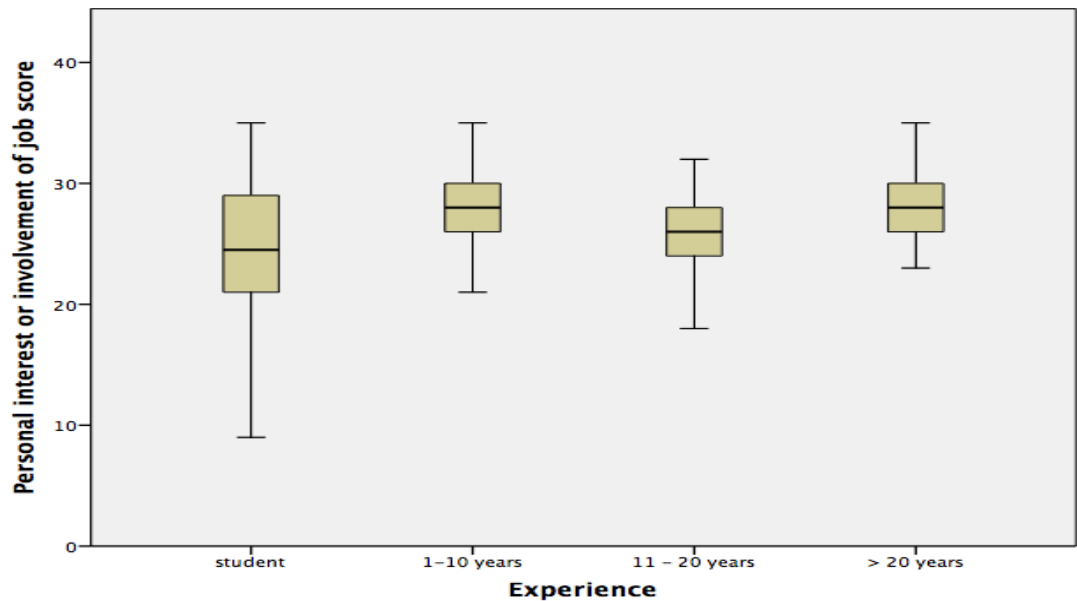


Figure 25: Personal interest or involvement score and experience as a nurse

As with Figure 23, the results were statistically significant, although again this can be attributed to the student group indicating a wider range of 'personal interest or job involvement' in the less than 25 age range compared to other age groups as demonstrated by an ANOVA, $F(3,171) = 8.154$, $p < 0.00$, and the Levene's Test for Equality of Error Variances being significant at Levene $\alpha = 0.05$, $F(3,171) = 14.225$, $p < 0.00$, and a Hochberg result of $\alpha = 0.1$, $p = 0.00$.

The following graph (Figure 26) shows the 'personal interest or involvement of the job' scores plotted against the number of participants in each service domain e.g. public, private or student.

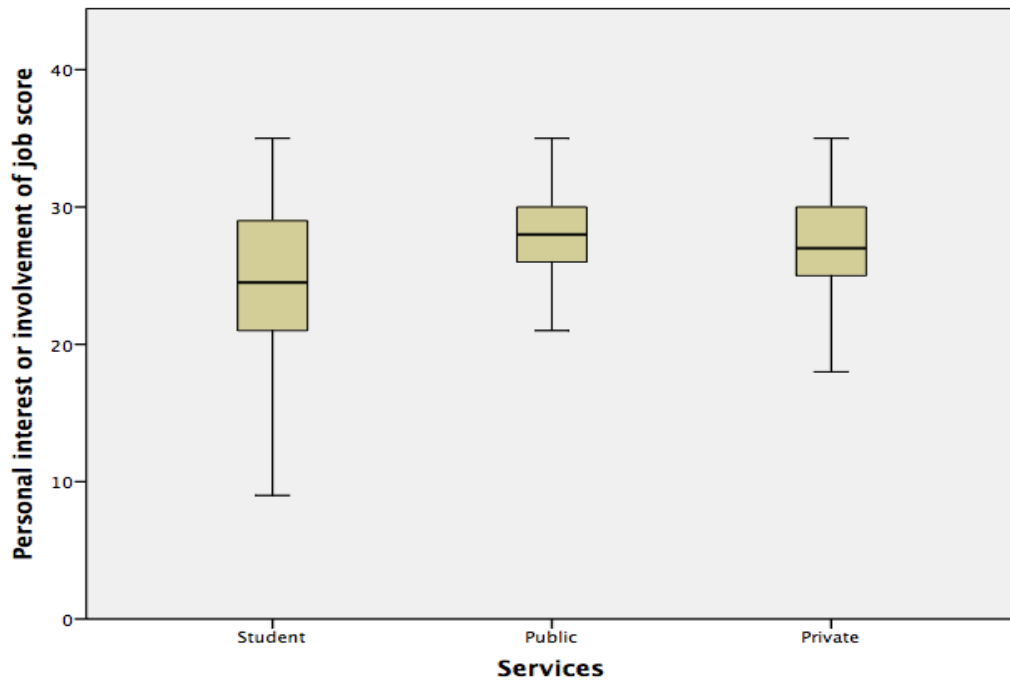


Figure 26: Personal interest or job involvement and service domains

Figure 26 showed a consistency with previous findings (Figures 23/25); that there was a significant difference as determined by the series of statistical analyses, with an ANOVA, $F(2,172) = 10.450$, $p = <0.00$. A Levene's Test for Equality of Error Variances being significant at Levene $\alpha = 0.05$, $F(2,172) = 20.000$, $p = < 0.00$, and a Hochberg result of $\alpha = 0.1$, $p = 0.00$ (student and public/private). However, no difference was noted between the public and private domains as determined by a Hochberg result of $\alpha = 0.1$, $p = 0.959$.

Figure 27 shows that the 'personal interest' score plotted against the participants' area of practice.

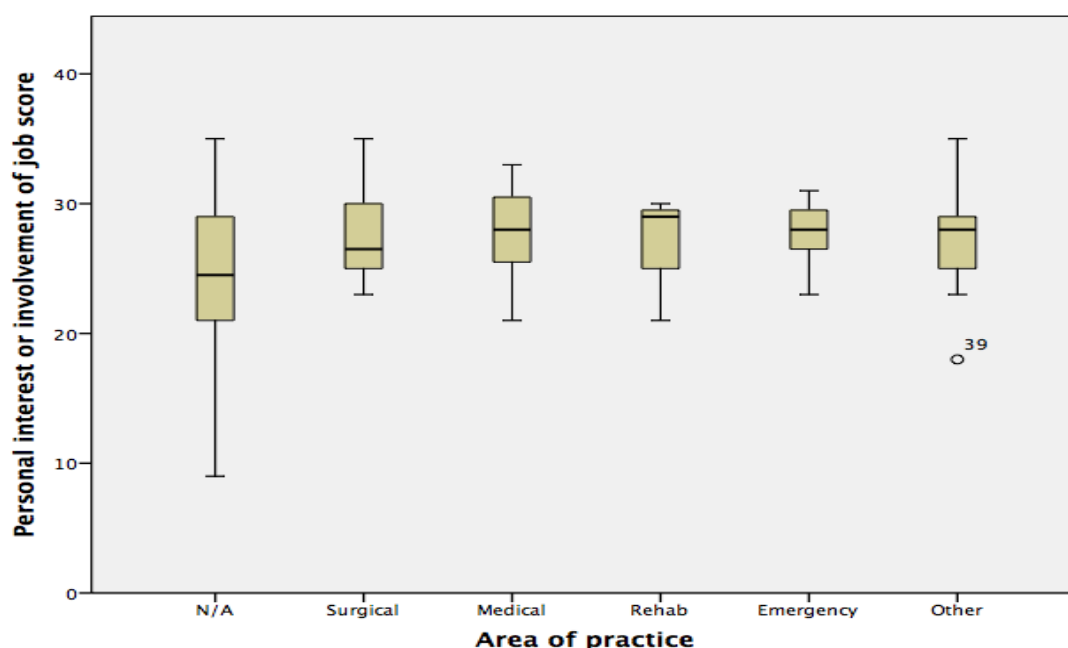


Figure 27: Personal interest score and area of practice

Findings showed a statistically significant result for 'personal interest or involvement' and the area of practice within which the participant works, or being a nursing student ANOVA, $F(5,169) = 4.156$, $p = 0.001$, Levene $\alpha = 0.05$, $F(5,169) = 8.577$, $p < 0.00$, Hochberg $\alpha = 0.1$, $p = 0.500$, $M = 13.893$. Again, this can be attributed to the student group indicating a wider range of 'personal interest or job involvement' compared to nurses in other areas of practice, as shown in Table 6.

Table 6: Area of practice

Games-Howell	Area of practice	$\alpha = ?$	$p = ?$
Nursing students' (N/A)	Surgical	$\alpha = 0.1$	$p = 0.035$
	Medical	$\alpha = 0.1$	$p = 0.007$
	Emergency department	$\alpha = 0.1$	$p = 0.001$

Therefore, it was concluded that there was a difference with area of practice and the 'personal interest or involvement in the job' score for nursing students. However, no difference was noted between the remaining areas of practice when students were removed.

The 'personal interest or involvement in the job' score was plotted with the level of nurse is shown in Figure 28.

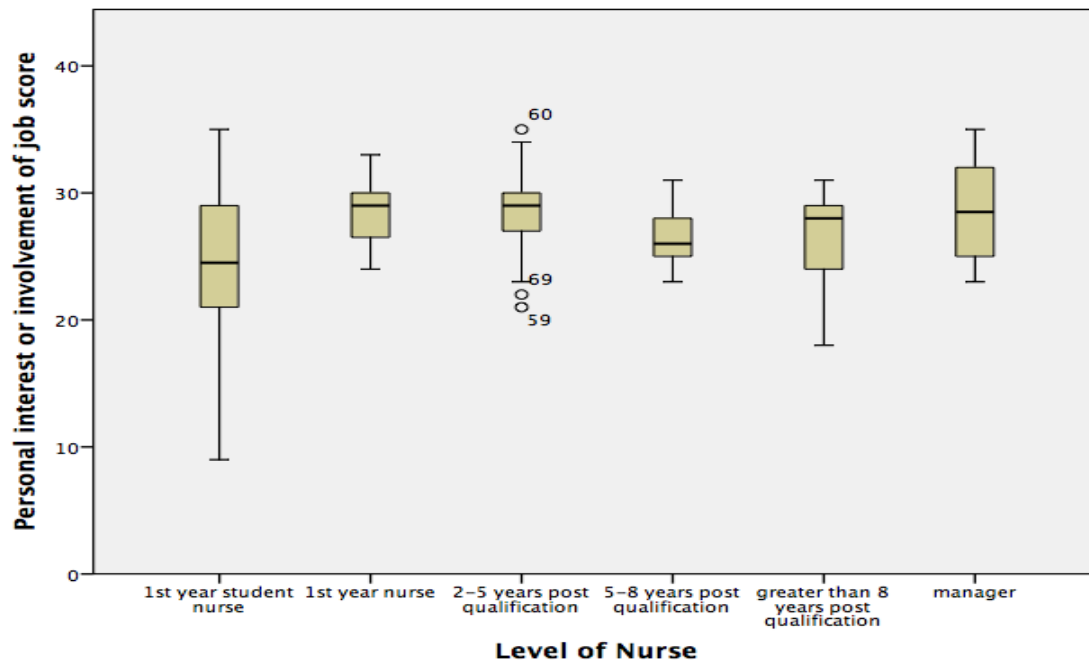


Figure 28: Personal interest or involvement of the job score and level of nurse

Figure 28 showed nurses 2-5 years post qualification ($n=29$) are more stressed than first year student nurses ($n=74$), this may be as a result of the support that first year nursing students received whilst on placement within the hospital environment. Furthermore, nurse managers ($n=18$) perceived more stress than the first year student nurses, again this could reflect the level of autonomy required in the role as a manager compared to the supported role of the first year student nurse.

The ANOVA showed a significant difference across the levels of nurse. (ANOVA, $F(5,169) = 4.990$, $p = <0.00$), as well as the Levene, $\alpha = 0.05$, $F(5,169) = 9.275$, $p = <0.00$.

The post hoc test using the Games-Howell also demonstrated a significant difference between the first year student nurses

- 2-5 years post qualification Games-Howell – $\alpha = 0.1$, $p = 0.002$.
- nurse managers Games-Howell – $\alpha = 0.1$, $p = 0.015$.

Figure 29 displays a histogram displaying the 'personal interest or involvement of the job' frequency score.

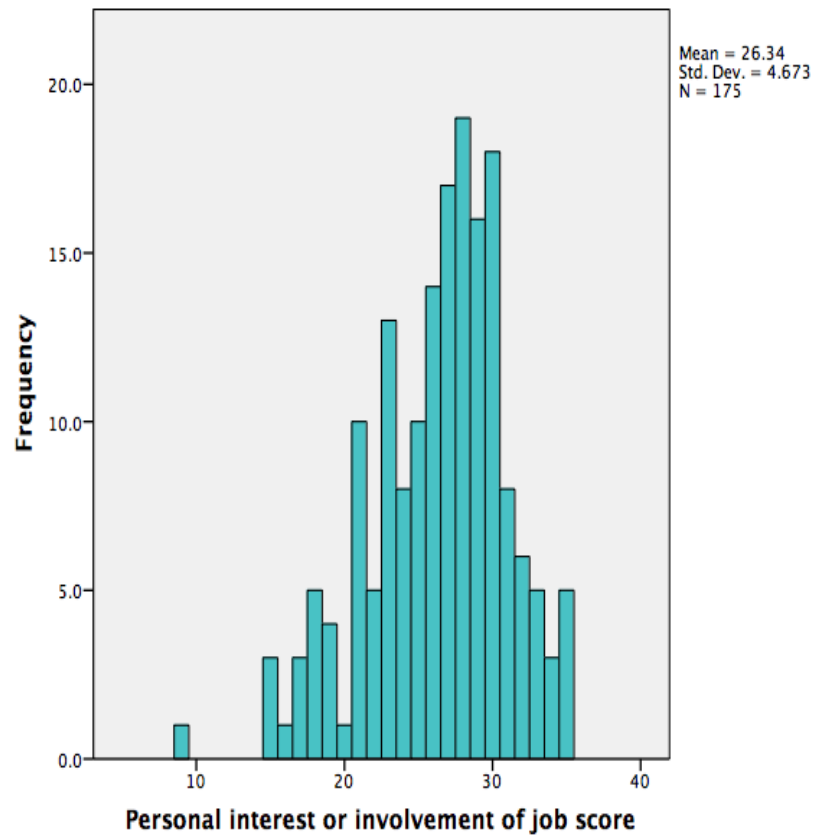


Figure 29: WSP personal interests or involvement of job frequency score

The totals findings for the third sub-category within the WSP questionnaire, demonstrates that a large majority of participants perceived a high level of stress as indicated by a score >23.

(Low stress <13-17 normal stress 18-22, high stress 23-27> (Rice, 1999)).

4.4.4 The WSP - collective totals score

The 'collective totals' score are the sum of all sub-categories added together and indicate the overall perceived work-related stress level of the participant.

Figure 30 indicates that the 'collective totals' score plotted against the age of the participant.

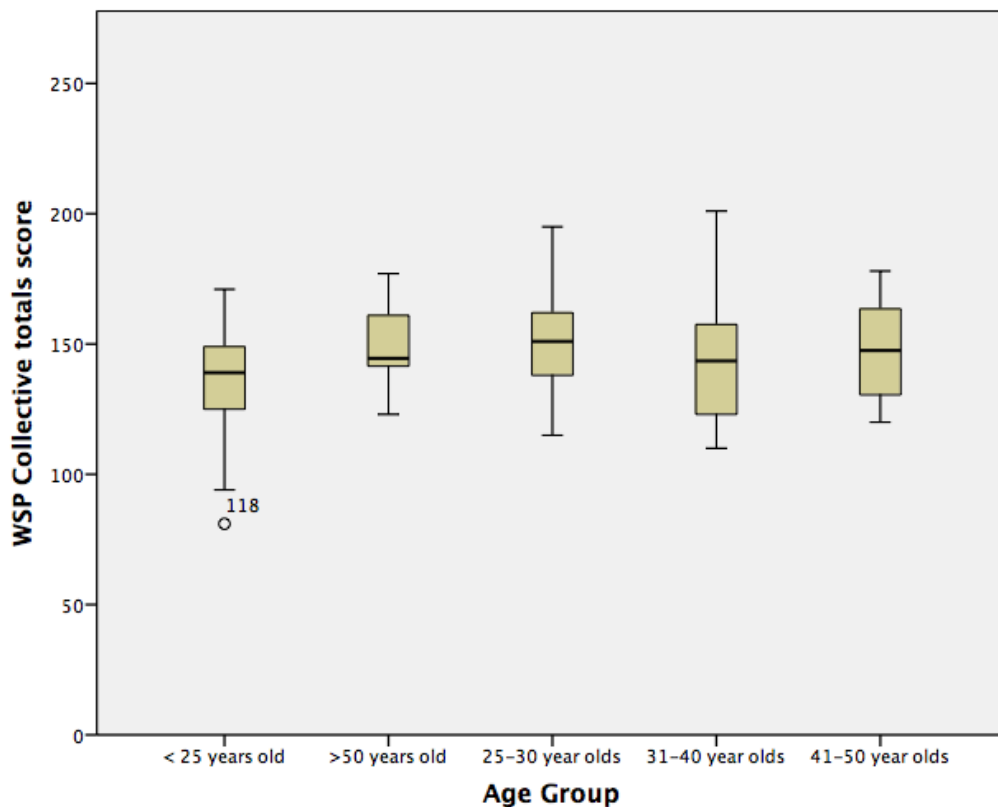


Figure 30: WSP collective totals score and the age of the participants

There was a statistically significant difference between the WSP 'collective totals' score for the <25 year olds and the 25-30 year old participants' as demonstrated by an ANOVA, $F(4,170) = 4.303$, $p = 0.002$, Levene test of $\alpha = 0.05$, $F(4,170) = 0.946$, $p = 0.439$, a Games-Howell result for – <25 year old $\alpha = 0.1$, $p = 0.001$, and 25 – 30 year olds $\alpha = 0.1$, $p = 0.001$.

The following series of Boxplots (Figures 31-34) show the WSP 'collective totals' score and the level of education, experience, level of the nurse, and the area of practice of the nurse (respectively).

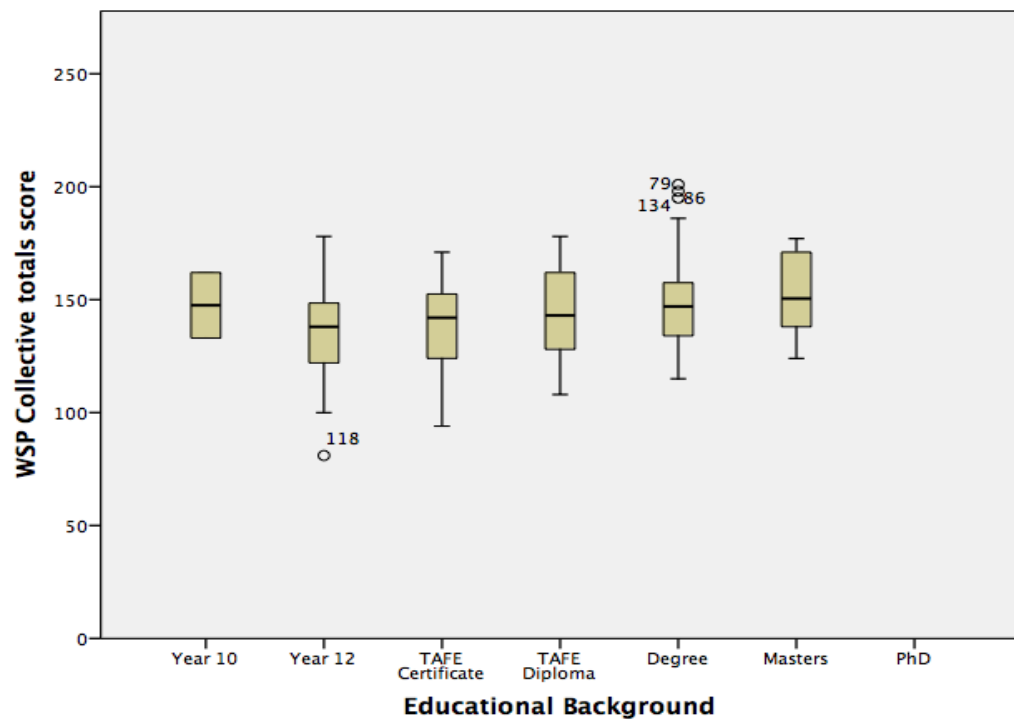


Figure 31: WSP collective totals score and the education level

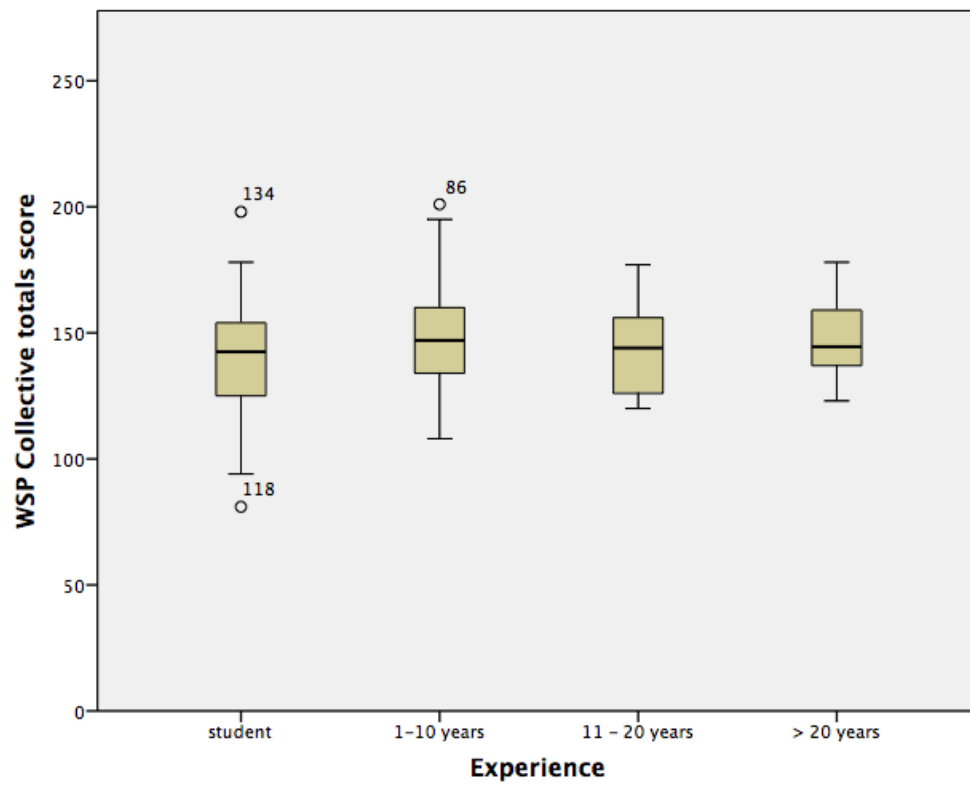


Figure 32: WSP collective totals score and the years of experience as a nurse

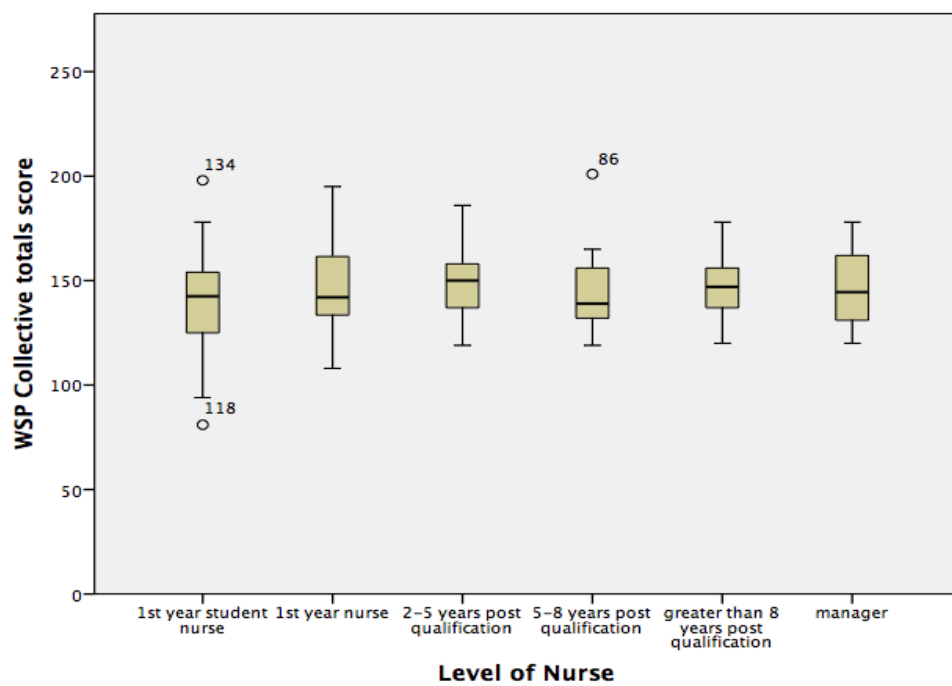


Figure 33: WSP collective totals score and level of nurse

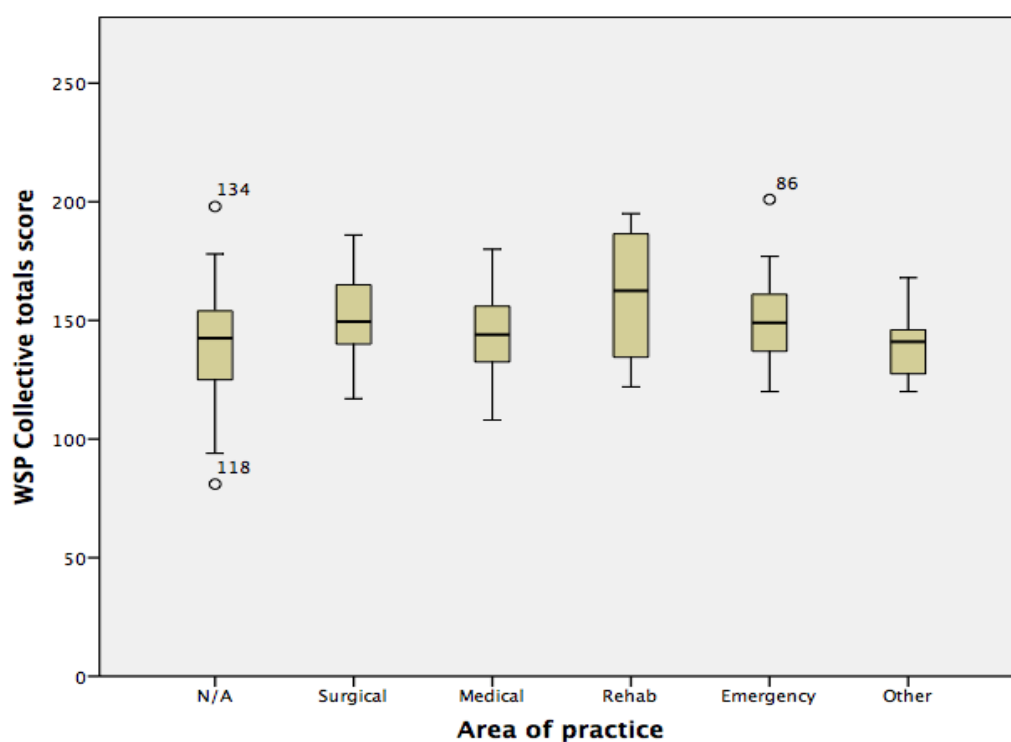


Figure 34: WSP collective totals score and area of practice

Table 7 shows there was no difference between the WSP 'collective totals' score relating to the level of education, years of experience, level of the nurse or practice area of the participants in the study (Figures 31-34).

Table 7: WSP collective totals score lack of correlation with variables

Figure	ANOVA Correlations
Figure 31 WSP collective totals score and the education level of the participants	$F(5,169) = 2.127, p = 0.065$
Figure 32 WSP collective totals score and the years of experience as a nurse	$F(3,171) = 1.864, p = 0.138$
Figure 33 WSP collective totals score and level of nurse	$F(5,169) = 1.078, p = 0.374$
Figure 34 WSP collective totals and area of practice	$F(5,169) = 2.383, p = 0.40$

Figure 35 shows a histogram of the statistical dispersion of the WSP 'collective totals' frequency score for this study group.

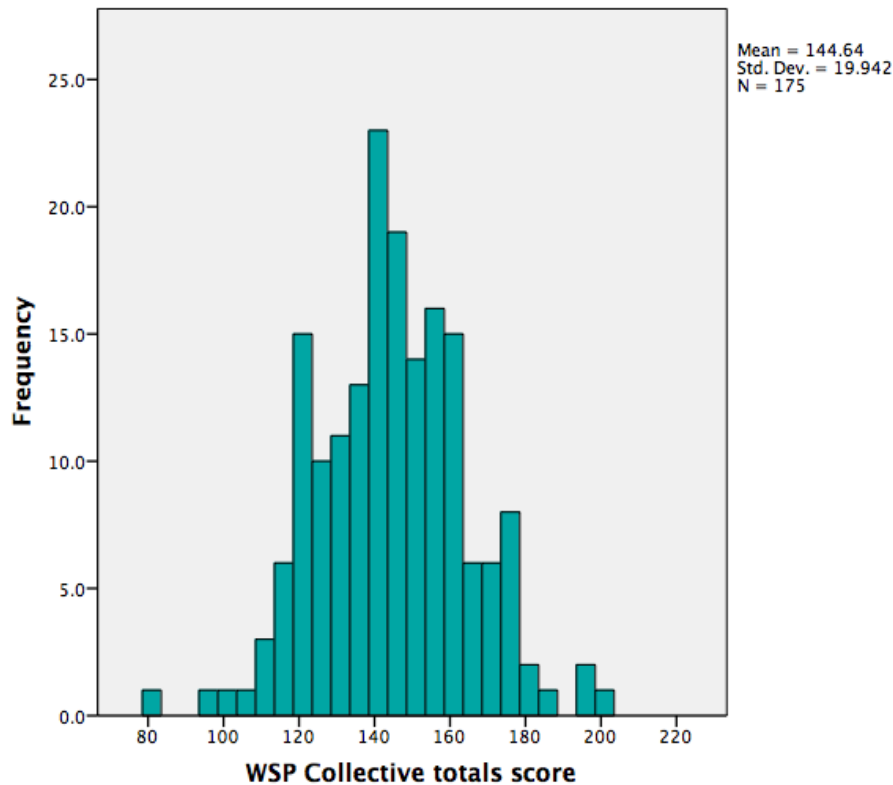


Figure 35: WSP collective totals frequency score

The findings for this WSP questionnaire sub-category, the 'collective totals' score demonstrates that a large proportion of this studies population perceived a high level of stress as indicated by a peak score of 142, and over half had a score >140.

(Low stress <91-111 normal stress 112-140, high stress 141-167> (Rice, 1999)).

4.5 THE PSS-10 RESULTS CORRELATION WITH WSP QUESTIONNAIRE

The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess the correlation between the WSP and PSS-10 questionnaire data (Table 8); all variables except the 'personal interest' score followed a normal distribution, or passed the normality test (Kolmogorov-Smirnov 0.000 $p > 0.05$, Shapiro-Wilk 0.001 $p > 0.05$). This means that parametric tests can be used to evaluate all data with the exception of the 'personal interest' scores.

Table 8: Tests of normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PSS SCORE	.066	175	.060	.990	175	.253
Workplace inter-relationship score	.048	175	.200*	.995	175	.770
Physical demands score	.064	175	.078	.993	175	.568
Personal interest or involvement of job score	.111	175	.000	.968	175	.001
WSP Collective totals score	.044	175	.200*	.994	175	.733

Correlation significant at the 0.01 level (2 tailed)

The following scatterplots (Figures 36-39) show the PSS-10 totals score results correlated with the 'workplace inter-relationship', 'physical demands', 'personal interests', and 'collective subtotals' score of the WSP questionnaire.

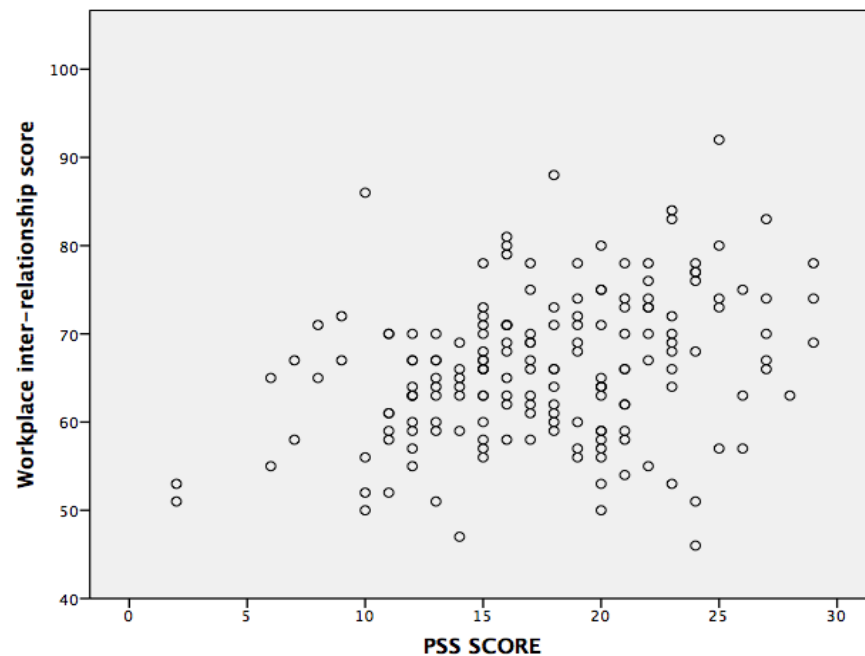


Figure 36: PSS-10 scores correlation with workplace inter-relationships score

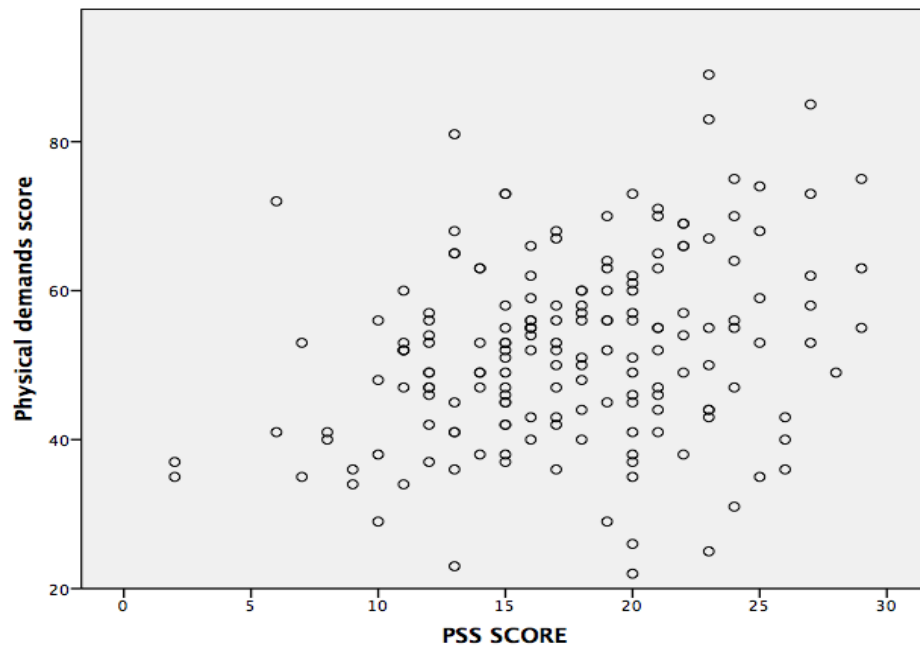


Figure 37: PSS-10 scores correlation with the WSP physical demands score

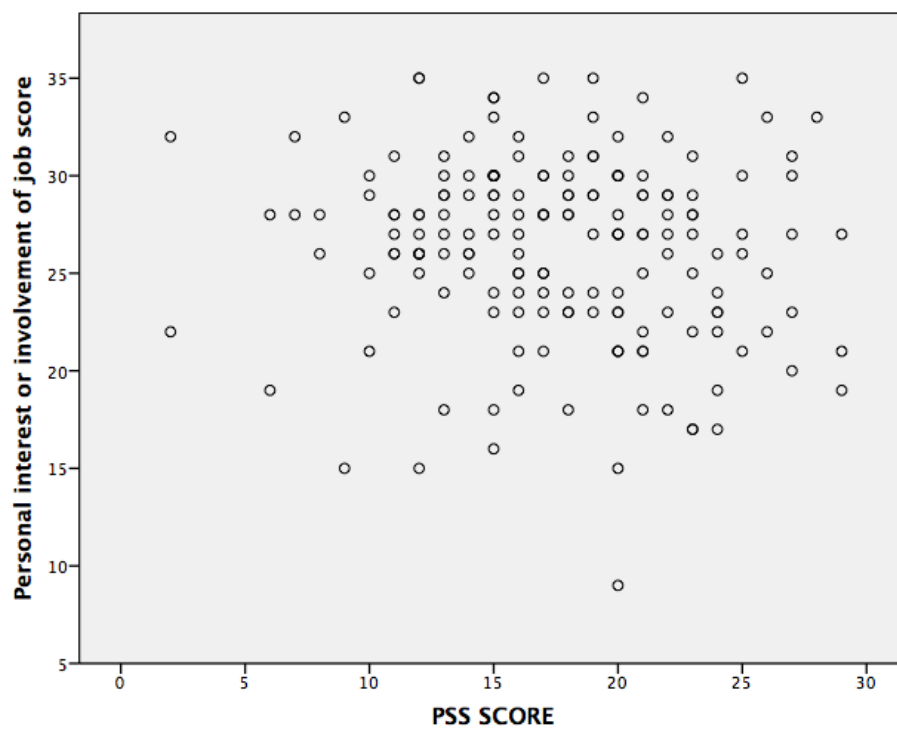


Figure 38: PSS-10 correlation with the personal interest or involvement of job

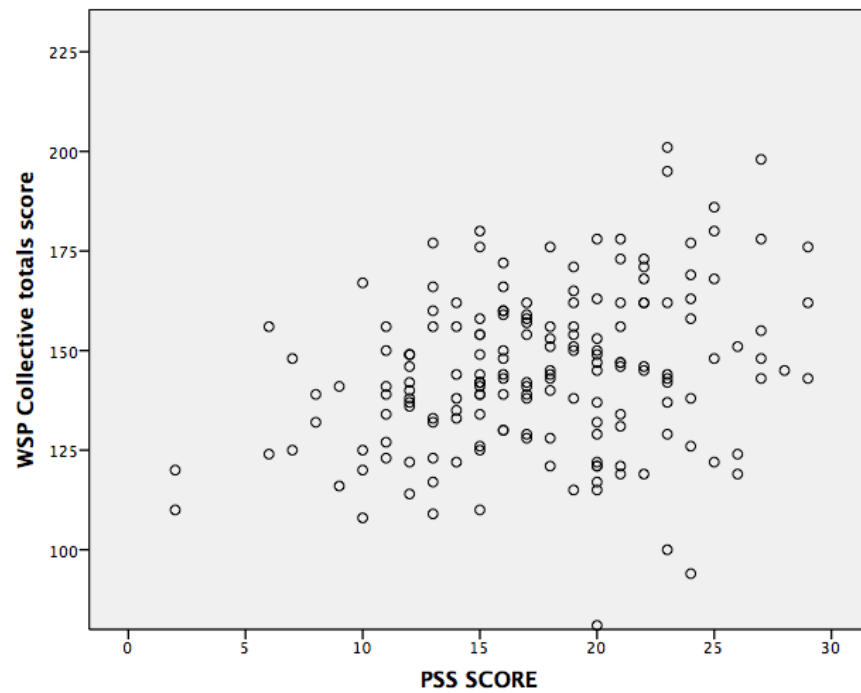


Figure 39: PSS-10 scores correlation with the WSP collective totals score

When assessing the WSP questionnaire, 'collective totals' score and the PSS-10 data on scatter plots (Figures 36-39) as well as the Pearson correlation for parametric tests bar chart (Table 9) and non-parametric testing via the use of the Spearman's correlation bar chart (Table 10), it becomes clear that there was a statistically significant relationship between the PSS-10 total score results, and the WSP 'work inter-relationships', 'physical demands' and WSP 'collective totals' score when performing both the Spearman's and Pearson's tests.

Table 9: Pearson correlations for parametric testing

		PSS SCORE	Workplace inter- relationship score	Physical demands score	Personal interest or involvement of job score	WSP Collective totals score
PSS SCORE	Pearson Correlation	1	.314**	.282**	-.124	.277**
	Sig. (2-tailed)		.000	.000	.102	.000
	N	175	175	175	175	175
Workplace inter- relationship score	Pearson Correlation	.314**	1	.622**	.135	.836**
	Sig. (2-tailed)	.000		.000	.076	.000
	N	175	175	175	175	175
Physical demands score	Pearson Correlation	.282**	.622**	1	.120	.909**
	Sig. (2-tailed)	.000	.000		.114	.000
	N	175	175	175	175	175
Personal interest or involvement of job score	Pearson Correlation	-.124	.135	.120	1	.365**
	Sig. (2-tailed)	.102	.076	.114		.000
	N	175	175	175	175	175
WSP Collective totals score	Pearson Correlation	.277**	.836**	.909**	.365**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	175	175	175	175	175

Correlation significant at the 0.01 level (2 tailed)

Table 10: Spearman's correlation for non-parametric testing

		PSS SCORE	Workplace inter-relationship score	Physical demands score	Personal interest or involvement of job score	WSP Collective totals score
PSS SCORE	Correlation Coefficient	1.000	.305**	.269**	-.141	.265**
	Sig. (2-tailed)	.	.000	.000	.063	.000
	N	175	175	175	175	175
Workplace inter-relationship score	Correlation Coefficient	.305**	1.000	.620**	.063	.832**
	Sig. (2-tailed)	.000	.	.000	.410	.000
	N	175	175	175	175	175
Physical demands score	Correlation Coefficient	.269**	.620**	1.000	.046	.902**
	Sig. (2-tailed)	.000	.000	.	.543	.000
	N	175	175	175	175	175
Personal interest or involvement of job score	Correlation Coefficient	-.141	.063	.046	1.000	.274**
	Sig. (2-tailed)	.063	.410	.543	.	.000
	N	175	175	175	175	175
WSP Collective totals score	Correlation Coefficient	.265**	.832**	.902**	.274**	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.
	N	175	175	175	175	175

Correlation significant at the 0.01 level (2 tailed)

4.6 A COMPARISON OF RESPONSES TO BOTH QUESTIONNAIRES WITH THE HAIR CORTISOL LEVELS

The following figures (Figure 40-44) explore both the PSS-10 questionnaire and WSP questionnaire results and correlate the findings with the hair cortisol levels taken from the corresponding participants' hair sample (n=85 participants).

Hair cortisol levels are classified as either:

High >2.5 ng/50mg – coded as a 2 (beige colour)

Medium >0.1 – 2.5 ng/50mg coded as a 1 (green colour)

Low <0.1 ng/50mg coded as a 0 (blue colour)

A histogram showing the distribution of the PSS-10 totals score results with each participant's hair cortisol levels (n=85).

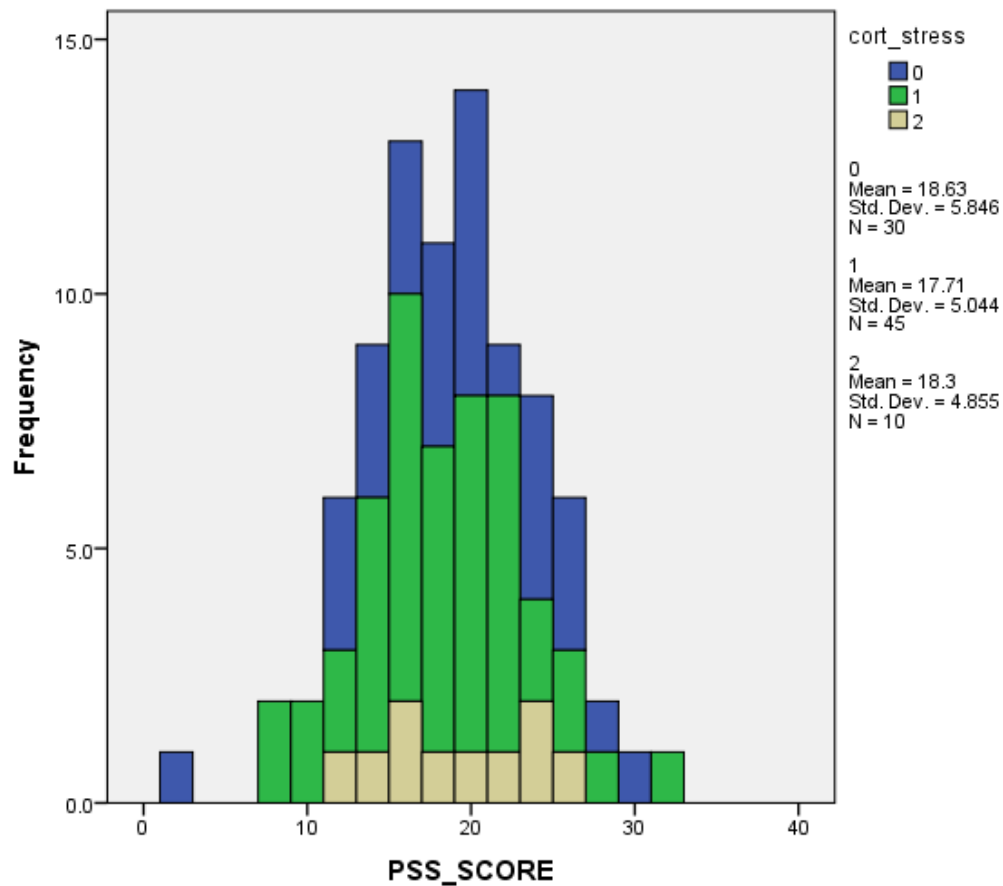


Figure 40: PSS-10 frequency distribution, and cortisol levels

The histogram demonstrates the total score for the participants' PSS-10 questionnaire (horizontal axis) and the frequency (vertical axis). The histogram is colour coded to represent the levels of hair cortisol using a high, medium or low scale respectively. This demonstrates the results from a PSS-10 score in relation to those participants' and their hair cortisol levels (a score of 13 or less indicate low stress score within the PSS-10 questionnaire, whereas moderately stressed people are expected to score between a score of 14 and 20. Scores above 20 indicate high levels of stress). The majority of participants' had a moderate level of hair cortisol, even though they perceived a high level of stress indicated by the PSS-10 totals score.

The following histograms compare each sub-category of the WSP questionnaire and the cortisol levels of the participants, commencing with the 'workplace inter-relationship' score (n=85).

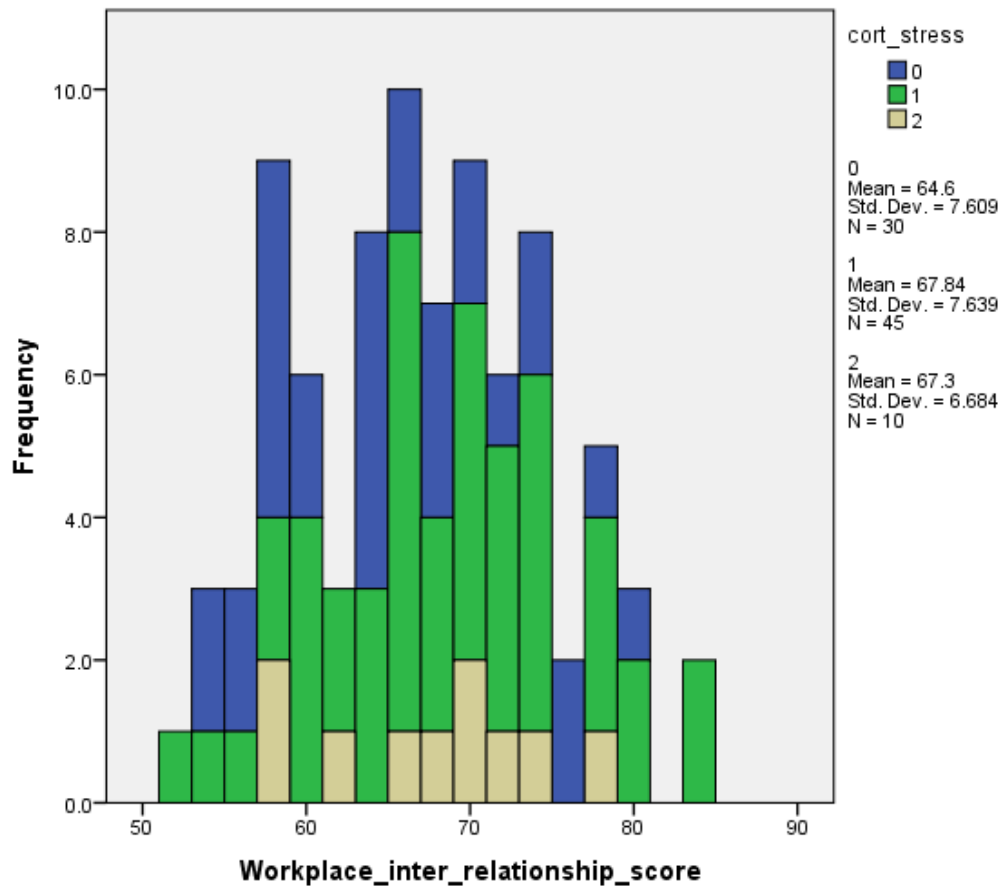


Figure 41: Workplace inter-relationship score and cortisol levels

The histogram shows that several participants perceived a high levels of work-related stress due to their 'workplace inter-relationship' scores (Low stress <39-46, normal stress 47-61, high stress 62-75> (Rice, 1999)). However this does not correlate with the level of cortisol in their hair. Rather their hair cortisol concentration indicated moderate levels of stress in comparison.

The 'physical demands' score and the hair cortisol level of the participants' are presented in the histogram below.

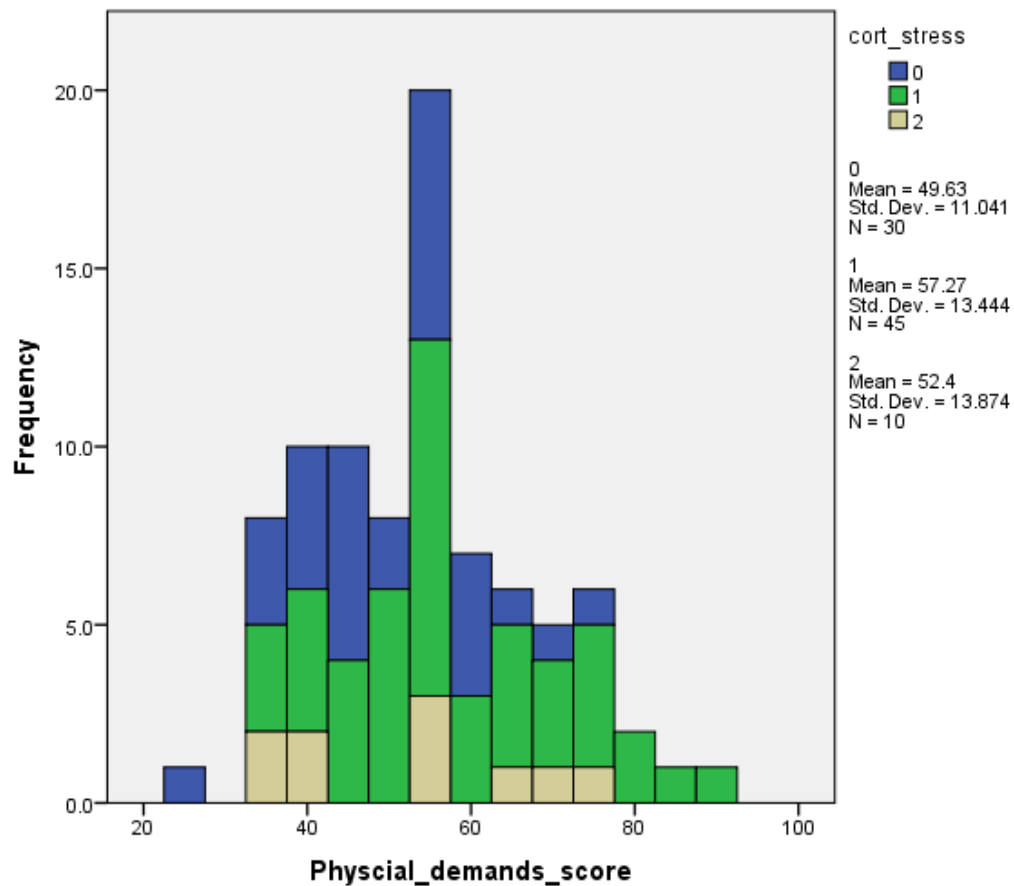


Figure 42: WSP physical demands score and cortisol levels

The histogram highlights that some participants' who perceived a low level of stress (Low stress <35-44, normal stress 45-57, high stress 58-67> (Rice, 1999)), actually had a high level of hair cortisol, indicative of a high level of stress. Interestingly, those who perceived the highest level of stress (>75) within the 'physical demands' section of the WSP questionnaire appeared to have medium levels (>0.1-2.5ng/50mg) cortisol levels within their hair sample.

The frequency and distribution of the 'personal interest or involvement in the job' score was presented along with the hair cortisol level of the participants' in a histogram below.

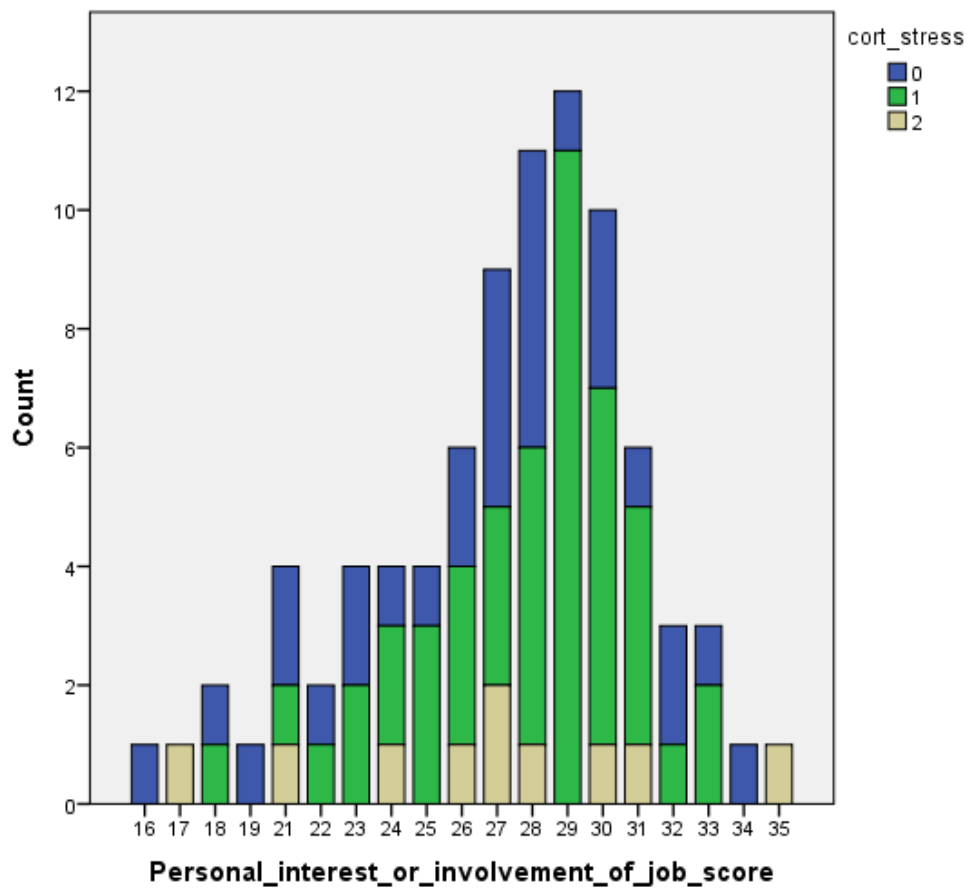


Figure 43: Personal interest or involvement in the job and cortisol levels

The frequency distribution of the 'personal interests or involvement of the job' score was skewed towards the higher level of perceived stress (Rice, 1999), demonstrating that 'personal interest or involvement in the job' was a major factor for the majority of the participants. This however was not reflected in their hair cortisol levels, which did not correlate well with the participants 'personal interest or involvement in the job' score.

The frequency distribution of the WSP 'collective totals' score showing the hair cortisol levels of the participants'

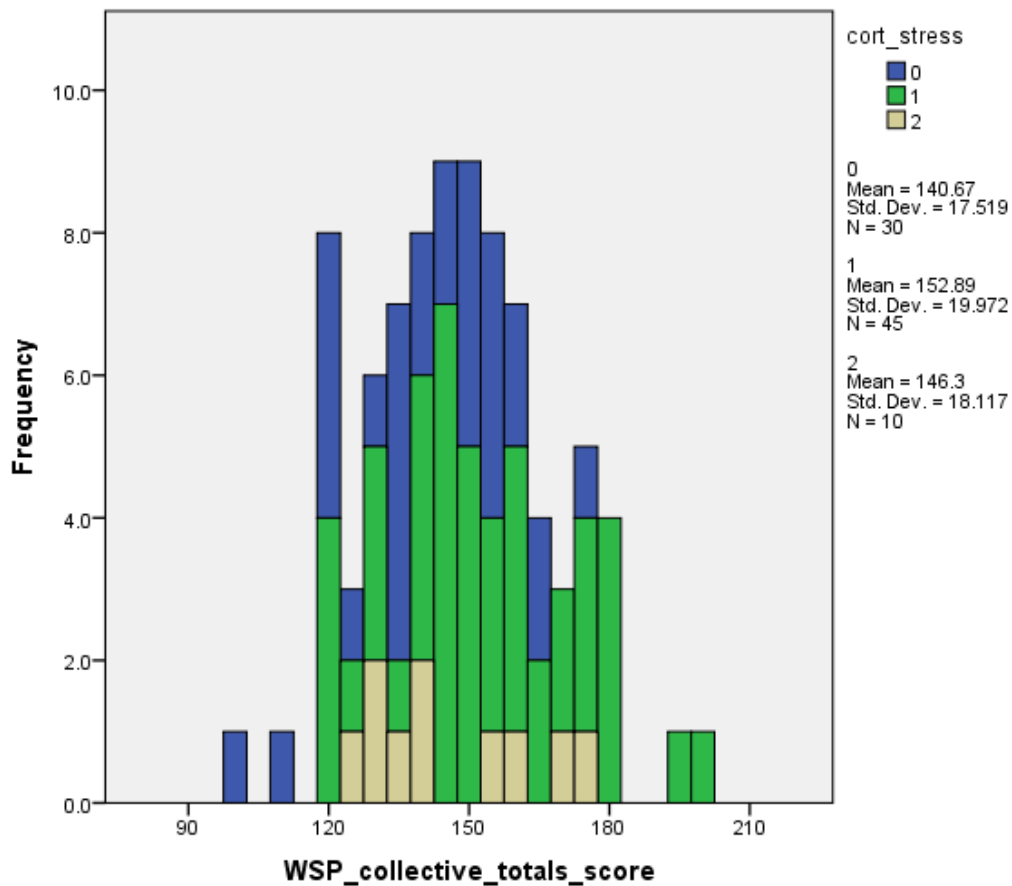


Figure 44: WSP collective totals score and the level of cortisol in hair

Figure 44 shows the cumulative score of the three WSP totals. As with previous histograms, the participants' perceptions of stress did not correlate well with their hair cortisol level, as the vast majority of participants reported a high level of stress in the WSP 'collective totals' score (low stress <91-111 normal stress 112-140, high stress 141-167> (Rice, 1999)), whilst the vast majority of participants had a medium (>0.1-2.5ng/50mg) of hair cortisol.

Figure 45 examines the relationship between the mean hair cortisol concentrations (HCC) and the PSS-10 total score for the whole study population

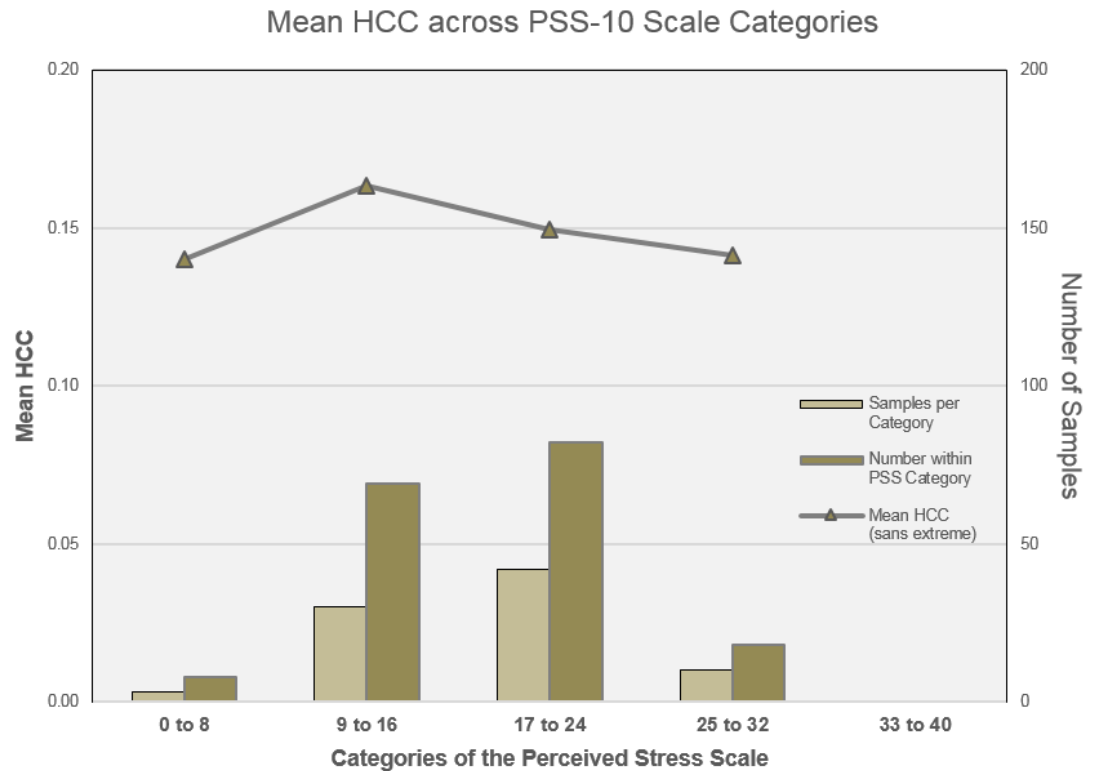


Figure 45: Mean HCC against categories of the Perceived Stress Scale

Figure 45 shows a fair representation of all participants who have completed the PSS-10 questionnaire (n=175), with the levels of hair cortisol as spread across the group (n=85). Hence it is possible to compare the PSS-10 results and hair cortisol levels as shown above. Figure 45 also shows a plateauing of hair cortisol concentrations consistent with Wells' (2014, p.339) study when using the same categories of perceived stress. However unlike Wells' (2014) sample (n=324) no participants' scored in the 33-40 range in the current study.

A scatterplot of the individual hair cortisol concentrations (HCC) versus PSS-10 totals scores is presented in Figure 46.

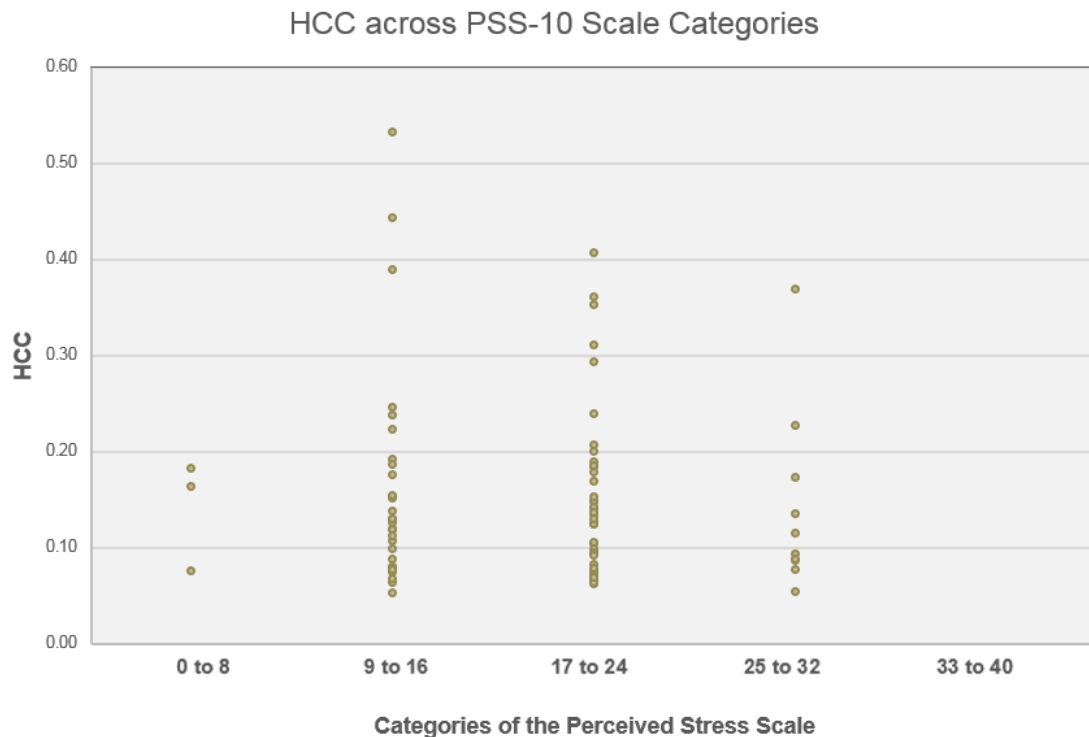


Figure 46: Individual HCC against categories of the Perceived Stress Scale

Figure 46 shows the distribution of each individual's hair cortisol concentrations (HCC) within each category of the PSS-10 total scores. It can be observed that there is a peak and a plateauing effect, which is consistent with the previous graph (Figure 45) and Wells' (2014) findings.

4.7 CHAPTER SUMMARY

Although participants reported a high level of perceived stress in both the PSS-10 questionnaire and the WSP questionnaire, there appeared to be only a weak correlation with the hair cortisol results in this study. However, findings are consistent with the trends identified in Wells' (2014) study, despite the number of participants' in the current study being lower (n=85 versus n=324).

CHAPTER 5 DISCUSSION

5.1 INTRODUCTION

This chapter will explore the results presented in chapter four, and will relate these results to the literature on perceived work-related stress and the nursing profession, and the use of hair cortisol analysis as a biomarker for stress.

5.2 A SUMMARY OF THE PSS-10 AND WSP QUESTIONNAIRE SCORING

To summarise, the PSS-10 questionnaire developed by Cohen et al. (1983), comprises of 10 questions which are general in nature, that enable the participant to assess the degree to which they believe their lives have been stressful in the month prior to taking the test. A total score of 13 or less indicates a low level of stress, whereas moderately stressed participants are expected to score between 14-20. Scores above 20 indicates a high level of perceived stress.

The WSP questionnaire was developed in the 1990's by Rice (1999) to assist individuals to identify perceived stressors within the workplace. It provides an overview of the level of perceived workplace stress and stratifies the stressors into four sub-categories: a workplace interpersonal relationship, physical demands of the job, personal interest or involvement of the job, and collective totals score.

First sub-category – Workplace interpersonal relationships

A total score of:

- <39-46 indicates a low level of perceived stress
- 47-61 indicates a normal level of stress and
- 62-75> a high level of stress.

Second sub-category – Physical demands of the job

A total score of:

- <35-44 indicates a low level of perceived stress
- 45-57 indicates a normal level of stress and
- 58-67> a high level of stress.

Third sub-category – Interests of the job and the control the participant perceives they have over their role

A total score of:

- <13-17 indicates a low level of perceived stress
- 18-22 indicates a normal level of stress and
- 23-27> a high level of stress.

The final sub-category – Collective totals

A total score of:

- <91-111 indicates a low level of perceived stress
- 112-140 indicates a normal level of stress and
- 141-167> a high level of perceived stress overall.

5.3 THE PERCEPTION OF STRESS IN THE STUDY GROUP

The PSS-10 questionnaire results indicated that there was a high level of perceived stress for 40% of this cohort of nurses. The results of the PSS-10 showed that four participants in this study recorded a score of 29 out of a maximum score of 40 (Figure 2). A score of 20 or greater is classified as a high level of perceived stress (Cohen & Williamson, 1988). Seventy out of the 175 participants had a score of 20 or above, which is considered to be in the high level of perceived stress. Males were less likely to fall into this category indicative by a score of 7% (n=5), while 41% of females reported a score above 20 (n=65).

In comparison, the WSP questionnaire indicated that the participants' perceived a normal to very high level of stress due to workplace inter-relationships. This was determined from the participants' total scores relating to the perception of demands, placed upon the nurse within the workplace relating to inter-relationships, job satisfaction and dissatisfaction. The total scores indicate a range from 46 to a maximum of 92, with the vast majority (n=174) in the normal to higher stress range.

It is evident from the responses to both questionnaires, that a large proportion of this cohort reported a high level of perceived stress, which is consistent with the literature exploring perceived stress in the nursing population (Blomberg et al., 2016; Bogossian et al., 2014; Bowden, Smith, Parker, & Boxall, 2015). This is evident when

comparing the total score for 'workplace interpersonal relationship' (Figure 15) with the total score of the PSS-10 questionnaire (Figure 2).

The main source of perceived stress was determined to be as a consequence of the inter-relationships nurses' perceive with other workplace members (derived from the WSP questionnaire), which is measured in the first sub-category of the WSP questionnaire. Perceived stress and bullying was examined by Ovayolu, Ovayolu, and Karadag (2014) who found that negative criticism by other members of the team, as well as being undervalued by other members and management, bullying and an unrealistic workload and timeframes, was perceived as sources of stress for the nurse. The findings of the current study highlight that the vast majority of participants perceived a high to extremely high level of perceived stress (Figure 15); which is in line with findings from De Almeida Vicente, Shadvar, Lepage, and Rennick (2016) when they explored the perceived stressors of paediatric nurses, and their feelings of powerlessness in providing quality patient care, partly due to their exclusion from the decision making process between doctors and the multidisciplinary team, and a sense of lack of autonomy and not perceiving that they have a voice.

A statistically significant relationship existed between the PSS-10, highly perceived stress results, and the 'work interpersonal-relationships', the 'physical demands', and the 'collective totals' categories of the WSP questionnaire. This was determined through a comparison of the totals score from the PSS-10 questionnaire that correlated with the WSP 'collective totals' score. The aim was to identify if the participants perceived they were stressed at work by the use of the PSS-10 questionnaire, and if this could be identified using the WSP questionnaire. Parametric data analysis using the Pearson's correlation test (Table 9) and a Spearman's test for non-parametric testing (Table 10) identified that the participants' of this study perceived they were stressed; furthermore, this stress was due to the workplace environment, and specifically the interpersonal-relationships and physical demands placed upon them. These findings are also supported in the literature (Stecker & Stecker, 2014; Vagharseyyedin, 2016; Yuwanich, Sandmark, & Akhavan, 2016).

This finding is noteworthy as the Transactional Model of Stress (Cox and Mackay (1976) indicates that those participants who perceived a high level of stress due to sources of demand, and then perceive the stressors too great for them to manage, are likely to suffer ill health if stress is not addressed (Cox & Mackay, 1976).

5.4 AGE AS A STRESSOR

Despite there being no association between age and the perceived stress levels based on the totals score of the PSS-10 data (Figure 3), there were statistical significant differences noted for the <25 and the 25-30 year old age groups, determined by the WSP questionnaire for the:

- Workplace inter-relationship (Figure 9)
- Physical demands (Figure 16) and
- Personal interests and involvement (Figure 23).

It was noted in the current study that younger participants perceived workplace interactions as stressful. This was determined as participants aged <25 (n=50), and those aged 25-30 years old (n=41), provided a statistically significant response relating to their perception of physical demands placed upon them every day whilst at work (as indicated in the second sub-category of the WSP questionnaire). Conversely there was no difference between the participants level of education, experience, practice area, or level of nurse (Figures 17, 18, 20, 21). These results are considered to reflect the level of personal interest and attention of the younger aged participants' to their careers, and their intent to remain in the nursing profession. A difference in findings was noted in a Finnish study by Mauno, Ruokolainen, and Kinnunen (2013) who found that younger nurses had less work related stress when compared with older nurses. Mauno et al. (2013) attributed this to the currently prevailing employment climate which resulted in minimal perceived stress for the younger nurse.

In relation to age and intention to stay in nursing, Takase, Teraoka, and Yabase (2016) explored the factors that contributed to the nurses' intentions to stay within the profession, and noted, that nurses in their middle twenties perceived a higher level of dissatisfaction within their workplace in contrast to their older peers. Findings of the current study suggest that younger nurses perceive workplace interactions as stressful, which warrants further investigation to explore if this perceived stress leads to an intention to exit the profession early.

In contrast to the current findings Huntley-Dale (2015) report a high level of perceived stress within the nursing profession, however they note, that older nurses reported the highest level of perceived stress. Although caution must be urged when applying Huntley-Dale (2015) findings to the broader nursing population due to their relatively smaller sample size (n=28), and differences in the age distribution of the

participants' which ranged from 35-50 (n=5), 51-65 years of age (n=22), and greater than 65 years of age (n=1). Huntley-Dale (2015) rightly conclude, a national study would further enable a better understanding of perceived work placed stress within nursing, and the stressors perceived by the nursing population globally.

In a study by Jamieson, Kirk, Wright, and Andrew (2015), the views of nurses were explored to determine what motivated them to stay in nursing. These views suggest that younger nurses, although happy with their career choices, report that a large number wished to change their working conditions, including the nurse to patient ratio, the amount of shift work and the physical demands of the job, all of which Jamieson et al. (2015) suggests impacts on their intention to remain in the profession. Conversely, Clendon and Walker (2011) suggests that although some may leave the profession due to the physical demands of the job, and the toll it puts on their body, others only intend to leave temporarily due to family commitments or pregnancy, and later intend to return to the profession. It could be argued that the highly perceived stress levels of the younger participants' of the current study reflect a combination of stressors arising from both their working and personal lives, rather than solely the physical demands of the job. Unlike the mature nurses' who may be at a different point in their personal lives. Moreover, having a wealth of experience and refined coping strategies, positively impacting on the perception of stress relating to the demands of the job.

Conversely, Keogh (2013) states that mature nurses report feelings of being undervalued, and their years of experience unappreciated by other team members. Therefore, the perception of stress is a personal viewpoint with many different intertwining aspects. One aspect being generational differences, as this appears to influence the perception of the individual in relation to their work environment, and perceived job demands, including their intention to stay in the practice area or even the nursing profession. The younger nurse, generation X and Y, perceive the work environment as too physically demanding and are more likely to resign due to work stress (Lavoie-Tremblay, Trépanier, Fernet, & Bonneville-Roussy, 2014), unlike the baby boomers (the mature nurse) who have experienced numerous changes within their careers and have developed a resilience and longevity within the careers and subsequent effective coping strategies (Bennett & Allie, 2014).

In support of this view Clendon and Walker (2016) suggest that older nurses have a greater resilience to the physical and psychological demands of the workplace, which have developed over the life of their career, and it enables them to buffer any

perceived workplace demands by effectively using a self-control coping strategy (Wakim, 2014).

Interestingly, Cicolini, Comparcini, and Simonetti (2014) conducted a systematic review, which considered nurses' job satisfaction and intention to stay, and they noted a positive correlation with increasing age and educational level. The correlation between job satisfaction and age is supported in this study (Figure 23). However, no such correlation was observed with higher educational levels (Figure 24). Among this cohort of nurses, age was correlated with perceived stress, this could be a reflection of the generational differences, and uncertainty relating to nurses interests and willingness to stay in the profession when faced with challenges in the younger generations.

Continuing to explore age as a variable, but from a slightly different perspective, it was noted within the current study that nurse managers reported more stress than first year nurses (Figure 28). On closer examination all managers within the current study were female (n=18) in relation to age, 2 managers were aged in their 20's (27 and 29 years of age), 1 in their 30's (38 years of age), 6 in their 40's (45, 46x4, 49 years of age), 8 in their 50's (50,51,53,54x3, 55x2 years of age) and 1 in their 60's (62 years of age). This clearly demonstrates that the managers within the current study comprised mainly of baby boomers (n=15) (born after World War II between the years 1946 and 1964). The stress they perceived related to the personal interest and involvement of the job (captured within the third sub-category of the WSP questionnaire) may be as a result of different generational traits. As Doran et al. (2015) points out, intergenerational studies highlight that the baby boomer generation regard their employment more favourably than the younger generations and report less workplace demands and stressors. However, when, or if, faced with such challenges, for example technology changes, or frustrations relating to the younger nurse not respecting or listening to the older nurse, who they perceive as more inclined to leave or have a sick day, rather than dealing with the issue, the baby boomer is more inclined to remain calm, and stay and deal with the situation (Spiva, Hart, & McVay, 2011). This may be evident within the current study and the subsequent level of perceived stress reported by the nurse manager relating to their involvement in the job (sub-category 3 of the WSP), as these issues may be out of their personal control, although the perceive stress is still evident. Supportive of this view, Kath et al. (2013) examined the predictors of nurse managers' stress and their findings suggest that role conflict whereby the manager is required to juggle multiple demands from subordinate nurses, and also from senior management

can be perceived as extremely stressful, this is further compounded by the organisational constraints that are placed upon them (Udod & Care, 2013).

It has been suggested in previous studies (Shirey, 2009) that older nurse managers who have more years nursing experience also have better coping styles than younger less experienced nurses, and subsequently utilise different coping strategies to address the stressors associated with their managerial role. This is demonstrated in a study by Johansson et al. (2013) whereby nurse managers overall perceived their own health as good, thus age and experience may be viewed as a contributing factor to the managers perceived good health, and effectiveness of their coping strategies. The average age of the cohort of nurse managers in the Johansson et al. (2013) study was 49.9, whereas in the current study it was 40.9 years.

A further finding by Johansson et al. (2013) was that the nurse managers' duties were less clearly defined than their subordinates, whose work tasks were clearly documented and understood. Such role ambiguity may contribute to the production of psychological stress, which may lead to a loss of interest in their work or role as a manager (Udod & Care, 2013). This finding is supported in the current study as a statistically significant difference was noted, whereby nurse managers perceived more stress than the first year nursing students' (Figure 28). This may reflect the level of autonomy required in the role as a manager compared to the supported role of the first year nursing student who has clear directions.

In summary although younger nurses perceived a high level of workplace stress relating to 'personal interest or involvement of the job' captured within the third sub-category of the WSP (Figure 23), the stressors they perceive may differ to the stressors perceived by nurse managers (Figure 28). Furthermore, how they deal with those stressors may also differ. Relating this back to the Transactional Model of Stress specifically stage three and four of the model. When an individual perceives that they are unable to cope any longer with the demands they perceive are being placed upon them, and the feelings of stress are overwhelming, they attempt to adjust their behaviour as a method of coping with this stress (Cox & Mackay, 1976). This change in behaviour may assist them to cope with the perceived stressor and remain in the work environment, or result in a negative change leading to withdrawal and isolation from the work environment and subsequent ill health.

Moreover, age and generational differences interlink with the nurses perceived internal and external stressors relating to the physical demands of the job. Combined with the stage they are at in their personal lives, all merge and contribute to the level of

physical demands the individual perceives is placed upon them whilst in the work environment, and subsequently has a large part to play in their intention to stay or leave, not only the practice area, but also the nursing profession.

5.5 STRESS AND THE YEARS OF EXPERIENCE OF THE NURSE

The number of years' experience and educational levels were explored as variables that may impact on nurses perceived stress levels. Neither the total score of the PSS-10 (Figure 4 and Figure 5) nor the WSP 'collective totals' findings (Figure 31 and Figure 32) could detect an effect. However, responses relating to the 'personal interests and involvement in the job', the third sub-category of the WSP questionnaire indicated that nurses 2-5 years post qualification perceived more stress than the first year student nurses (Figure 28). This may be as a result of increased levels of accountability, as student nurses are under supervision whilst those who have been qualified 2-5 years, are held accountable, whilst still being relatively inexperienced, thus increasing their levels of work related stress. Similarly, nurse managers were also more stressed than student nurses (Figure 28); however, this may be as a result of the nature and involvement that a senior role requires in relation to balancing numerous intense stressors at the same time. Unlike the student nurse, who is in a highly supportive and nurturing environment and is therefore likely to perceive stressors differently.

Furthermore, of the participants' who reported a high level of perceived stress within the total score of the PSS-10 questionnaire, 11% were nurse managers (n=8), 53% were student nurses (n=37), followed by 6% of nurses within their first year post graduation (n=4). These findings support the hypothesis that inexperienced nurses are more stressed than their experienced counterparts, although they are less stressed than the nurse managers, which is considered to be associated with their additional role stressors (Figure 28). These findings are in contrast to those of Johansson et al. (2013) who reported that Swedish nurse managers in spite of the higher level of demand required of their role, perceived a higher level of control, that enabled them to cope without the demands of the job impacting on their general health and wellbeing. In Canada, Udod and Care (2013) determined that the job related demands of managing others, completing work priorities as well as staff shortages placed stressful demands on nurse managers, leading to a turnover as high as "30% in some regions of Canada" (p.67). Supportive of this view, Jones (2013) notes that a lot of the stress nurse managers perceive, relates to the need to ensure the best possible level of care for their patients, whilst trying to juggle other competing demands.

A longitudinal study investigating the perceived stress levels of 997 nurses early in their careers, found that one in five reported extreme levels of perceived stress within the first three years, and one in two within the second year of practice (Rudman & Gustavsson, 2011). This finding was supported by Blomberg et al. (2016) who found that newly graduated nurses perceived nursing as a moderate to highly stressful profession, within their first year of practice, regardless of the practice area or level of clinical supervision they received. Moreover, age and gender did not impact on the participants' level of perceived stress; rather it was a reflection of their experience.

However, Arslan et al. (2015) did find that the organisational stress scores were higher in the participants with 0-5 years emergency care experience, and less in participants with greater than six years' experience, which is again supported in the current study when exploring the third sub-category of the WSP questionnaire, namely the 'personal interests or involvement of the job' section (Figure 28), which also notes participants who have been qualified from 2-5 years perceive a higher level of perceived stress than those qualified greater than 5-8 years.

Findings from the current study note that of those who reported a high level of perceived physical stress 5% (n=10) were managers, 5% (n=10) were nurses who were 2-5 years post-graduation, 5% (n=10) were nurses who were greater than 8 years post-graduation, and 2% (n=4) were first year post-graduation nurses (Figure 28).

An Iranian study by Raeisi, Namvar, Golabadi, and Attarchi (2014) found a link between the experience of the nurse, and the perceived physical demands of the job by reporting a significant association noted between the perceived physical demands, and reports of personal injury among nurses with more than seven years' experience, a finding not supported by this Australian study, and this could be due to differences in nursing practices and occupational health and safety training and expertise

Exploring the literature in relation to the perceived physical demands reported by nurse's highlights that both physical and psychological demands could be perceived as both a positive and negative stressor. However, as long as they are perceived, as being under control no adverse consequences should occur, if however they are perceived as requiring too much effort to address or control, then negative reactions such as fatigue and absenteeism will follow. Furthermore, with an ever-increasing aging population and staff shortages these perceived demands are likely to increase rather than decrease (Roelen et al., 2014). From a slightly different perspective Chin, Nam, and Lee (2016) explored the physical demands and occupational risk factors which encompassed job demand, role, and physical workload of 394 nurses noting that

although the physical demands of the job may increase due to the aging population, a correlation also exists with obesity, with managers and supervisors being at increased risk due to the sedentary nature of their role, compared to nurses delivering direct patient care.

These findings differ from the findings of the current study, whereby both nurse managers, and nurses delivering patient care reported a high level of perceived physical demands. Furthermore, the physical demands of a nurse's job not only affect the individuals work life, can also negatively manifest into their personal lives, and that of their families. Findings from the Ovayolu et al. (2014) study notes that younger or less experienced nurses perceived stress within the workplace, which is supported by the findings of the current study, in relation to age and workplace inter-relationships (Figure 9). A study by Lin, Lin, Cheng, Wu, and Ou-Yang (2016) suggests that this ongoing stress blurs the ability to differentiate if the stress is a result of the physical demands of the job, or if it originates from their personal lives. Which may explain why there is a variance in the research findings relating to physical demands.

Focusing on the hospital environment, Han, Trinkoff, and Gurses (2015) suggest that nurses generally, who perceive they have a say in the decision making process relating to their patients, report less workplaces stressors, increased job satisfaction and are less inclined to leave their position within the organisation. This may substantiate the findings of the current study whereby the nurses who were 2-5 years post qualification, perceived they were more stressed than the first year nursing students (Figure 28) which may be as a consequence of the lack of autonomy granted them within their current position within the organisation or practice environment.

Furthermore, it was noted in the current findings that participants with nursing experience also perceived a high level of workplace stress which appears to decrease the longer they have been practicing as a nurse (13 participants had 11-20 years nursing experience, 10 had 21-30 years nursing experience, 3 had >31 years nursing experience), this is again supported in the literature (Doran et al., 2015; Shirey, 2009; Spiva et al., 2011). Not forgetting that the 'collective score' sub-category of the WSP questionnaire does not focus on a specific stressor within their roles, unlike the earlier sub-categories, rather this is a general perception of their workplace stress levels.

The 'collective totals' score within the WSP questionnaire explores the overall perceived work-related stress. The findings from this section indicated that 60% of respondents perceived a high level of work-related stress (n=105) as indicated by a score greater than 141 (Figure 35). On closer examination it became evident that within

the high range scores, 75% (n=79) related to the nurses' with less than 10 years' experience within the nursing profession, which supports the hypothesis that inexperienced nurses suffer more work related stress than the more experienced nurse, a finding that is supported in the current literature (Rudman & Gustavsson, 2011; Wakim, 2014).

Of the 75% of nurses who reported a high level of work-related perceived stress, 40 were student nurses, 18 were nurses with 1-3 years nursing experience, 10 had 4-6 years nursing experience, and 11 had 7-10 years nursing experience. This is supportive of the view that student nurses perceive workplace stressors such as bullying, and negative interactions with other staff members, when relating to their practicum placements (Mannix, Harrison, & Sumsion, 2013; Pulido-Martos et al., 2012). Smith, Gillespie, Brown and Grubb (2016) found that the extent of these workplace stressors were difficult to measure due to the variance in reports. However the fact that these students questioned whether they should continue in the profession as a result of their experiences, or whether they should leave prematurely, should be a major concern for the profession.

5.6 STUDENT NURSES

There were 3% of nursing students (n=6) who perceived they were highly stressed due to the physical demands of the job, which potentially was a result of the participants' inexperience working within a nursing environment. This view is consistent with a study by Singh and Kohli (2015) who assessed the perception of stress, and coping strategies amongst nursing students in Delhi, and noted, that student nurses perceived a high level of physical stress due to their lack of knowledge and skills, which is consistent with numerous studies exploring student nurses perceptions of stress (Alzayyat & Al-Gamal, 2014; Galbraith, Brown, & Clifton, 2014).

The findings of this study provide further evidence to support the general findings that there is a higher perception of stress amongst inexperienced nursing students. The results indicate that stress declines as the level of experience increases. However, the type of role being undertaken confounds the findings, which needs further exploration. Nurse managers perceived a high level of stress as a result of their job role rather than experience. Amongst this study cohort, high-perceived stress prevalence decreased from 36% for new graduates (<1 year experience) and 28% of those who qualified in the last 2-5 years. Undoubtedly, it is an area, which requires further exploration and focus.

5.7 PRACTICE AREA

The association between nurses perceived stress levels and their area of practice was explored by d'Ettorre and Greco (2016) who found that within the hospital environment, nursing staff were at greater risk of suffering from work-related stress due to the nature of the environment they faced each day. The stress levels of nurses were also explored by Arslan et al. (2015), who found, as is the case in the current study, that the nurses' perception of stress was not impacted by their level of education, or status (Table 3).

Bowden, Smith, Parker, and Boxall (2015) remarked that stress is multi-faceted, and consists of a combination of work-related, personal and environmental factors. The results from the total score of the PSS-10 questionnaire in this study indicate that the majority of participants perceived a moderate to high level of stress over the previous month (Figure 2), and this is also supported within the 'collective totals' score of the WSP questionnaire (Figure 35), indicating that stress is therefore not exclusively related to a single factor such as age or practice area.

Delving further into the WSP questionnaire, results indicate there was a correlation between the 'personal interest or involvement of the job' sub-category (sub-category three), and the nursing students. However there were no statistically significant differences observed for those working in surgical, medical and emergency areas (Figure 27), a larger multi-centre study would need to be conducted to obtain a large enough sample for this level of analysis.

The practice area in which a nurse worked and the effect on their perceived stress was explored by Hall (2016) who makes a very valid point, when stating that hospital nurses are not presented with the same challenges or stressors that nurses working in the community are faced with, such as accessing clients properties, or housing conditions as well as dealing with pets and travel requirements. Therefore, it can be seen that different practice environments may impose different stressors (Hall, 2016). Further research to explore the various stressors, and the resulting perceptions of the nurse working in both the hospital and non-hospital settings is needed.

5.8 PERSONAL ATTRIBUTES OF THE NURSE

The response to the perceived 'physical demands' sub-category indicated that there was a blurring of demands. This is a view that Cox (1978) would attribute to the individuals' personal life interlinking with the sources of demands perceived in the

individuals' working environment, making it difficult for the participant to distinguish where the source of demand actually originates, and only becomes apparent when appraising their work situation or environment, which is encompassed within stage one of the Transactional Model of Stress (Cox & Mackay, 1976).

Others suggest that managing the physical and psychological demands of nursing has more to do with a personal attribute that the nurse holds (Cope, Jones, & Hendricks, 2016). It has also been argued that perceived stress is not related to the nurses age, experience, education or personal attributes, rather it is reflective of the support or lack of it within a specific practice area (Gillespie, Chaboyer, & Wallis, 2009), clearly perceived stress is multifaceted and needs further investigation.

On relating this back to the Cox and Mackay (1976) Transactional Model of Stress, within stage one of the model, it is proposed that individuals may acknowledge that their roles are physically demanding, but they are currently able to cope with these demands. However, if they perceived that the physical demands of their job were too great for them to manage, it is considered that they would have progressed to the second stage of the model due to their cognitive appraisal of the situation, or the demands of the job have led them to feel they are no longer able to cope, or that the demand is perceived as overwhelming.

5.9 HAIR CORTISOL ANALYSIS

The uniqueness of the current study is not that perceived stress was explored in nursing; rather it was the methods used to identify this stress. The two written questionnaires utilised within this study were both validated tools, but to support this exploration, a hair sample was obtained from consenting participants, to enable analysis of their level of cortisol, which has been identified as a biomarker of stress, and has only been used in minimal studies relating to the nursing profession. When discussing the measurement of stress, Levenstein et al. (1993) made a very valid point by stating "There is however, no gold standard for validating a measure of stress. If the individual is for instance asked how much stress he or she is under, stress may be reported quite differently according to the context in which the question is asked" (p.26). Taking a hair sample enabled a way of removing the variability, and is a method which Davenport et al. (2006) suggest is a non-invasive, reliable indicator of stress, unlike salivary sampling, which is affected by numerous confounding variables, as discussed in chapter two.

The hair analysis within this study was performed in a NATA approved laboratory, in line with Salimetrics protocol and procedures (Salimetrics, USA). From the analysis of hair cortisol it was noted that 10 (n=85) samples were in the high range (>0.25 ng/50mg hair), 43 samples were in the medium range ($>0.1 - <0.25$ ng/50mg hair), and 32 samples were in the low range (<0.1 ng/50mg hair). On closer investigation 1 sample was in the extremely high range (9.660 ng/50mg) with no apparent reason noted within the written questionnaire to justify such a high reading, for example the need for stress medication or that some type of trauma had occurred. When examining perceived stress, Faresjö et al. (2014) makes note that how an individual perceives stress, does not always correlate to the stress measured by the biomarkers of stress. Within, Faresjö et al. (2014) study a follow-up interview was conducted unlike the current study, which identified that two participants with an extremely high level of cortisol concentration had experienced serious life events in their lives during the retrospective time of sampling their hair cortisol levels.

There is conflicting evidence regarding the correlation between levels of perceived stress and cortisol levels (Chan, Sauvé, Tokmakejian, Koren, & van Uum, 2014; Dettenborn et al., 2010; Karlén et al., 2011; Lambert et al., 2014), despite there being reports of a correlation in other studies (Faresjö et al., 2013; Wells et al., 2014).

5.9.1 Do the hair cortisol results correlate with questionnaire findings

Clearly there is a disparity between what the participants' perceived as stressful, and their level of hair cortisol, as the participants' in this study perceived a high level of stress whilst the hair cortisol levels were moderate. This was evident in the findings from the total score of the PSS-10 questionnaire and sections of the WSP questionnaire. These findings are similar to those findings of a comparable study by Wells et al. (2014) who also utilised the PSS-10 questionnaire, in conjunction with hair cortisol levels, their study focused on mental health factors and the perception of stress, in a random sample of 324 participants'. It was noted that a possible reason for the weak correlation between perceived stress and hair cortisol might be due to the fact that the effect is "curvilinear, and dampened at the highest level (p.340)". Wells' et al (2014) subsequently concluded, "Hair Cortisol Concentrations (HCC) increased with higher perceived stress but decreased at the highest level of stress" (p.334). This finding was replicated in the current study where it was found that participants' perceived a high level of workplace stress, but their hair cortisol levels indicated a moderate to high level (Figure 40) thereby confirming the hypothesis of Wells et al and

their hypothesis regarding the 'curvilinear effect'. Furthermore, hair cortisol sampling and questionnaires were completed concurrently to address the issue of a "mismatch between time frames for self-reported stress and HCC" (Wells et al., 2014, p.340). Since this potential source of error was eliminated, it can be assumed that the finding was due to the physiology of the coping mechanism of the individual (Chakraborty, Chatterjee, & Chaudhury, 2012; Wells et al., 2014).

The disparity between what participants perceive as stressful, and their level of hair cortisol was observed for the 'physical demands' sub-category section of WSP questionnaire (Figure 42), and the 'personal interests and involvement in the job' sub-category (Figure 43). Again, the participants perceived a high level of stress in both of these sub-categories, but findings from the hair analysis indicated moderate to high level of cortisol. A valid point was made by Nowrouzi et al. (2015) who stated that a study can "only capture a snapshot of nurses' views and may not accurately reflect their work environments and occupational stress levels" (p.310).

Consistent with the previous sub-categories of the WSP questionnaire, the 'collective totals' score noted that participants perceived a high level of stress within the workplace, although again, the levels of hair cortisol indicated a moderate level of stress (Figure 44). Further research is needed to investigate if this is as a result of a decrease in hair cortisol concentration at the highest point of the individuals' level of perceived stress, or whether the coping strategies utilised by the individual assists to decrease their level of cortisol and to determine the underlying psychophysiological mechanism.

Advances in cortisol analysis and its sensitivity are addressed by Wester, Lamberts, and van Rossum (2014) who noted that further research is needed to understand the influence that behavioural interventions may have on the long-term level of hair cortisol produced by the individual. This point is relevant within the current study, as the participants' coping strategies may have reduced participants' hair cortisol levels to a moderate level, even though the participant still perceived a high level of workplace stress. Hence the coping strategies utilised by the participant whilst at work and within their leisure time may have led to their levels being reduced. Undoubtedly as Wester, Lamberts, et al. (2014) suggest, more research is needed to explore this point further.

This study, which is in agreement with other similar studies (Stalder et al, 2012; Wells et al. 2014), highlights the fact that there is disparity with the hair cortisol results and the questionnaires findings. However, these can be explained, in the most part, by

the 'curvilinear effect', which is considered to be a physiological effect likely to be due to the coping strategies which reduce the level of cortisol once peaked and plateau's. It remains that perceived stress is subjective whilst hair cortisol levels are considered objective. However, the two combined has the potential with further research to be an effective tool used to determine actual stress.

5.10 RECOMMENDATIONS

The findings from this study suggested that overall the experience of the nurse impacts on their perceived work-related stress levels. One remarkable cause of nurses' perceived stress is that they report that they are excluded from the decision making process. However, as perceived stress is multifaceted there are other known factors such as the stressful leadership demands, which was a key component of nurse managers' stress. A larger interstate study would provide a better understanding of this dimension of stress occurrence within the nursing profession in Australia.

From an organisational perspective, further research is required to implement stress-reducing initiatives, and to assess the effectiveness of such interventions in terms of the benefits to staff, as well as their cost effectiveness to the organisation. This could include strategies such as addressing staffing levels for nurses, enabling quality patient care (Carrigan, 2013), role clarity and addressing workloads (Toh et al., 2012).

Although nursing is predominately a female dominated profession, a larger study is required to explore and compare the stressors that both male and female nurses perceive within their nursing practice to aid a better understanding for both genders.

5.10.1 Recommendations for nursing practice

Further studies exploring generational differences within the nursing profession, in particular the younger generations' interests and willingness to stay in nursing when faced with challenges would be beneficial to the nursing workforce.

Younger nurses perceive workplace interactions as stressful, further research is required to explore if this leads to an intention to leave the nursing profession early rather than exiting for a short period of time, with the intention of returning.

Further training is recommended for nurse supervisors to facilitate a positive learning experience for the nursing student whilst on placement.

The current study was unable to detect any significant association with practice areas due to inadequate sample size once the cohort was stratified by practice area. Further research is required to determine if working within a speciality area impacts on the level of perceived stress for those nurses working in those areas.

Although not a component of this current study, further research is also recommended exploring the stressors perceived by community nurses practicing within the rural areas of Australia, compared to those nurses working within a hospital environment.

5.10.2 Recommendations for research

Further studies on other occupational groups are recommended to demonstrate that hair cortisol measurement used in conjunction with validated perceived stress questionnaires is a robust protocol.

The perception of stress that nurse managers' report needs further research and exploration, as further training or stress reducing strategies may be required to assist them manage their role and alleviate their stress.

5.10.3 Recommendations for nursing education

It is recommended that nurse educators teach nursing students' how to identify hazards that have the potential to cause stress. Including hazard assessment and risk control measures which can minimise the effects of the stressor, or stressors the individual perceives.

Further exploration into coping strategies already utilised by the nurse is recommended, along with the impact this has on the individuals' hair cortisol level, as this would assist in the understanding of the perceived work-related stressors for nurses.

5.11 LIMITATIONS

The following limitations of the study are noted.

This study was conducted in a single hospital within the Northern Suburbs of Perth WA.

Participants' were volunteers who "self-selected" to participate. The potential for selection bias needs to be considered when interpreting the findings of this study.

The study was cross-sectional and both stress perception and cortisol levels could have changed over time.

Initially nursing students were considered to be an ideal control group, however, it was recognised that although the nursing students' were completing a nursing course at university, they were likely to be working in part time jobs within a hospital environment or indeed elsewhere within a health environment, so the data was analysed as a collective sample rather than sub-groups.

5.12 CONCLUSION

People are exposed to various sources of stress in any work environment. While the precise definition of stress and perceived stress remains elusive (Donovan et al., 2013). Goodnite (2014) supports the definition that stress is the end result of an "individual's perception to a stimulus, interpreting this as overwhelming, and the inability to meet the challenge" (p.72).

It is acknowledged that stress is a very individual and subjective phenomenon whereby no two people react the same to the same stressor at the same time, there are professions known to be highly stressful occupations such as nursing. In line with this view McNeely (2005) reported that nursing is ranked amongst the highest professional groups for occupational injury and illness, and often due to the complexity of stress, focus is given to easier quantifiable areas such as needle stick or musculoskeletal injuries rather than exploring the perceived stressors nurses report.

Although perceived stress is considered to be multi-faceted, this study methodology was able to elicit noteworthy factors within a local WA nursing population that impacted on their perceived stress. These being:

1. Inexperienced nurses suffer more work-related stress than the more experienced nurse.
2. Stressful leadership demands for the nurse manager predominate this.
3. Age and generational differences' were also noted.

The results from this study adds to the research and understanding of these stressors perceived by nurses within WA, at various times in the nurses' career. This study also assists stakeholders with the development of strategies aimed at reducing stress for nurses, aid staff retention, and help to nurture a healthy workforce and enhance job satisfaction.

It is considered that measuring hair cortisol is a valid way to measure stress, and that the use of a questionnaire can then be used to determine the causes of the perceived stress.

The aim of this study was to explore the perceived stress levels amongst a group of nurses in WA, and to determine if there was a correlation between self-reported stress amongst nurses and hair cortisol levels.

It was hypothesised that:

H1: Inexperienced nurses are more stressed than their experienced counterparts.

H2: Practice area is a factor that influences stress levels for nurses.

H3: Hair cortisol levels correlate with self-reported perceived stress levels.

This study did not determine a statistically significant effect due to the practice area, therefore 'H2: Practice area is a factor that influences stress levels for nurses' could not be assessed adequately once the sample had been stratified. It is therefore recommended that a larger multi-centre study would need to be conducted to obtain a large enough sample for this level of analysis to be conclusive.

There are numerous models of stress that could have been used for this study, however, the Cox and Mackay (1976) Transactional Model of Stress appears to be most suitable as it takes into consideration the psychophysical demands of the individual and their inter-relationship with the work environment which consists of a fluid entity, that is continually changing and evolving.

Utilising a non-invasive technique to detect the level of cortisol as a biomarker for stress has the potential to identify high-risk individuals, who can then be counselled to seek further support and education in relation to coping strategies to assist with their perceived stress and workplace demands. Traditionally saliva sampling has been the preferred method for detecting the stress hormone cortisol as a biomarker for stress. However, current research and sampling techniques indicate that hair sampling may provide a robust and reliable method; hence it was used as the technique of choice in this study.

The uniqueness of the current study is not that perceived stress was explored in the nursing profession; rather it was the methods used to identify this perceived stress, which consisted of a combination of questionnaires, and hair cortisol levels, making this study unique within a solely nursing population.

The findings from this study indicated that 60% of respondents perceived a high level of work-related stress (n=105) as indicated by a score greater than 141. On closer examination it became evident that within the high range scores, 75% (n=79) were from participants with less than 10 years' experience within the nursing profession, which again supports the hypothesis that inexperienced nurses suffer more work related stress than the more experienced nurse. However, nurse managers' report less perceived stress despite their cortisol levels being the highest. This may be due to their effective coping strategies inter-linking with their physiological mechanisms, though this requires further exploration.

The age and generational differences of the nurse interlinked with the nurses perceived internal and external stressors combined with the stage they are at in their personal lives, all merge and contributed to the level of physical demands the individual perceived was placed upon them whilst in the work environment, and subsequently had a large part to play in their intention to stay or leave, not only the practice area, but also the nursing profession. Cox (1978) would suggest that the perceived physical demands indicated in the responses to the written questionnaires, may also indicate a blurring of demands, a view that Cox (1978) would attribute to the individuals' personal life interlinking with the sources of demands perceived in the individuals' working environment, making it difficult for the participant to distinguish where the source of demand actually originates, this only becomes apparent when appraising their work situation or environment, which is also encompassed within stage one of the Transactional Model of Stress (Cox & Mackay, 1976).

Furthermore, how the nurse deals with those stressors may also differ, which is addressed within stage three and four of the Transactional Model of Stress (Cox & Mackay, 1976) whereby the individual experiences an imbalance following the realisation that they are unable to cope with the perceived demands resulting in a feeling of stress and an attempt to adjust their behaviour as a method of coping.

The experimental design of this current study was controlled to ensure the hair cortisol sampling and questionnaires were completed in unison to address the issue of a possible "mismatch between time frames for self-reported stress and HCC" (Wells et al., 2014, p.340). Hence there was no mismatch, and the 'curvilinear effect' appears to be real. This effect is postulated to be due to the physiology of the individuals coping mechanisms (Chakraborty, Chatterjee, & Chaudhury, 2012; Wells' et al., 2014), though the physiology behind the 'curvilinear effect' needs further exploration; it is considered that hair cortisol is a valid screening tool for stress in the occupational environment.

It is considered that measuring hair cortisol is a valid way to measure stress, and that the use of a questionnaire can then be used to determine the causes of the perceived stress. Such a protocol will not only be able to be used for the WA Nursing Profession, but for any workplace stress investigation.

5.13 PERSONAL REFLECTION

This study has been a journey of ups, downs, and at times extreme difficulties and frustrations, to the point where I questioned why I was doing it. Reflecting back, I can see just how far I have come, and how much I have learnt. My supervisors have supported and listened to me during my darkest days, especially when my husband died and my youngest son struggled to cope, never faltering in their belief of me.

Academically, I understand that this is not the end of the journey, but rather the beginning, and I welcome the challenge of what lies ahead.

Although not a quote by a famous academic, the singer Dolly Parton once said something, which sums up my journey and personally means so much to me “In order to get to the rainbow you must be able to deal with the rain”.

I think I’ve been through, and dealt with the rain, let’s hope the rainbow is not far behind.

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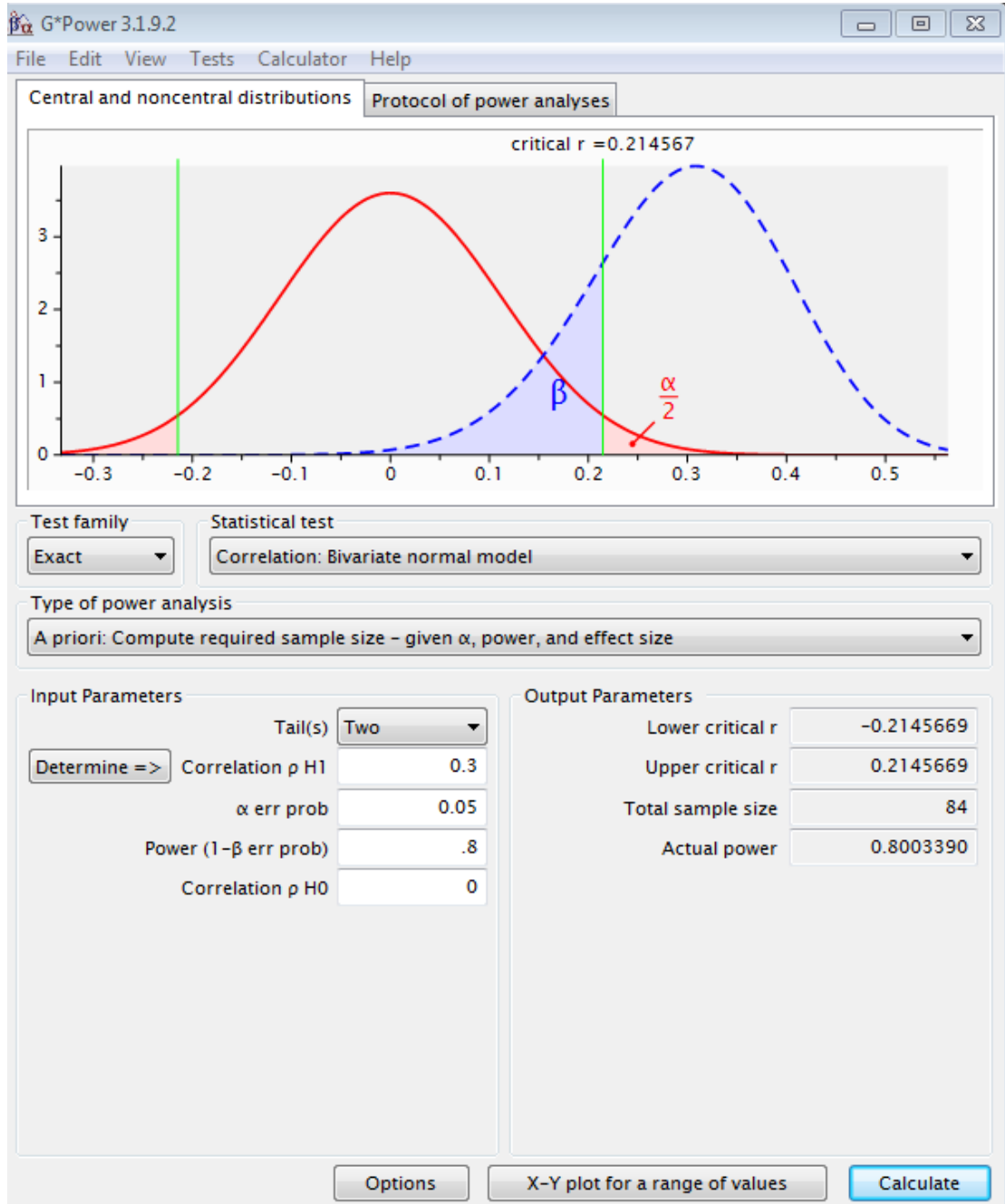
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APPENDIX A GPOWER ANALYSIS



APPENDIX B STUDENT NURSES

PARTICIPANT'S INFORMATION SHEET



PARTICIPANT INFORMATION SHEET

My name is Kim Oliver and I am conducting a research study as part of my PhD. I am a Registered Nurse and lecturer in the School of Nursing and Midwifery at Edith Cowan University. I am conducting a study to investigate whether the self-reporting of stress associated with the experience of nurses can be validated by the level of hair cortisol in these nurses.

What is this study about?

This study aims to compare the perceived occupational stress levels from a group of experienced registered nurses, as well as a group of first year nursing students, utilising a written questionnaire. Hair cortisol concentrations levels will be examined to see if these cortisol levels validate self-reported levels of stress.

Why am I being invited to participate in this study?

As a student nurse currently practicing within the nursing profession, you have firsthand knowledge of the occupational workplace stressors that impact on the nursing profession. For this reason you are invited to share your thoughts on your practicum experiences.

If I decide to participate, what will happen?

Participation in this study is **voluntary**, that is you may decide to be in the study or not take part in it at all.

Any decision you make will have no bearing on your education or any assessment that may occur in your studies.

If you decide to take part in the study you will be asked to complete and return a signed Consent Form on the day prior to commencing the study.

Once you have completed your consent form, you will be invited to share your thoughts through a written questionnaire, and a small hair sample will be obtained following your consent, from the back of the head, just below the crown, approximately 15-20 strands dependent upon the thickness of the hair, to enable analysis of the hair cortisol levels.

If you wish to complete the written questionnaire, without giving a hair sample for analysis, you will still be able to partake in this study.

What are the costs to me?

There are no costs associated with participating in this study.

Do I have to take part in this study?

No, you do not have to participate in the hair cortisol analysis, nor the written questionnaire. If you decide to take part, you may decide to withdraw at any time until your survey has been submitted. You do not need to give a reason, and there will be no penalty if you do withdraw.

Are there any reasons I should not be in the study?

You should not participate in this study if you do not wish to record your perceived level of stress or if:-

- Had any traumatic event either physical or psychological (pertaining to shocking, distressing, hurtful, harrowing, painful, serious or life threatening illness, loss, grief, cancer to the individual or close family member), within previous three months.
- Under the age of 18.
- Not a first year ECU nursing student commencing their second semester.

For participants willing to supply a hair sample the follow exclusion criteria apply

- Individual not able to provide hair sample due to shave or bald head.
- Individuals who currently have hair extensions.
- Pregnancy – hair cortisol levels have been noted as being raised during pregnancy (Sanjog et al., 2007).

Results of the research study

Feedback regarding the findings of this study will be available on request from the Principal Investigator following completion of this study.

What are the benefits to me of being in the study?

You may enjoy sharing your thoughts and feelings about your perceived level of stress through the use of the questionnaire. Findings from this study will also add to the knowledge and evidence base, which can be used to provide direction for nurse education in relation to stressors within nursing and the wellbeing of nurses throughout the nursing profession in Western Australia (WA).

What are the possible side effects, risks and discomforts of taking part?

There is a risk you may feel discomfort about exploring your perceived stress; you are free to stop at any time, and recommence when you feel you wish to do so, or you can withdraw if you feel this is too uncomfortable to continue with this study. Furthermore, Beyond Blue is always available to discuss your feelings and thoughts on phone number: 1300 22 4636. Your information will enable a better understand of the stressors nurses report, and whether hair cortisol levels can validate self-reported levels of stress within the nursing profession in Western Australia.

How will my privacy be protected?

Your decision to take part in the study, or not, will be kept confidential. If you agree, your questionnaire and hair sample will be allocated a numeric number so the questionnaire and hair sample can be linked together for data analysis. Identifiable data will not be obtained. Only the researcher will have access to this data. Any information that identifies a person will

be removed at the time of transcription, by the Principal Investigator who will transcribe the numeric data from the questionnaires into SPSS for analysis.

The written questionnaire and hair sample will only be identified by a numeric code. This information will be stored on a password protected computer in the locked office of the researcher. All consent forms will be scanned and digitally recorded. The paper records will be destroyed once the data is uploaded onto the computer. Once hair samples have been sent to the laboratory for analysis of hair cortisol levels, they will be destroyed through the appropriate destruction of human tissue sample by the laboratory. The study data will be retained for a period of five years after the submission of the PhD thesis for examination, as per Edith Cowan University records and management policy and NHMRC guidelines for research involving human participants.

The thesis will discuss broad themes that came up in the questionnaires. No names will be used, but some unidentified comments may appear as examples to show important points.

It is anticipated the findings from this study will be published through health journals and shared at professional meetings, as well as part of my doctoral thesis. No identifying information will be published and data will be reported in the aggregate only. By taking part in this study, you agree not to restrict the use of any data even if you withdraw. Your rights under any applicable data protection laws are not affected.

Who can I contact if I have questions about the study?

If you have any questions or require any further information about the research project, please contact the Principal Investigator Kim Oliver on mobile 0435310869.

You can also contact my supervisor:

Associate Professor Jacques Oosthuizen
Faculty of Health, Engineering & Science
School of Exercise and Health Sciences
Edith Cowan University
Ph. (08) 6304 5876
Email: j.oosthuizen@ecu.edu.au

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Research Ethics Officer
Edith Cowan University
270 Joondalup Drive
Joondalup WA 6027
Ph. (08) 6304 2170
Email: research.ethics@ecu.edu.au



Who has given permission for this study to proceed?

The Joondalup Health Campus Human Research Ethics Committee and Edith Cowan University Human Research Ethics Committee have approved the ethical aspects of this study.

Thank you for taking the time to read this Invitation Letter – It is yours to keep.

APPENDIX C REGISTERED NURSES PARTICIPANT'S INFORMATION SHEET



PARTICIPANT INFORMATION SHEET

My name is Kim Oliver and I am conducting a research study as part of my PhD. I am a Registered Nurse and lecturer in the School of Nursing and Midwifery at Edith Cowan University. I am conducting a study to investigate whether the self-reporting of stress associated with the experience of nurses can be validated by the level of hair cortisol in these nurses.

What is this study about?

This study aims to compare the perceived occupational stress levels from a group of experienced registered nurses, as well as a group of first year nursing students, utilising a written questionnaire. Hair cortisol concentrations levels will be examined to see if these cortisol levels validate self-reported levels of stress.

Why am I being invited to participate in this study?

As a registered nurse currently practicing within the nursing profession, you have firsthand knowledge of the occupational workplace stressors that impact on the nursing profession. For this reason you are invited to share your thoughts on your workplace experiences.

If I decide to participate, what will happen?

Participation in this study is **voluntary**, any decision you make will not affect your employment or any benefit to which you would be otherwise entitled.

If you decide to take part in the study you will be asked to complete and return a signed Consent Form on the day prior to commencing the study.

Once you have complete your consent form, you will be invited to share your thoughts through a written questionnaire, and a small hair sample will be obtained following your consent, from the back of the head, just below the crown, approximately 15-20 strands dependent upon the thickness of the hair, to enable analysis of the hair cortisol levels.

If you wish to complete the written questionnaire, without giving a hair sample for analysis, you will still be able to partake in this study.

What are the costs to me?

There are no costs associated with participating in this study.

Do I have to take part in this study?

No, you do not have to participate in the hair cortisol analysis, nor the written questionnaire. If you decide to take part, you may decide to withdraw at any time until your survey has been submitted. You do not need to give a reason, and there will be no penalty if you do withdraw.

Are there any reasons I should not be in the study?

You should not participate in this study if you do not wish to record your perceived level of stress or if:-

- Had any traumatic event either physical or psychological (pertaining to shocking, distressing, hurtful, harrowing, painful, serious or life threatening illness, loss, grief, cancer to the individual or close family member), within previous three months.
- A nurse not employed within the hospital
- Under the age of 18.

For participants willing to supply a hair sample the follow exclusion criteria apply

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You may enjoy sharing your thoughts and feelings about your perceived level of stress through the use of the questionnaire. Findings from this study will also add to the knowledge and evidence base, which can be used to provide direction for nurse education in relation to stressors within nursing and the wellbeing of nurses throughout the nursing profession in Western Australia (WA).

What are the possible side effects, risks and discomforts of taking part?

There is a risk you may feel discomfort about exploring your perceived stress; you are free to stop at any time, and recommence when you feel you wish to do so, or you can withdraw if you feel this is too uncomfortable to continue with this study. Furthermore, Beyond Blue is always available to discuss your feelings and thoughts on phone number: 1300 22 4636. Your information will enable a better understand of the stressors nurses report, and whether hair cortisol levels can validate self-reported levels of stress within the nursing profession in Western Australia.

How will my privacy be protected?

Your decision to take part in the study, or not, will be kept confidential. If you agree, your questionnaire and hair sample will be allocated a numeric number so the questionnaire and hair sample can be linked together for data analysis. Identifiable data will not be obtained. Only the researcher will have access to this data. Any information that identifies a person will

be removed at the time of transcription by the Principal Investigator who will transcribe the numeric data from the questionnaires into SPSS for analysis.

The written questionnaire and hair sample will only be identified by a numeric code. This information will be stored on a password protected computer in the locked office of the researcher. All consent forms will be scanned and digitally recorded. The paper records will be destroyed once the data is uploaded onto the computer. Once hair samples have been sent to the laboratory for analysis of hair cortisol levels, they will be destroyed through the appropriate destruction of human tissue sample by the laboratory. The study data will be retained for a period of five years after the submission of the PhD thesis for examination, as per Edith Cowan University records and management policy and NHMRC guidelines for research involving human participants.

The thesis will discuss broad themes that came up in the questionnaires. No names will be used, but some unidentified comments may appear as examples to show important points.

It is anticipated the findings from this study will be published through health journals and shared at professional meetings, as well as part of my doctoral thesis. No identifying information will be published and data will be reported in the aggregate only. By taking part in this study, you agree not to restrict the use of any data even if you withdraw. Your rights under any applicable data protection laws are not affected.

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If you have any questions or require any further information about the research project, please contact the Principal Investigator Kim Oliver on mobile 0435310869.

You can also contact my supervisor:
Associate Professor Jacques Oosthuizen
Faculty of Health, Engineering & Science
School of Exercise and Health Sciences
Edith Cowan University
Ph. (08) 6304 5876
Email: j.oosthuizen@ecu.edu.au

If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:

Research Ethics Officer
Edith Cowan University
270 Joondalup Drive
Joondalup WA 6027
Ph. (08) 6304 2170
Email: research.ethics@ecu.edu.au



Who has given permission for this study to proceed?

The Joondalup Health Campus Human Research Ethics Committee and Edith Cowan University Human Research Ethics Committee have approved the ethical aspects of this study.



Thank you for taking the time to read this Invitation Letter – It is yours to keep.

APPENDIX D ONE MINUTE UPDATE

ONE MINUTE UPDATE
Your weekly JHC staff news update

Calling all nurses!

ECU lecturer, Kim Oliver, is looking for nurses to participate in a research study into stress and cortisol levels. The study will investigate whether the self-reporting of stress is associated with the experience of the nurse and if cortisol levels found in hair validated an individual's perceived stress level. For more information on this study and how to participate, email Kim Oliver on k.oliver@ecu.edu.au or call 6304 3497

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6 of 7

Panasonic

APPENDIX E SALIMETRICS – SALIVARY CORTISOL ENZYME IMMUNOASSAY KIT

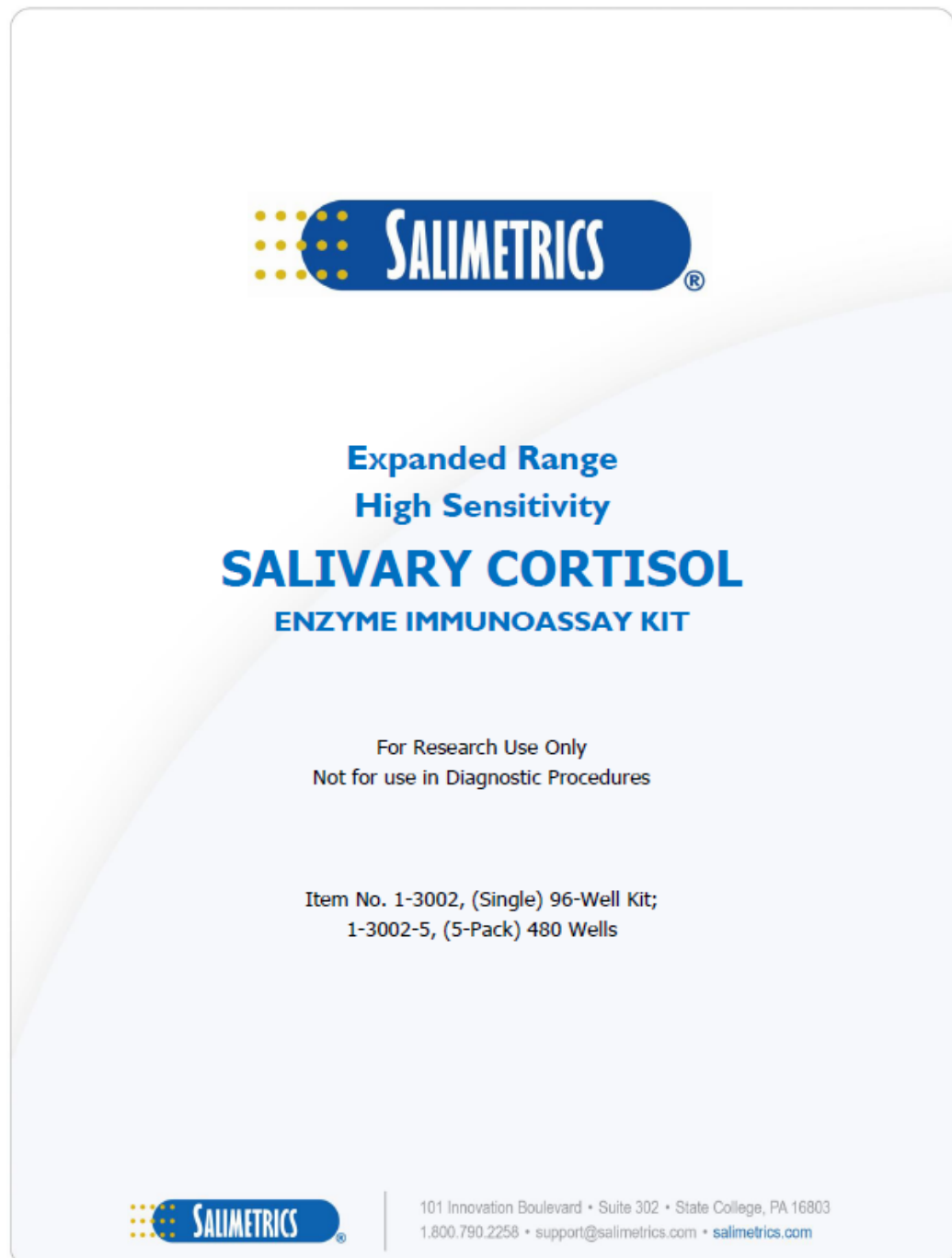


TABLE OF CONTENTS

Intended Use	1
Introduction	1
Test Principle	2
Safety Precautions	2
General Kit Use Advice	3
Storage	3
pH Indicator	3
Specimen Collection	4
Sample Handling and Preparation	4
Materials Supplied with Single Kit	5
Materials Needed But Not Supplied	6
Reagent Preparation	7
Procedure	7
Quality Control	9
Calculations	9
Typical Results	10
Limitations	11
Salivary Cortisol Example Ranges	11
Salivary Cortisol EIA Kit Performance Characteristics	13
References	18
Seller's Limited Warranty	19



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Intended Use

The Salimetrics® Cortisol Enzyme Immunoassay Kit is a competitive immunoassay specifically designed and validated for the quantitative measurement of salivary cortisol. It is not intended for diagnostic use. It is intended only for research use in humans and some animals. Salimetrics has not validated this kit for serum or plasma samples.

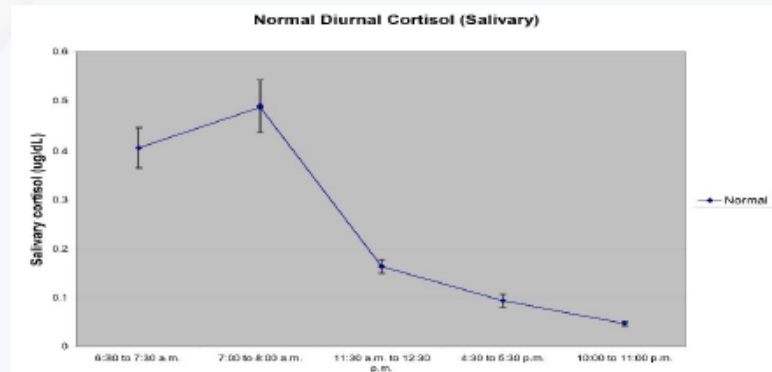
Please read the complete kit insert before performing this assay. Failure to follow kit procedure and recommendations for saliva collection and sample handling may result in unreliable values.

For further information about this kit, its application, or the procedures in this insert, please contact the technical service team at Salimetrics or your local sales representative.

Introduction

Cortisol (hydrocortisone, Compound F) is the major glucocorticoid produced in the adrenal cortex. (1) Cortisol production has a circadian rhythm, (2,3) with levels peaking in the early morning and dropping to lowest values at night. (4,5) Levels rise independently of circadian rhythm in response to stress. (6)

In blood, only about 5-10% of cortisol is in its unbound or biologically active form. The remaining cortisol is bound to serum proteins. (7) Unbound serum cortisol enters saliva via intracellular mechanisms; in saliva, the majority of cortisol remains unbound to protein. Salivary cortisol levels are unaffected by salivary flow rate and are relatively resistant to degradation from enzymes or freeze-thaw cycles. (8,9) Studies consistently report high correlations between serum and salivary cortisol, indicating that salivary cortisol levels reliably estimate serum cortisol levels. (10-12)



(Internal Salimetrics Data, n=26. Time of cortisol peak will vary in individuals relative to their normal wake-up time.)



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Test Principle

This is a competitive immunoassay kit. Cortisol in standards and samples compete with cortisol conjugated to horseradish peroxidase for the antibody binding sites on a microtitre plate. After incubation, unbound components are washed away. Bound cortisol enzyme conjugate is measured by the reaction of the horseradish peroxidase enzyme to the substrate tetramethylbenzidine (TMB). This reaction produces a blue color. A yellow color is formed after stopping the reaction with an acidic solution. The optical density is read on a standard plate reader at 450 nm. The amount of cortisol enzyme conjugate detected is inversely proportional to the amount of cortisol present, in the sample. (13)

Safety Precautions

Read Safety Data Sheets before handling reagents.

Hazardous Ingredients

Liquid stop solution is caustic; use with care. We recommend the procedures listed below for all kit reagents.

Handling

Follow good laboratory practices when handling kit reagents. Laboratory coats, gloves, and safety goggles are recommended. Wipe up spills using appropriate absorbent materials while wearing protective clothing. Follow local regulations for disposal.

Emergency Exposure Measures

In case of contact, immediately wash skin or flush eyes with water for 15 minutes. Remove contaminated clothing. If inhaled, remove individual to fresh air. If individual experiences difficulty breathing call a physician.

The above information is believed to be accurate but is not all-inclusive. This information should be used only as a guide. Salimetrics will not be liable for accidents or damage resulting from misuse of product.

Safety Data Sheets are available by contacting Salimetrics at support@salimetrics.com (See www.salimetrics.com for alternative contact options).

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General Kit Use Advice

- This kit uses break-apart microtitre strips. You may run less than a full plate. Unused wells must be stored at 2-8°C in the foil pouch with desiccant and used in the frame provided.
- Avoid microbial contamination of opened reagents. Salimetrics recommends using opened reagents within one month. Store all reagents at 2-8°C.
- The quantity of reagent provided with a single kit is sufficient for three partial runs. The volumes of wash buffer and enzyme conjugate prepared for assays using less than a full plate should be scaled down accordingly, keeping the same dilution ratio.
- Do not mix components from different lots of kits.
- To ensure highest quality assay results, pipetting of samples and reagents must be done as quickly as possible (without interruption) across the plate. Ideally, the process should be completed within 20 minutes or less.
- When using a multichannel pipette to add reagents, always follow the same sequence when adding all reagents so that the incubation time is the same for all wells.
- When running multiple plates, or multiple sets of strips, a standard curve must be run with each individual plate and/or set of strips.
- The temperature of the laboratory may affect assays. Salimetrics' kits have been validated at 68-74°F (20-23.3°C). Higher or lower temperatures may affect OD values.
- Routine calibration of pipettes and other equipment is critical for the best possible assay performance.
- When mixing plates during assay procedures, avoid speeds that spill the contents of the wells.

Storage

All unopened components of this kit are stable at 2-8°C until the kit's expiration date.

pH Indicator

Cortisol values from samples with a pH ≤ 3.5 or ≥ 9.0 may be inaccurate. A pH indicator in the assay diluent alerts the user to samples with high or low pH values. Upon addition of the assay diluent, acidic samples will turn yellow and alkaline samples will turn purple. Dark yellow or purple wells indicate that a pH value for that sample should be obtained using pH strips. Samples with a pH ≤ 3.5 or ≥ 9.0 should be recollected. (14)



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Specimen Collection

Avoid sample collection within 60 minutes after eating a major meal or within 12 hours after consuming alcohol. Acidic or high sugar foods can compromise assay performance by lowering sample pH and influencing bacterial growth. To minimize these factors, rinse mouth thoroughly with water 10 minutes before sample is collected.

Collect whole saliva by unstimulated passive drool. Donors may tilt the head forward, allowing the saliva to pool on the floor of the mouth, and then passing the saliva through the SalivaBio Collection Aid (SCA) into a polypropylene vial. Collection protocols/methods are available online at www.salimetrics.com or upon request.

Samples visibly contaminated with blood should be recollected. Samples may be screened for possible blood contamination (15,16) using our Blood Contamination EIA Kit (Item Nos. 1-1302/1-1302-5). Do not use dipsticks, which result in false positive values due to salivary enzymes.

It is important to record the time and date of specimen collection when samples are obtained due to the diurnal variation in cortisol levels.

Sample Handling and Preparation

After collection it is important to keep samples cold, in order to avoid bacterial growth in the specimen. Refrigerate sample within 30 minutes, and freeze at or below -20°C within 4 hours of collection. (Samples may be stored at -20°C for up to 6 months.) For long term storage, refer to the Salimetrics Collection and Handling Advice Booklet.

Do not add sodium azide to saliva samples as a preservative, as it may cause interference in the immunoassay.

On day of assay, thaw the saliva samples completely, vortex, and centrifuge at 1500 x g (@3000 rpm) for 15 minutes. Freezing saliva samples will precipitate mucins. Centrifuging removes mucins and other particulate matter which may interfere with antibody binding and affect results. Samples should be at room temperature before adding to assay plate. Pipette clear sample into appropriate wells. Re-freeze saliva samples as soon as possible after adding to the assay plate. Re-centrifuge saliva samples each time that they are thawed. Avoid multiple freeze-thaw cycles.



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Materials Supplied with Single Kit

	Item	Quantity/Size
1	Microtitre Plate Coated with monoclonal anti-cortisol antibodies.	1/96 well
2	Cortisol Standard In a saliva-like matrix. Ready to use, traceable to NIST standard: 3.0, 1.0, 0.333, 0.111, 0.037, 0.012 µg/dL (82.77, 27.59, 9.19, 3.06, 1.02, 0.33 nmol/L). Contains: Cortisol, buffer, preservative.	6 vials / 500 µL each
3	Cortisol Controls High, Low, in a saliva-like matrix. Ready to use. Contain: Cortisol, buffer, preservative.	2 vials / 500 µL each
4	Cortisol Enzyme Conjugate Concentrate. Dilute before use with assay diluent. (See step 5 of Procedure.) Contains: Cortisol conjugated to HRP, preservative.	1 vial / 50 µL
5	Assay Diluent Contains: phosphate buffer, pH indicator, preservative.	1 bottle / 60 mL
6	Wash Buffer Concentrate (10X) Dilute before use according to Reagent Preparation. Contains: phosphate buffer, detergent, preservative.	1 bottle / 100 mL
7	TMB Substrate Solution Non-toxic, ready to use.	1 bottle / 25 mL
8	3 M Stop Solution Contains: sulfuric acid.	1 bottle / 12.5 mL
9	Non-Specific Binding (NSB) Wells Do not contain anti-cortisol antibody. Break off and insert as blanks (optional) where needed.	1 strip



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Materials Needed But Not Supplied

- Precision pipette to deliver 15 and 25 μL
- Precision multichannel pipette to deliver 50 μL and 200 μL
- Vortex
- Plate rotator with 0.08-0.17 inch orbit capable of 500 rpm
- Plate reader with 450 nm and 490 to 492 reference filters
- Computer software for data reduction
- Deionized water
- Reagent reservoirs
- One disposable polypropylene tube to hold at least 24 mL
- Pipette tips
- Serological pipette to deliver up to 24 mL
- Centrifuge capable of 1500 x g (@3000 rpm)



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Reagent Preparation

- Bring all reagents to room temperature and mix before use. A minimum of 1.5 hours is recommended for the 24 mL of assay diluent used in Step 5 (conjugate dilution) to come to room temperature.
- Bring microtitre plate to room temperature before use. ***It is important to keep the foil pouch with the plate strips closed until warmed to room temperature, as humidity may have an effect on the coated wells.***
- Prepare 1X wash buffer by diluting Wash Buffer Concentrate (10X) 10-fold with room-temperature deionized water (100 mL of Wash Buffer Concentrate (10X) to 900 mL of deionized H₂O). ***Dilute only enough for current day's use and discard any leftover reagent.*** (If precipitate has formed in the concentrated wash buffer, it may be heated to 40°C for 15 minutes. Cool to room temperature before use in assay.)

Procedure

Step 1: Read and prepare reagents according to the Reagent Preparation section before beginning assay. Determine your plate layout. Here is a suggested layout. (Standards, controls, and saliva samples should be assayed in duplicate.)

	1	2	3	4	5	6	7	8	9	10	11	12
A	3.000 Std	3.000 Std	Ctrl-H	Ctrl-H								
B	1.000 Std	1.000 Std	Ctrl-L	Ctrl-L								
C	0.333 Std	0.333 Std	SMP-1	SMP-1								
D	0.111 Std	0.111 Std	SMP-2	SMP-2								
E	0.037 Std	0.037 Std	SMP-3	SMP-3								
F	0.012 Std	0.012 Std	SMP-4	SMP-4								
G	Zero	Zero	SMP-5	SMP-5								
H	NSB*	NSB*	SMP-6	SMP-6								

*NSB = Non-specific binding wells. These may serve as blanks. Use is optional.



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Step 2: Keep the desired number of strips in the strip holder and place the remaining strips back in the foil pouch. If you choose to place non-specific binding wells in H-1, 2, remove strips 1 and 2 from the strip holder and break off the bottom wells. Place the strips back into the strip holder leaving H-1, 2 blank. Break off 2 NSB wells from the strip of NSB wells included in the foil pouch. Place in H-1, 2. Alternatively, NSBs may be placed wherever you choose on the plate. Reseal the foil pouch with unused wells and desiccant. Store at 2-8°C.

Cautions: *1. Extra NSB wells should not be used for determination of standards, controls, or unknowns.*

2. Do not insert wells from one plate into a different plate

Step 3: Pipette 24 mL of assay diluent into the disposable tube. (Scale down proportionally if using less than the entire plate.) Set aside for Step 5.

Step 4:

- Pipette 25 µL of standards, controls, and saliva samples into appropriate wells.
- Pipette 25 µL of assay diluent into 2 wells to serve as the zero.
- Pipette 25 µL of assay diluent into each NSB well.

Step 5: Dilute the enzyme conjugate 1:1600 by adding 15 µL of the conjugate to the 24 mL tube of assay diluent. (Scale down proportionally if not using the entire plate.) Conjugate tube may be centrifuged for a few minutes to bring the liquid down to the tube bottom. Immediately mix the diluted conjugate solution and add 200 µL to each well using a multichannel pipette.

Step 6: Mix plate on a plate rotator for 5 minutes at 500 rpm and incubate at room temperature for a total of 1 hour.

Step 7: Wash the plate 4 times with 1X wash buffer. A plate washer is recommended. However, washing may be done by gently squirting wash buffer into each well with a squirt bottle, or by pipetting 300 µL of wash buffer into each well and then discarding the liquid over a sink. After each wash, the plate should be thoroughly blotted on paper towels before turning upright. If using a plate washer, blotting is still recommended after the last wash.

Step 8: Add 200 µL of TMB Substrate Solution to each well with a multichannel pipette.

Step 9: Mix on a plate rotator for 5 minutes at 500 rpm and incubate the plate in the dark (covered) at room temperature for an additional 25 minutes.

Step 10: Add 50 µL of 3M Stop Solution with a multichannel pipette.



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Step 11:

- Mix on a plate rotator for 3 minutes at 500 rpm. If green color remains, continue mixing until green color turns to yellow. Be sure all wells have turned yellow.

Caution: Spillage may occur if mixing speed exceeds 600 rpm.

- Wipe off bottom of plate with a water-moistened, lint-free cloth and wipe dry.
- Read in a plate reader at 450 nm. Read plate within 10 minutes of adding 3M stop solution. (For best results, a secondary filter correction at 490 to 492 nm is recommended.)

Quality Control

The Salimetrics' high and low cortisol controls should be run with each assay. The control ranges established at Salimetrics are to be used as a guide. Each laboratory should establish its own range. Variations between laboratories may be caused by differences in techniques and instrumentation.

Calculations

1. Compute the average optical density (OD) for all duplicate wells.
2. Subtract the average OD for the NSB wells (if used) from the OD of the zero, standards, controls, and saliva samples.
3. Calculate the percent bound (B/Bo) for each standard, control, and saliva sample by dividing the OD of each well (B) by the average OD for the zero (Bo). (The zero is not a point on the standard curve.)
4. Determine the concentrations of the controls and saliva samples by interpolation using data reduction software. We recommend using a 4-parameter non-linear regression curve fit.
5. Samples with cortisol values greater than 3.0 µg/dL (82.77 nmol/L) should be diluted with assay diluent and rerun for accurate results. If a dilution of the sample is used, multiply the assay results by the dilution factor.

A new Standard Curve must be run with each full or partial plate.



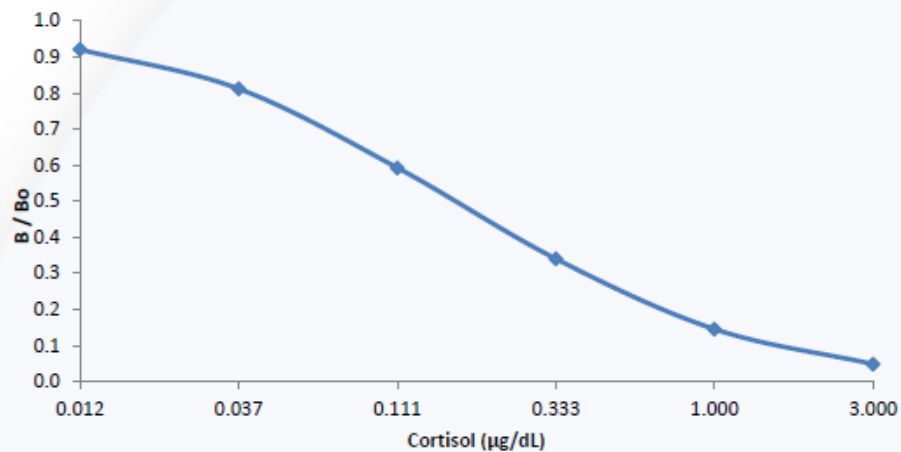
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Typical Results

The results shown below are for illustration only and should not be used to calculate results from another assay.

Well	Standard	Average OD	B	B/Bo	Cortisol (µg/dL)
A1,A2	S1	0.094	0.071	0.048	3.000
B1,B2	S2	0.236	0.213	0.145	1.000
C1,C2	S3	0.524	0.501	0.340	0.333
D1,D2	S4	0.897	0.874	0.593	0.111
E1,E2	S5	1.219	1.196	0.812	0.037
F1,F2	S6	1.379	1.356	0.921	0.012
G1,G2	Bo	1.496	1.473	NA	NA
H1,H2	NSB	0.023	NA	NA	NA

Example: HS Cortisol 4-Parameter Curve Fit



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Limitations

- Samples with cortisol values greater than 3.0 µg/dL (82.77 nmol/L) should be diluted with assay diluent and rerun for accurate results. To obtain the final cortisol concentration, multiply the concentration of the diluted sample by the dilution factor.
- A pH value should be obtained on samples that appear yellow or purple after the diluted conjugate solution is added and the plate is mixed (Step 6). Samples with pH values ≤ 3.5 or ≥ 9.0 should be recollected.
- See "Specimen Collection" recommendations to insure proper collection of saliva specimens and to avoid interfering substances.
- Samples collected with sodium azide are unsuitable for this assay.
- Any quantitative results indicating abnormal cortisol levels should be followed by additional testing and evaluation.

Salivary Cortisol Example Ranges*

Group	Number	Overall Range (µg/dL)
Children, neonatal	275	ND - 3.417
Children, age 6 months	165	ND - 2.734

Group	Number	23:00 hrs (µg/dL)
Normal subjects	19	0.007 – 0.115
Cushing's subjects	21	0.130 – 2.972



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Group	Number	AM Range (µg/dL)	PM Range (µg/dL)
Children, ages 2.5-5.5	112	0.034 - 0.645	0.053 - 0.607
Children, ages 8-11	285	0.084 - 0.839	ND - 0.215
Adolescents, ages 12-18	403	0.021 - 0.883	ND - 0.259
Adult males, ages 21-30	26	0.112 - 0.743	ND - 0.308
Adult females, ages 21-30	20	0.272 - 1.348	ND - 0.359
Adult males, ages 31-50	67	0.122 - 1.551	ND - 0.359
Adult females, ages 31-50	31	0.094 - 1.515	ND - 0.181
Adult males, ages 51-70	28	0.112 - 0.812	ND - 0.228
Adult females, ages 51-70	23	0.149 - 0.739	0.022 - 0.254
All adults	192	0.094 - 1.551	ND - 0.359

*To be used as a guide only. Each laboratory should establish its own range.

ND = None detected

Expected ranges for neonates to 5.5 years were derived using the Salimetrics Salivary Cortisol Immunoassay Kit. Expected ranges for 8 to 18 years were reported from an unpublished manuscript, Pennsylvania State University's Behavioral Endocrinology Laboratory. Adult ranges were obtained from published literature. (7)



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HS Salivary Cortisol EIA Kit Performance Characteristics

Precision

The intra-assay precision was determined from the mean of 20 replicates each.

Saliva Sample	N	Mean (µg/dL)	Standard Deviation (µg/dL)	Coefficient of Variation (%)
PS1	20	2.07	0.08	4
PS2	20	1.14	0.05	4
PS3	20	0.42	0.01	3
PS4	20	0.16	0.01	5
PS5	20	0.06	0.00	7

The inter-assay precision was determined from the mean of average duplicates for 20 separate runs.

Saliva Sample	N	Mean (µg/dL)	Standard Deviation (µg/dL)	Coefficient of Variation (%)
PS1	20	1.99	0.05	3
PS2	20	1.16	0.05	4
PS3	20	0.43	0.01	3
PS4	20	0.18	0.01	9
PS5	20	0.06	0.01	11



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Recovery

Five saliva samples containing different levels of an endogenous cortisol were spiked with known quantities of cortisol and assayed.

Saliva Sample	Endogenous (µg/dL)	Added (µg/dL)	Expected (µg/dL)	Observed (µg/dL)	Recovery (%)
1	0.071	2.00	2.07	2.20	106
2	0.071	0.20	0.27	0.28	104
3	0.071	0.04	0.11	0.11	98
4	0.078	2.33	2.41	2.33	97
5	0.078	0.20	0.28	0.31	113
6	0.080	0.04	0.12	0.12	103
7	0.86	0.20	1.06	1.16	109
8	0.89	0.04	0.93	1.02	109

Analytical Sensitivity

The lower limit of sensitivity was determined by interpolating the mean optical density minus 2 SDs of 10 sets of duplicates at the 0 µg/dL level. The minimal concentration of cortisol that can be distinguished from 0 is 0.007 µg/dL.

Correlation with Serum

The correlation between serum and saliva cortisol was determined by assaying 49 matched samples using the Diagnostic Systems Laboratories serum Cortisol EIA and the Salimetrics HS Salivary Cortisol EIA.

The correlation between saliva and serum was highly significant, $r(47) = 0.91$, $p < 0.0001$.



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Sample Dilution Recovery

Four saliva samples were diluted with assay diluent and assayed.

Saliva Sample	Dilution Factor	Expected (µg/dL)	Observed (µg/dL)	Recovery (%)
S1	undiluted	N/A	0.73	N/A
	1:2	0.37	0.39	107
	1:4	0.18	0.20	111
	1:8	0.09	0.10	111
	1:16	0.05	0.05	105
S2	undiluted	N/A	0.80	N/A
	1:2	0.40	0.40	101
	1:4	0.20	0.19	97
	1:8	0.10	0.09	94
	1:16	0.05	0.05	110
S3	undiluted	N/A	0.61	N/A
	1:2	0.31	0.30	98
	1:4	0.15	0.15	101
	1:8	0.08	0.08	108
	1:16	0.04	0.04	108
S4	undiluted	N/A	2.89	N/A
	1:2	1.45	1.53	105
	1:4	0.72	0.77	106
	1:8	0.36	0.42	115
	1:16	0.18	0.20	108



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Linearity of Assay

Saliva Sample	Samples		Avg Observed (µg/dL)	Expected (µg/dL)	Recovery (%)
	Low	High			
a (Low)	100%	0%	0.07	0.07	N/A
b	90%	10%	0.36	0.34	108
c	80%	20%	0.63	0.61	104
d	70%	30%	0.93	0.88	106
e	60%	40%	1.13	1.15	98
f	50%	50%	1.45	1.42	102
g	40%	60%	1.64	1.69	97
h	30%	70%	1.88	1.96	96
i	20%	80%	2.27	2.23	102
j	10%	90%	2.49	2.50	99
k (High)	0%	100%	2.77	2.77	N/A



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Antibody Specificity

Compound	Spiked Concentration (ng/mL)	% Cross-reactivity in HS Salivary Cortisol EIA
Prednisolone	100	0.568
Prednisone	1000	ND
Cortisone	1000	0.130
11-Deoxycortisol	500	0.156
21-Deoxycortisol	1000	0.041
17 α -Hydroxyprogesterone	1000	ND
Dexamethasone	1000	19.2
Triamcinolone	1000	0.086
Corticosterone	10,000	0.214
Progesterone	1000	0.015
17 β -Estradiol	10	ND
DHEA	10,000	ND
Testosterone	10,000	0.006
Transferrin	66,000	ND
Aldosterone	10,000	ND

ND = None detected (<0.004)



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APPENDIX F BACKGROUND INFORMATION TO THE PARTICIPANT



BACKGROUND INFORMATION TO THE PARTICIPANT

Perceived Stress: Is the self-reporting of stress associated with the experience of the nurse? Furthermore, do cortisol levels found in hair validate self-reported stress?

Investigators:

Kim Oliver – Lead investigator

Associate Professor Dr. Jacques Oosthuizen – co-investigator

Dr. Martyn Cross – co-investigator

Dr. Amanda Towell – co-investigator

Edith Cowan University, School of Exercise and Health Sciences

ECU Human Research Ethics Committee and Joondalup Health Campus have approved this study.

BACKGROUND

Within any working environment, people are exposed to various sources of stress. How people perceive and interpret their own health is a good indicator of the health of the population. This impacts the larger community through medical and legal expenses, and decreased productivity and morale. Whilst there have been numerous studies exploring stressors for student and graduate nurses, less has been conducted on nurse managers and those in leadership roles.

The aim of this study is to explore whether perceived stress levels are associated with the experience of the nurse. Additionally, whether perceived stress levels correlate with the individuals hair cortisol. Findings from this study will aid the development of stress reducing strategies, positively impact on retention, injury rates, furthermore, aid job satisfaction, and patient care.

PROTOCOL

This research project is divided into two different experiments.

- 1) Completion of a written questionnaire comprising of general information Perceived Stress Scale – 10 and Work Stress Profile (20minutes to complete)
- 2) A sample of hair approximately 50mg (approximately 15-20 strands depending on thickness of hair), 2cm in length from the back of the head.

All questions are welcomed; the researchers will undertake to give clarification and answers.

Please answer the following questions: -

What is your age in years

How many years have you been nursing? (Exclude gap years)

Gender (please circle): Male / Female / Other

Currently what level nurse are you? 1st year student / 1st year nurse / 2-5 years post qualification / 5-8 years post qualification / greater than 8 years / manager (circle one)

If you have been practicing for 2-10 years or are a manager, what area do you currently practice in? (circle one)

Surgical	ICU	High Dependency Department
Medical	Outpatients	Emergency Department
Rehab	Mental health	Other.....

Are there causes (or reasons) for stress in your personal life? Yes / No (circle one)

Comments.....

Educational background: circle the highest, which you have achieved

Year 10	Year 12	TAFE Cert
TAFE Diploma	Degree	Masters

Perceived Stress Scale -10

INSTRUCTIONS:

The following questions ask about your feelings and thoughts during THE PAST MONTH. In each question, you will be asked HOW OFTEN you felt or thought a certain way. Although some of the questions are similar, there are small differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the exact number of times you felt a particular way, but tell me the answer that in general seems the best.

For each statement, please tell me if you have had these thoughts or feelings: never, almost never, sometimes, fairly often, or very often. (Read all answer choices each time)

	Never	Almost Never	Sometimes	Fairly Often	Very Often
1. In the past month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the past month, how often have you felt unable to control the important things in your life?	0	1	2	3	4
3. In the past month, how often have you felt nervous or stressed?	0	1	2	3	4
4. In the past month, how often have you felt confident about your ability to handle personal problems?	0	1	2	3	4
5. In the past month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the past month, how often have you found that you could not cope with all the things you had to do?	0	1	2	3	4
7. In the past month, how often have you been able to control irritations in your life?	0	1	2	3	4

8. In the past month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the past month, how often have you been angry because of things that happened that were outside of your control?	0	1	2	3	4
10. In the past month, how often have you felt that difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Permission to use Perceived Stress Scale 10 for research purposes, obtained from Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A Global Measure of Perceived Stress *Journal of Health and Social Behavior*, 24(4), 385-396.

Work stress profile

The following statements describe work conditions, job environment, or personal feelings that workers encounter in their jobs. After reading each statement, circle the answer that best reflects the working conditions at your place of employment, or your practicum experience:

Never – not at all true of your work conditions or feelings.

Often - exists about 75% of the time

Rarely – exists about 25% of the time

Most times – the condition or feeling is virtually always present

	Never	Rarely	Some time	Often	Most time
1. Support personnel are incompetent or inefficient	1	2	3	4	5
2. My job is not very well defined	1	2	3	4	5
3. I am not sure about what is expected of me	1	2	3	4	5
4. I am not sure what will be expected of me in the future	1	2	3	4	5
5. I cannot seem to satisfy my superiors	1	2	3	4	5
6. I seem to be able to talk with my superiors	1	2	3	4	5
7. My superiors strike me as incompetent, yet I have to take orders from them	1	2	3	4	5
8. My supervisors seem to care about me as a person	1	2	3	4	5
9. There are feelings of trust, respect, and friendliness between me and my superiors	1	2	3	4	5
10. There seems to be tension between administrative personnel and staff personnel	1	2	3	4	5
11. I have autonomy in carrying out my job duties	1	2	3	4	5
12. I feel as though I can shape my own destiny in this job	1	2	3	4	5
13. There are too many bosses in my area	1	2	3	4	5
14. It appears that my boss has 'retired' on the job	1	2	3	4	5
15. My superiors give me adequate feedback about my job performance	1	2	3	4	5
16. My abilities are not appreciated by my superiors	1	2	3	4	5
17. There is little prospect of personal or professional growth in this job	1	2	3	4	5

18. The level of participation in planning and decision making at my place of work is satisfactory	Never 1	Rarely 2	Some time 3	Often 4	Most time 5
19. I feel that I am over-educated for this job	1	2	3	4	5
20. I feel that my educational background is just right for this job	1	2	3	4	5
21. I fear that I will be laid off or fired	1	2	3	4	5
22. In-service training for my job is inadequate	1	2	3	4	5
23. Most of my colleagues are unfriendly or seem uninterested in me as a person	1	2	3	4	5
24. I feel uneasy about going to work	1	2	3	4	5
25. There is no release time for personal affairs or business	1	2	3	4	5
26. There is obvious sex/race/age discrimination in this job	1	2	3	4	5
27. The physical work environment is crowded, noisy, or dreary	1	2	3	4	5
28. Physical demands of the job are unreasonable (heavy lifting, extraordinary periods of concentration required, etc.).	1	2	3	4	5
29. My workload is never-ending	1	2	3	4	5
30. The pace of work is too fast	1	2	3	4	5
31. My job seems to consist of responding to emergencies	1	2	3	4	5
32. There is no time for relaxation, coffee breaks, or lunch breaks on the job	1	2	3	4	5
33. Job deadlines are constant and unreasonable	1	2	3	4	5
34. Job requirements are beyond the range of my ability	1	2	3	4	5
35. At the end of the day, I am physically exhausted from work	1	2	3	4	5
36. I can't even enjoy my leisure because of the toll my job takes on my energy	1	2	3	4	5
37. I have to take work home to keep up	1	2	3	4	5
38. I have responsibility for too many people	1	2	3	4	5
39. Support personnel are too few	1	2	3	4	5
40. Support personnel are incompetent or inefficient	1	2	3	4	5
41. I am not sure about what is expected of me	1	2	3	4	5

42. I am not sure what will be expected of me in the future	Never	Rarely	Some time	Often	Most time
	1	2	3	4	5
43. I leave work feeling burned out	1	2	3	4	5
44. There is little prospect for personal or professional growth in this job	1	2	3	4	5
45. In-service training for my job is inadequate	1	2	3	4	5
46. There is little contact with colleagues on the job	1	2	3	4	5
47. Most of my colleagues are unfriendly or seem uninterested in me as a person	1	2	3	4	5
48. I feel uneasy about going to work	1	2	3	4	5
49. The complexity of my job is enough to keep me interested	1	2	3	4	5
50. My job is very exciting	1	2	3	4	5
51. My job is varied enough to prevent boredom	1	2	3	4	5
52. I seem to have lost interest in my work	1	2	3	4	5
53. I feel as though I can shape my own destiny in this job	1	2	3	4	5
54. I leave work feeling burned out	1	2	3	4	5
55. I would continue to work at my job even if I did not need the money	1	2	3	4	5
56. I am trapped in this job	1	2	3	4	5
57. If I had it to do all over again, I would still choose this job	1	2	3	4	5

Permission to use the Work Stress Profile for research purposes, obtained from Rice, P. L. (1999). *Stress and Health* (3rd ed.): USA: Brooks/Cole.

Thank you for taking the time to participate.

APPENDIX G CONSENT FORM



CONSENT FORM

*Perceived Stress: Is the self-reporting of stress associated with the experience of a nurse?
Furthermore, do cortisol levels found in hair validate self-reported stress?*

Participant Name: _____

Date of birth: _____

1. I have been given information, verbally, about this study and having had time to consider it, am now able to make an informed decision to participate.
2. I have been told about the potential benefits and possible risks of taking part in this study and I understand what this means to me.
3. I have been given the opportunity to discuss this study with the researcher, as well as a member of my family or friend. I have been able to ask questions and have had all my questions answered.
4. I know that I do not have to take part in this study, and my decision to take part is voluntary. I know I can withdraw from this study without this decision affecting my employment.
5. I understand I can withdraw at any time until the questionnaire and hair sample have been submitted. I understand I cannot withdraw after this point.
6. I accept that by taking part in this research, any information obtained from me during the study may be published, provided my name and other identifying information are not used.

_____ Name of Participant	_____ Signature of Participant	_____ Date
------------------------------	-----------------------------------	---------------

_____ Name of Researcher	_____ Signature of Researcher	_____ Date
-----------------------------	----------------------------------	---------------

The Joondalup Health Campus Human Research Ethics Committee, and Edith Cowan University have approved the ethical aspects of this study. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact The Research Ethics Officer, Edith Cowan University. Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

APPENDIX H HAIR CORTISOL LEVELS AND CLASSIFICATION

Hair cortisol level	Classification
0.352	High beige (>2.5ng/50mg)
0.406	
0.443	
0.311	
9.660	
0.293	
0.532	
0.368	
0.389	
0.360	
0.237	Medium – green (>0.1 – 2.5ng/50mg)
0.192	
0.222	
0.135	
0.148	
0.186	
0.129	
0.206	
0.119	
0.183	
0.104	
0.133	
0.168	
0.153	
0.124	
0.138	
0.189	
0.141	
0.137	
0.182	
0.142	
0.200	
0.178	
0.246	
0.152	
0.175	
0.147	
0.239	
0.163	

0.106	
0.227	
0.115	
0.119	
0.129	
0.129	
0.105	
0.126	
0.126	
0.136	
0.151	
0.112	
0.185	
0.154	
0.172	
0.124	
0.077	Low – blue (<0.1ng/50mg)
0.063	
0.074	
0.087	
0.076	
0.094	
0.067	
0.094	
0.062	
0.078	
0.099	
0.072	
0.071	
0.063	
0.088	
0.054	
0.077	
0.069	
0.091	
0.077	
0.053	
0.086	
0.080	
0.099	
0.079	
0.082	
0.076	
0.093	
0.067	
0.066	

APPENDIX I OUTLIER TABLE

Table 11: Overview of outliers (n=21)

Participant	Question excluded	Comments	Rationale for exclusion	Reference figure	Likelihood of impact
14	All questions answered	<ul style="list-style-type: none"> • A low PSS-10 score (15) highlighted when comparing differences between PSS-10 score and: • Age - 41-50, level of education - degree, working - domain private, and area of practice - other. 	A boxplot contains the middle 50% of scores; the 'whiskers' extend to the highest and lowest score in that distribution, other than the outliers. An outlier score is between 1.5 and 3 box lengths above or below the box boundaries and denoted with a circle or asterisk (Field, 2013).	Figures 3,5,6,7	No impact on results
16	All questions answered	<ul style="list-style-type: none"> • A high PSS-10 score (18) highlighted when comparing differences between PSS-10 score and: • Area of practice - medical 	"	Figure 7	No impact on results
133	All questions answered	<ul style="list-style-type: none"> • A low PSS-10 score (13) highlighted when comparing PSS score against: • Experience – student, level of education – TAFE, Services – student, area of practice – student, level of nurse – 1st year student nurse 	"	Figures 4,5,6,7,8	No impact on results
75	All questions answered	<ul style="list-style-type: none"> • A high PSS-10 score (15) highlighted when comparing differences between PSS-10 score and: • Level of nurse – 1st year nurse post graduation 	"	Figure 8	No impact on results
91	All questions answered	<ul style="list-style-type: none"> • A low PSS-10 score (15) highlighted when comparing differences between PSS-10 score and: • Level of nurse – 5-8 years post graduation 	"	Figure 8	No impact on results
60	All questions answered	<ul style="list-style-type: none"> • A high WSP 'work inter-relationship' score (76), and 'personal interests' score (23) highlighted when comparing differences with: 	"	Figures 9,10,11,12, 13,14,28	No impact on results

		<ul style="list-style-type: none"> • Age group – 25-30 years education – degree, experience – 1-10 years, service domain – private, area of practice – surgical, level of nurse – 2-5 years post graduation. 			
86	All questions answered	<ul style="list-style-type: none"> • A high WSP 'work inter-relationship' score (71) • WSP 'Physical demands' score (53) • Led to a high • WSP 'collective totals' score (158) as highlighted when comparing differences with: <ul style="list-style-type: none"> • Experience 1-10 years • Age – 31-40 years, • Level of education – degree, • Service domain – public, • Area of practice - emergency, • Level of nurse – 5-8 years post qualification 	“	Figures 11,16,17, 18,19,21, 31,32,33, 34	No impact on results
80	All questions answered	<ul style="list-style-type: none"> • A high WSP 'work inter-relationship' score (92) compared to other participants with an experience level of 1-10 years 	“	Figures 11	No impact on results
83	All questions answered	<ul style="list-style-type: none"> • A low WSP 'work inter-relationship' score (73) compared to other participants with an experience level of 1-10 years 	“	Figures 11	No impact on results
30	All questions answered	<ul style="list-style-type: none"> • A low WSP 'work inter-relationship' score (65) compared to other participants in the public service domain • Who's practice area is the emergency department 	“	Figures 12,13	No impact on results
134	All questions answered	<ul style="list-style-type: none"> • A high WSP 'Physical demands' score (54) led to a high WSP 'collective totals' score (146) that was highlighted when comparing differences with: <ul style="list-style-type: none"> • Educational background – degree • Experience - student 	“	Figures 17,18,19, 20,21	No impact on results
79	All questions answered	<ul style="list-style-type: none"> • A high WSP 'Physical demands' score (68) led to a high WSP 'collective totals' score (160) that was highlighted when comparing the differences with: <ul style="list-style-type: none"> • Educational background - degree 	“	Figures 17,31	No impact on results

118	All questions answered	<ul style="list-style-type: none"> • A low WSP 'Physical demands' score (67) led to a low WSP 'collective totals' score (162) as highlighted when exploring the differences with educational level – year 12, and age group <25, experience - student 	“	Figures 17,30,31, 32,33,34	No impact on results
130	All questions answered	<ul style="list-style-type: none"> • A low WSP 'Physical demands' score (37) as highlighted when exploring the differences with educational level – year 12 	“	Figures 17	No impact on results
172	All questions answered	<ul style="list-style-type: none"> • A high WSP 'Physical demands' score (35) as highlighted when exploring the differences with: • Area of practice – emergency department and • Level of nurse >8 years post graduation 	“	Figures 20,21	No impact on results
39	All questions answered	<ul style="list-style-type: none"> • A low WSP 'Personal interests' score (26) as highlighted when exploring the differences with: • Age group 31-40 years • Educational background – degree • Area of practice - other 	“	Figures 23,24,27	No impact on results
135	All questions answered	<ul style="list-style-type: none"> • A low WSP 'Personal interests' score (21) as highlighted when exploring the differences with: • Age group 31-40 years 	“	Figures 23	No impact on results
113	All questions answered	<ul style="list-style-type: none"> • A low WSP 'Personal interests' score (15) as highlighted when exploring the differences with: • Age group 31-40 years 	“	Figures 23	No impact on results
151	All questions answered	<ul style="list-style-type: none"> • A low WSP 'Personal interests' score (26) as highlighted when exploring the differences with: • Age 31-40 years 	“	Figures 23	No impact on results
69	All questions answered	<ul style="list-style-type: none"> • A low WSP 'Personal interests' score (33) as highlighted when exploring the differences with: • Level of nurse – 2-5 years post qualification 	“	Figures 28	No impact on results
59	All questions answered	<ul style="list-style-type: none"> • A low WSP 'Personal interests' score (31) as highlighted when exploring the differences with: Level of nurse – 2-5 years post qualification 	“	Figures 28	No impact on results

APPENDIX J TOM COX CONSENT

RE: Figure 1.10 : Transactional Model of Stress (Cox and Mackay) from m... <https://staffmail.ecu.edu.au/owa/?ac=Item&t=IPM.Note&id...>

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RE: Figure 1.10 : Transactional Model of Stress (Cox and Mackay) from m To m Cox's Stress (1978) (ISBN-10 : 0333194039)
 Christianson, Sarraounia [Sarraounia.Christianson@palgrave.com]

Sent: Friday, 7 August 2015 6:42 PM
 To: Kim OLIVER

Dear Kim,

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Let me know if you have any further questions.

Kind Regards,
 Ousie

-----Original Message-----
 From: Kim OLIVER [mailto:k.oliver@ecu.edu.au]
 Sent: 06 August 2015 07:52
 To: Christianson, Sarraounia
 Subject: FW: Figure 1.10 : Transactional Model of Stress (Cox and Mackay) from m To m Cox's Stress (1978) (ISBN-10 : 0333194039)

Hi Ousie,

Did you receive this attachment, also what do I do now to obtain consent to use this diagram?

Regards Kim Oliver
 Lecturer School of Nursing and Midwifery Building 21, Room 420
 Ph (618) 6304 3497 Fax (618) 6304 2323
 k.oliver@ecu.edu.au
 Faculty of Health, Engineering and Science Edith Cowan University
 276 Joondalup Drive, Joondalup WA6027

From: Kim OLIVER
 Sent: Saturday, 1 August 2015 9:03 AM
 To: Christianson, Sarraounia
 Subject: RE: Figure 1.10 : Transactional Model of Stress (Cox and Mackay) from m To m Cox's Stress (1978) (ISBN-10 : 0333194039)

Hi Ousie

I have had trouble saving the whole PhD but here is the page with the permission granted

Let me know if you need anything else, and what I should do now to try and obtain permission to use this diagram

Regards
 Kim Oliver
 Lecturer School of Nursing and Midwifery Building 21, Room 420
 Ph (618) 6304 3497 Fax (618) 6304 2323
 k.oliver@ecu.edu.au
 Faculty of Health, Engineering and Science Edith Cowan University
 276 Joondalup Drive, Joondalup WA6027

From: Christianson, Sarraounia [Sarraounia.Christianson@palgrave.com]
 Sent: Friday, 31 July 2015 5:57 PM
 To: Kim OLIVER
 Subject: RE: Figure 1.10 : Transactional Model of Stress (Cox and Mackay) from m To m Cox's Stress (1978) (ISBN-10 : 0333194039)

Hi Kim,

Thank you for letting me know the page. Are you able to forward the correspondence which gave permission for this diagram before?

I have now checked the book and as the figure was not created for this book, but taken from another paper (please see the reference on page 181, which refers to the following: Cox, T. and Mackay, C. J. (1978). A psychological model of occupational stress. A paper presented to Medical Research Council meeting Mental Health in Industry, London, November) so initially it doesn't look as though we could approve this.

All best wishes,
 Ousie

APPENDIX K PSS-10 CONSENT

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Vita	<i>Department of Psychology</i>
Laboratory Members	<i>Carnegie Mellon University</i>
	<i>5000 Forbes Avenue</i>
	<i>Pittsburgh, PA 15213</i>
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and cover letter with interests to Dr. Sheldon Cohen, at the above
address.

APPENDIX L WORK STRESS PROFILE CONSENT

Work Stress Profile

Phil <ricep@mnstate.edu>

Wed 12/11/2014 8:43 AM

Inbox

To: Kim OLIVER <koliver3@our.ecu.edu.au>;

Hello Mrs. Oliver,

Thank you for the interest in the Work Stress Profile. I am pleased that you find it useful for your doctoral study. This is to provide you with formal permission to use the scale with two stipulations. First, do cite the source of the scale appropriately by APA standards in any written or oral presentation of your work using the scale. Second, upon completion of your study, I would like to receive an abstract or other short summary of your study. There is no need to send a copy of the dissertation itself unless you wish to do so yourself.

I do not wish to charge any royalty fee for use so there is no need to involve Wadsworth/Brooks Cole in this process. Should your university or committee need a more formal letter of permission, I am happy to supply one but hopefully this email will suffice.

I wish you the best as you proceed with this study and in completing your doctoral degree. If there is anything else I can do to be of assistance, feel free to contact me again by either letter or email.

Regards,

Phil Rice