FIREFIGHTER POSTTRAUMATIC STRESS DISORDER, COGNITIVE IMPAIRMENT, AND SOCIAL DESIRABILITY: A QUANTITATIVE WORK BASED STUDY

A Thesis submitted by

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ABSTRACT

This thesis-by-publication explores post-traumatic stress disorder (PTSD), cognitive impairment (CI) and social desirability (SD) against background and demographic variables in firefighters in Queensland, Australia. Participants were full and part-time employed firefighters (*N* = 134) who completed a survey of standardised measures of PTSD (i.e., the PCL-5, which defines PTSD as the psychological result of exposure to highly stressful or traumatic events), CI (i.e., the AD8, which defines CI as impairments that are not significant enough to interfere with activities of daily living but nevertheless identifiable), and SD (i.e., the Marlowe-Crowne Form C, which defines SD as biased self-presentation or dissimulation and the concealment of one's thoughts, feelings, or character), as well as various background and demographic questions. Results suggest that no differences were found between full- and part-time employed firefighters on any measure except for demographic variables of age, gender and years of service. Those who scored higher on SD scored lower on post-traumatic stress disorder and cognitive impairment, meaning those firefighters who tended toward concealing their thoughts or feelings also had lower PTSD and lower CI. Age, years of service, and those who answered a subjective question on whether they had any psychopathology scored higher on PTSD and CI, indicating that PTSD and CI were unsurprisingly both related to age, years of service and a subjective sense of psychopathology. Furthermore, rates of firefighter CI were over double those of firefighter PTSD. These results indicate that most firefighters give socially desirable answers to portray lower PTSD and CI, while being older and/or having more years of service might contribute to more PTSD and CI. Interestingly, this conclusion implies that despite the significant body of research on firefighter PTSD, firefighter CI would appear to be a more common (i.e., prevalent) and insidious affliction. A final implication of this research is that a significant majority of firefighters may give socially desirable answers about their mental health, a topic that needs further investigation.

CERTIFICATION OF THESIS

I, Michael Chamberlin declare that the Thesis entitled ‘Firefighter posttraumatic stress disorder, cognitive impairment and social desirability: A quantitative work-based study’ is not less than 20,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references, and footnotes. The thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Date: 28/12/2023

Endorsed by:

Assoc Prof Henriette van Rensburg
Principal Supervisor

Dr Lee Fergusson
Associate Supervisor

Student and supervisors’ signatures of endorsement are held at the University.

STATEMENT OF CONTRIBUTION

There are three authors.

Paper 1:

Firefighter posttraumatic stress disorder, cognitive impairment and social desirability: A quantitative work-based study.

Student contributed 80% to this paper. Collectively, Assoc Prof Henriette van Rensburg and Dr Lee Fergusson contributed the remainder.

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I truly hope something positive will come from this research, as if I have helped just one Firefighter, then all of this pain has been worth it.

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DEDICATION

“Men are disturbed not by things, but by the views which they take of things.”
Epictetus 50-135 AD

This thesis and any future publications are dedicated to any past, present and future firefighters who have been, or will be, affected psychologically as a result of our profession.

Always remember, it is only a job that can shorten your life, so *please*
live every day, because you die just once.

“There is nothing either good or bad, but thinking makes it so. To me, it is a prison.”
William Shakespeare 1564-1616

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ABBREVIATIONS

Abbreviations	Definitions
AD8	Aging and Dementia Eight
AD8-NEW	Aging and Dementia Eight new variable for statistical analyses incorporating the clinical cut-off scores.
ANCOVA	Analysis of Co-Variance
ANOVA	Analysis of Variance
CI	Cognitive Impairment
DSM	Diagnostic Statistical Manual
DSM-5	Diagnostic Statistical Manual Fifth edition
DSM-5TR	Diagnostic Statistical Manual Fifth edition Text Revision
FORM-C	Marlowe-Crowne Social Desirability Scale 13-item short form
HSD	Tukey's honestly significant difference
MiND	Mild Neurocognitive Disorder
MND	Major Neurocognitive Disorder
MMPI	Minnesota Multiphasic Personality Inventory
NSW	New South Wales
NSWFB	New South Wales Fire Brigade
PCL-5	Post Traumatic Stress Disorder Checklist for DSM-5
PTSD	Post Traumatic Stress Disorder
PTSD-NEW	PCL-5 new variable for statistical analyses incorporating the clinical cut-off scores.
QFES	Queensland Fire and Emergency Service
SD	Social Desirability
SD-NEW	Form-C new variable for statistical analyses incorporating the clinical cut-off scores.
STDEV	Standard Deviations
UniSQ	University of Southern Queensland
UniSQHEC	University of Southern Queensland Human Ethics Committee
USA	United States of America
WTC	World Trade Centre

CHAPTER 1: INTRODUCTION

The State Government of Queensland is the executive authority for the administrative responsibility of the state. Through its executive authority, the State Government determines legislation, policy and regulations and delivers services via 30 different agencies (Queensland Government, 2020).

The Queensland Fire and Emergency Services (QFES) is one of these agencies, which is responsible for the protection and preparedness of people, their property and the environment from fire and all other emergencies. This agency employs 2433 permanent (full-time) and 1904 auxiliary (part-time) firefighters, as well as support staff (Queensland Government, 2021). QFES also supports around 31000 voluntary rural firefighters and about 5000 State Emergency Service volunteers, as well as almost 100 other volunteers in chaplaincy, disaster assistance response and scientific investigation (Queensland Government, 2021).

The firefighter

> …position may, in the eyes of some, appear[s] to be a lowly one; but we who know the work which the fireman has to do believe that his is a noble calling. Our proudest moment is to save lives. Under the impulse of such thoughts, the nobility of the occupation thrills us and stimulates us to deeds of daring, even of supreme sacrifice. (Croker, 1908)

In the above quote, it is important to note the vernacular of Fire Chief Croker when he says “fireman” and “his is a noble calling”. Such were the times back then when females were not employed as firefighters. In 1995, the Queensland Fire Service (now Queensland Fire and Emergency Services or QFES)

welcomed its first female firefighters. Currently, QFES employs 971 females or 18.73% of the firefighting workforce (Queensland Government, 2020).

When one hears the word ‘firefighter’ the general public’s image is a persona of “action-oriented…highly dedicated, risk takers, highly motivated…to help and rescue others…and to be in control of the situation and themselves” (Fox & Bowlus, 1996, p. 41). Unfortunately, in this profession, being ‘in control of the situation and themselves’, can also be an occupational hazard with significant lifelong personal consequences.

1.1 Background

Some of the above personal consequences can (depending upon the individual) manifest into maladaptive psychopathology, such as Post-Traumatic Stress Disorder (PTSD) (American Psychiatric Association, 2022). As a result, or due to the complex dysfunctional interactions of the individual’s psychopathology, a firefighter can also develop cognitive impairment (American Psychiatric Association, 2022).

When these firefighter-related psychological disorders have been compared to the general population, significant disparities have been highlighted. For example, some firefighters have higher PTSD than the general population (Chamberlin & Green, 2010; Forbes et al., 2007; Fullerton et al., 2004; Harvey et al., 2015; Noor et al., 2019; Paulus et al., 2018). Female firefighters have higher PTSD than their male counterparts (Noor et al., 2019), which can manifest into suicide (Stanley et al., 2017).

It has also been found that firefighters may have Cognitive Impairment (CI) from the physical aspects of their employment, for example dehydration and working in heat (Cvirn et al., 2019; Rodrigues et al., 2018). For the purposes of this study,

cognitive impairment is defined as a neurocognitive condition which involves impairments or cognitive limitations beyond those expected based on an individual's age and education, but which are not significant enough to interfere with activities of daily living. Longitudinal research into World Trade Centre (WTC) responders (Clouston et al., 2019) has found that PTSD and prolonged exposure were associated with CI. For firefighters specifically, Brackbill et al. (2019) found CI in those exposed during their WTC employment.

If a firefighter has any PTSD and/or CI, the question can be asked: are they really being honest with themselves, or are they being truthful with the organisations that support them? Being dishonest or malingering, and/or giving socially desirable answers, is a problem amongst firefighters.

As there is an increasing awareness of PTSD symptomologies within firefighters, there is also evidence that individuals can give Socially Desirability (SD) answers with “considerable proficiency” (Harvey et al., 2015, p. 29). In this context, firefighters may give socially desirable answers to over-report their symptomology, yet some firefighters may also be under-reporting their psychopathological symptomology (Harvey et al., 2015).

1.2 Statement of research problem

This work-based research investigated QFES firefighter psychopathology, in particular PTSD and CI. Social Desirability was investigated; however, due to the limiting scope of the degree program, SD was only used as a screen to gain a more accurate representation of QFES firefighter PTSD and CI.

1.3 Purpose of the research

The purpose of this work- based research was to explore the presence of, and gain an accurate representation of, PTSD and CI in QFES firefighters. This was

also aligned to the research questions that asked what the current level of PTSD and CI in QFES Firefighters was and how it related to the normative data. This work-based research investigated firefighter demographic variables associated with PTSD and/or CI and it the role that SD has with self-reported PTSD and/or CI.

1.4 Scope of the research

The scope of this research was to investigate PTSD and CI in QFES firefighters. Background or demographic variables were included to investigate any changes affecting the PTSD and/or CI domains. A final part of the scope was an investigation of the the impact of SD upon PTSD and/or CI.

1.5 The researcher as a practitioner

This author has been a professional firefighter for over 32 years with multiple firefighting employment experiences in Australian and Canadian Fire Services, which has culminated in becoming a QFES Station Officer at Yarrabilba Fire Station within the Logan Command, South East Region.

Initially, I started working as a military firefighter with the Australian Army in 1991. Then in 1995, I joined QFES and was posted to the Gold Coast Command, South East Region; simultaneously, I continued working as a Royal Australian Air Force Active Reserve military firefighter for over 21 years. I have also participated in a six-week firefighter exchange with the New South Wales Fire Brigade and a 12-month international firefighter exchange in Canada with the Kitchener Fire Department. In 2007, I was seconded to work in the QFES-Office of the Commissioner, as the A/Manager of FireCare for approximately 12 months. FireCare was QFES's Employee Assistance Program and in that position, I was

responsible for the network of 90 Peer Supporter Officers and a network of 50 psychologists. Finally, I have been an instructor on multiple QFES courses including teaching on three recruit firefighter courses. As may be appreciated, after more than 32 years of professional firefighting, I have attended a significant number of and many differing types of incidents. ‘No two fires are the same’ is an old firefighter adage that still holds firm after all these years and it conceptualises my professional pedagogy.

I simultaneously started studying psychology in 2000 and after 10 years of academia and the associated registration process became a registered Australian psychologist. I have since worked in a variety of part-time psychologist positions, from private practice at the Walloon Medical Centre to subcontractor psychologist roles at Headspace and Lifeline, as a paid shift supervisor. I have also worked casually for Queensland Health in the Emergency Departments of the Metro South City hospitals. In this final role, I encountered and assessed the absolute extremities of human psychopathology.

1.6 Professional Studies

Work-based learning as the foundational pedagogy of Professional Studies, what is it, why is it relevant to the researcher.

Work-based learning can be conceptualised as completing challenging work tasks which come from the culmination of work-based learning and a variety of other factors. Illeris (2004) postulated a theoretical model of “learning in working life” that can be applied to an individual’s learning within their working life.

This model is applied to a firefighter recruit example in this study. As the recruit starts with QFES, they come with previously gained knowledge and skills from previous workplaces and/or life experiences and/or academic endeavours. They

also come with a psychological perspective of emotions and motivations. These key capabilities then interact with the environment, which is the recruit academy. The firefighter recruit academy is the organisation's learning environment which creates the work conditions that determine the work-based learning. For example, the classrooms are utilised for the theoretical instruction, whilst the drill yard is where recruits put the theoretical instruction into practice by undertaking practical firefighting learning such as bowling hose for example.

The other component of the recruit academy is the social-cultural learning environment. This is where the recruit learns how to work and operate within the work community of a team of four firefighters, and how their individual tasks will contribute to the overall effectiveness of the resolution of any emergency incident. When all these key concepts and capabilities converge, two major factors develop: "work identity" and "working practice" (Illeris, p. 438).

For the firefighter recruit, work identity is how they perceive themselves as a recruit and/or potential operational firefighter, whereas working practice is a result of how they are influenced by how the working environment is organised. This is further compounded by how the recruit functions within the social-cultural environment of their course environment.

Illeris (2004) postulated that when the work identity and working practice factors overlap, workplace learning has taken place, which then marks the end of the first of many cycles and/or dimensions of the work-based learning pedagogy.

The relevance for this researcher is twofold: both in professional practice and in personal development as a professional firefighter and a registered psychologist.

Lifelong learning

Learning is a lifelong evolutionary process that is fundamental to human survival- as learning is to live and living is to learn. From a personal development perspective, I am an advocate for lifelong learning as there is significant research that has found that lifelong learning reduces the risk of cognitive decline, which is negatively correlated with age (Baumgart et al., 2015) .

This research contributes to my personal self-development insofar as it contributes towards the goal of lifelong learning. From a professional perspective, this research may lead to the development of an organisational resilience training package targeting those identifying as at-risk groups, which currently does not exist.

Reflective practice and its fundamental role in Professional Studies.

Reflective practice refers to being able to reflect upon past personal interactions with the aim of learning from those interactions and then implementing what has been learned for the improvement of similar situations in the future (Horton-Deutsch & Sherwood, 2017).

As an operational firefighter, reflective practice is a critical component, because when lives are at stake, it is vital to ensure good practices are utilised to protect people, property and the environment. For a psychologist, the reflective process is fundamental to good therapy as this will guide future sessions.

Chamberlin and Green (2010) mentioned the need for the inclusion of an SD measure in future studies. This inclusion is an example of a past reflection which has been included in the current research.

A final reflection upon previous work-based learning is that brevity is at the heart of firefighter participation; therefore, only three differing psychological constructs (PTSD, CI and SD) have been investigated.

Learning objectives

The first Learning Objective (LO) will see professional and firefighter industry psychopathological knowledge improved by administration of contemporary psychological instruments, which will be evidenced when the results have been published in a peer reviewed journal. The second LO will be the objective judgement of firefighter psychopathological knowledge through the inclusion of the SD measure, which has been achieved now that the research has been completed.

All of these constructs contribute to the learning objective of investigating and analysing the quantitative data of Queensland firefighter psychopathology and then comparing the results to the firefighter psychopathology literature and contributing to that literature.

CHAPTER 2: LITERATURE REVIEW

This chapter includes a literature review focusing on PTSD, CI and SD. Section 2.1 investigates PTSD and includes the diagnostic criteria from the *Diagnostic and statistical manual of mental disorders* (fifth text-revised edition) (DSM-5TR) (American Psychiatric Association, 2022). The chapter further focuses on PTSD research within various Australian and international firefighter populations.

Section 2.2 examines CI and includes the diagnostic criteria from the DSM-5, before concentrating on CI amongst various firefighter populations. SD is presented in section 2.3, which commences with a definition before reviewing the literature amongst firefighter populations. Section 2.4 presents a conceptual model of the literature review and section 2.5 presents the research questions.

2.1. Post-Traumatic Stress Disorder

Primarily, post-traumatic stress disorder is a result of exposure to a highly stressful or traumatic event and symptoms may persist long after the event has finished (Taylor, 2003; VandenBos, 2016). One of the earliest records of post-traumatic stress can be found at the time of the 1666 great fire of London, when a diarist who experienced this event was still suffering what is now known as post-traumatic stress six months after the fires (Barlow & Durand, 2005). The term “shell shock” from the First World War has been used synonymously with the words “post-traumatic stress” (Hodgkinson & Stewart, 1998, p. 20), a term first used by the *Diagnostic and statistical manual of mental disorders* (DSM) III in 1980 (Barlow & Durand, 2005). Before this time, litigation courts referred to this condition as “nervous shock” (Schell, 1997, p. 17).

There are many instances which may trigger post-traumatic stress, but typically tragic and traumatic events such as war (El Moujabber et al., 2023), natural

disasters (Futterman et al., 2023), violence (Taylor et al., 2022), murder, hostage situations, major illness, terrorist attacks, physical assaults (including rape), sudden death of a family member, and car accidents (American Psychiatric Association, 2022).

According to the DSM-5TR, at the core of these PTSD triggers are the diagnostic criteria of:

- Exposure to actual or threatened death, serious injury or sexual violence in one or many ways;
- Presence of one or more of intrusion symptoms associated with the traumatic event;
- Persistent avoidance of stimuli associated with the traumatic event;
- Negative alterations in cognitions and mood associated with the traumatic event; and
- Marked alteration in arousal and reactivity associated with the traumatic event.

(American Psychiatric Association, 2022).

The DSM-5TR then explains that PTSD rates are higher for military veterans and those whose professions involve traumatic exposure, for example emergency service workers (American Psychiatric Association, 2022).

Within the international PTSD literature about firefighters, 5.62% of United Kingdom firefighters were found to have PTSD (Langtry et al., 2021) with 6.9% of Brazilian firefighters having PTSD (Lima et al., 2015). Furthermore, a USA study discovered that approximately 20% of female firefighters (Noor et al., 2019)

positively scored on a PTSD measure. Similarly, Stanley et al. (2017) established that 19.7% of female firefighters “met or exceeded the threshold for a probable PTSD diagnosis” (p. 97).

The DSM-5 TR further explains that PTSD is more prevalent among females than males across the lifespan, and females experience PTSD for a longer duration than males (American Psychiatric Association, 2022). Surprisingly though, Onyedire et al. (2017) discovered no differences between genders in their Nigerian sample.

Whilst analysing the literature it is increasingly evident there is significant variability in the percentage of firefighters with PTSD symptomology. Interestingly, Boffa et al. (2016) found 31.8% of 893 participants in a web-based survey of United States of America (USA) firefighters with a “probable PTSD diagnosis” (Boffa et al., 2016, p. 279). Yet a recent USA study of permanent and part-time firefighters discovered that 11% had a probable PTSD diagnosis (Lebeaut et al., 2022). Finally, Jitnarin et al. (2022) identified a 7% PTSD prevalence rate in their USA firefighter sample.

From an Australian perspective, a recent study which had 2975 firefighter participants drawn across all Australian firefighting organisations found a lifetime diagnosis of PTSD of 11.5% (Kyron et al., 2021). More specifically, those employed with the New South Wales Fire Brigade (NSWFB) reported PTSD rates of 8%, which increased significantly to 18% for retired NSWFB firefighters (Harvey et al., 2016).

The most recent Queensland-based research discovered that firefighters have a rate of 12.4% PTSD symptomology (Chamberlin & Green, 2010) and therefore, this literature review confirms what other researchers have found: a significant

variability in firefighter PTSD symptomology which ranges from 1.9% to 57% (Obuobi-Donkor et al., 2022).

To investigate the variability in PTSD rates, Del Ben et al. (2006) found that different types of PTSD instruments may influence the outcomes, whilst Serrano-Ibáñez et al. (2022) have conducted a systematic review which shows evidence of protective and risk factors of firefighter PTSD, which may influence the significant variability of PTSD research outcomes. Yet despite all the reasons for the variability, the majority of above firefighter PTSD rates are still significantly higher than the Australian public prevalence rate of 5.7% (Australian Bureau of Statistics, 2021) and the world-wide public prevalence rate of 3.9% (American Psychiatric Association, 2022).

In conclusion, PTSD researchers have found significantly higher rates of firefighter PTSD than those amongst the general population, and from a co-morbidity perspective, PTSD is linked to a significant association with Major Neurocognitive Disorder (American Psychiatric Association, 2022)

2.2. Cognitive Impairment

While researching the DSM for CI, it is easy to think that CI is similar to the diagnostic criteria for dementia. However, dementia has been subsumed into the entity of Major Neurocognitive Disorder (MND), as the DSM-5 also recognises the less severe form of Cognitive Impairment (CI) as Mild Neurocognitive Disorder (MiND) (American Psychiatric Association, 2013, 2022).

Stokin et al. (2015) compared and analysed CI and Mild Neurocognitive Disorder (MiND). They explained the main difference between CI and MiND as being the

research behind the classification, and implied that MiND and CI are therefore essentially the same construct.

Thus, an informal definition of CI is “any impairment in perceptual, learning, memory, linguistic or thinking abilities.” (VandenBos, 2016, p. 77). By contrast, the formal definition of MiND from the DSM-5 TR has the following diagnostic criteria:

- Evidence of modest cognitive decline from a previous level of performance in one or more cognitive domains,
- The cognitive deficits do not interfere with the capacity for independence in everyday activities,
- The cognitive deficits do not occur exclusively in the context of a delirium, and
- The cognitive deficits are not better explained by another mental disorder (American Psychiatric Association, 2022).

The DSM 5TR then explains that the prevalence estimates of MiND/CI among older individuals are variable, ranging from 2% to 10% at age 65, to 5% to 25% by age 85 for the world-wide population (American Psychiatric Association, 2022, p 608). Within Australia, the CI prevalence rate is at least 5% (Douglas & Bigby, 2020).

For these prevalence rates, neurocognitive disorders can be triggered by a myriad of causes, which have been classified as impaired cognitions that were not present at birth or early in someone’s life, and therefore this represents some sort of decline from a previously attained level of cognitive functioning (Sanford,

2017). Furthermore, CI which has not been acquired through ‘normal’ human development is developed through life experiences (Douglas & Bigby, 2020).

When working as a firefighter, CI has been associated with dehydration and working in heat (Cvirn et al., 2019; Rodrigues et al., 2018). However, research into firefighter PTSD of those who attended the World Trade Centre (WTC) disaster discovered that some firefighters who did not officially have PTSD still reported a functional impairment at home or at work (Brackbill et al., 2019)

Recently the results from longitudinal research into the World Trade Centre (WTC) responders have shown significantly higher than expected incidences of mild CI if the responder had more prolonged WTC exposure. There was a strong association (Clouston et al., 2019) with an increased occurrence of mild CI, which in turn caused higher future rates of MiND within this population.

From an occupational perspective, Levy-Gigi et al. (2014) have postulated that CI varies within a “function of occupation” (p. 7), with firefighters struggling to learn cues of repeated traumatic exposure with negative outcomes, which was then actually associated with a positive outcome when presented later in a different context. They further discovered that their participants who had “repeated traumatic exposure” failed to adequately “encode” a traumatic association to the appropriate presentational context. In their study, Levy-Gigi et al. (2014) did not use “trauma related stimuli” and they found that “repeated traumatic exposure” reflects a general CI, which was independent of PTSD symptomology and therefore added to the probability of another significant dimension (CI) of “repeated traumatic exposure” being present, which was not picked up in PTSD screening instruments.

Prolonged exposure to any incident creates a multitude of hazards and Zhang et al. (2023) have indicated that long-term exposure to fine particles from smoke may cause dementia (Zhang et al., 2023). They have further claimed that higher rates of dementia might be associated with the fine particulate matter which is generated from wildfires.

When age is considered, Ma et al. (2023) have discovered strong evidence that fine particulate pollution is a causal link between exposure and increased incidences of dementia in older adults.

2.3. Social Desirability

Social Desirability (SD) or giving socially desirable answers (often referred to as participant reactivity in quantitative research) is defined as the inclination of participants to represent themselves in a manner that they think will be viewed positively by others (VandenBos, 2016). The definition further explains the propensity of participants to give answers that they think is in accordance with the social norms of a group, instead of giving a genuine response which is an actual representation of their own personal views (VandenBos, 2016).

A participant giving socially desirable answers may either over- or under-report their behaviours and/or symptomology, which can then seriously undermine research results when using self-reporting instruments (Paulhus, 2020). Not only do these biases interfere with the interpretation of average tendencies, as well as individual differences (Paulhus, 2020), but if enough participants give socially desirable answers, this may undermine the outcome of the overall research.

Malingering, faking bad, faking good, tendency to agree or disagree, tendency to use extreme ratings, having a particular response bias, giving socially desirable

answers, or in its most basic form, simply lying, have always been a problem for social science researchers (Harvey et al., 2015). When it comes to firefighters, there appears to be limited research on utilisation of an SD measure with this population's psychopathology. To the best of this author's knowledge, the only published firefighter SD prevalence rate was by Wagner et al. (1998), who included a SD measure which discovered that 22.9% of German firefighters gave socially desirable responses. This high level of SD also resulted in significant mean differences between those with and those without SD in their PTSD scoring and other measures (Wagner et al., 1998).

There appears to be limited research, from a physiological perspective, which found that firefighters who have high SD scores also have higher cortisol levels (Brody et al., 2000). If a firefighter has a high cortisol level, it indicates they could have high stress, which is a combination of poor stress coping, greater psychopathology (e.g., PTSD) and a significant risk of long-term "neuronal and immunologic damage" (Brody et al., 2000, p. 228). These researchers have further suggested that because someone has elevated cortisol levels which suppress neuronal activity, this could also be interpreted as possibly having CI, which in turn affects a participant's SD responding (Brody et al., 2000), thus suggesting the occurrence of a negative feedback loop.

According to Greinacher et al., (2019), firefighters not only give SD answers when it comes to primary trauma exposure, but they also give SD answers by under reporting any secondary trauma. This phenomenon is significant when it comes to some firefighters as they may under-report any psychopathology and/or CI to try to fit into a perceived stereotype and/or pre-conceived perception (O'Neill &

Rothbard, 2017), which can be a major problem for researchers (Harvey et al., 2015).

When it comes to over-reporting psychopathology, some firefighters may exaggerate their symptomology and/or they may malinger when compensation is involved (Harvey et al., 2015). As individuals are becoming more aware of PTSD causations and/or symptomology, some people are faking symptomology (Bostock-Matusko et al., 2013) with “considerable proficiency…particularly when using self-report symptom inventories” (Harvey et al., 2015, p. 29).

2.4. Literature review summary

For those employed within the firefighting profession, there is an increased risk of developing PTSD. The prevalence rate for the general population is 3.9%; however, the rates in the firefighter literature significantly vary from 1.9% up to 57%.

Firefighter CI is associated with the physical aspects of the job, yet there is limited research with this population and its associated psychopathology. Longitudinal researchers have found that the longer a firefighter was exposed at a job site the more likelihood that there was a stronger association with and an increased occurrence of CI. This supports other researchers who have reported that firefighters with repeated trauma exposure failed to adequately encode non-trauma associated stimuli, which then leads them to suggest that CI is independent of PTSD.

From a physiological perspective, emerging research has explained that fine particulate matter from wild/bushfire smoke will cause dementia/MND in older adults. When this is applied to older firefighters, it is important to consider that

they have generally been employed as firefighters for longer periods of time and most likely have had greater exposure to wild/bushfire smoke.

SD encompasses over- and under-reporting of symptomology, which occurs regularly on self-report inventories. Over-reporting is typically seen in financial and/or compensation claims, whereas under-reporting is usually part of the perception of newer firefighters thinking they have to fit into a preconceived stereotype. There is very limited research on the utilisation of an SD instrument within firefighter psychopathology; however, one researcher found high levels of SD affecting PTSD scoring and other measures, while others found high stress leading to CI, which may affect SD responding.

2.5 Gaps in the literature

There are multiple gaps in the literature, as it is evident there is no current PTSD research on QFES firefighters. Additionally, there appears to be no Australian CI research on firefighters that relates to PTSD and/or any other psychopathology. Finally, there also appears to be no SD screened research drawn from any Australian firefighter population, thus making the present research particularly important.

This research therefore examined QFES firefighters' PTSD symptomology. It also studied MiND within the same population. SD was measured so that as accurate a representation as possible of the population could be gained.

There are relationships with firefighters, PTSD and CI. There is also a suggestion that CI may be associated with SD; however, given the size and scope of the current researcher's degree program, SD was explored but it was predominantly used to exclude those respondents who gave SD answers.

2.6 Research questions

This work-based study quantitatively investigated Firefighter Post-Traumatic Stress Disorder, Cognitive Impairment, and Social Desirability, using three specific research questions:

1: What are the current levels of PTSD and CI in QFES firefighters and how do they relate to normative data?

2: Are any background and/or demographic variables associated with PTSD and/or CI in QFES firefighters?

3: Is SD associated with PTSD and/or CI in QFES firefighters?

CHAPTER 3: PAPER 1 – FIREFIGHTER POSTTRAUMATIC STRESS DISORDER, COGNITIVE IMPAIRMENT, AND SOCIAL DESIRABILITY: A QUANTITATIVE WORK BASED STUDY

3.1 Introduction

Chapter one introduced the background and statement of the research problem. It then went on to outline the purpose and scope of the research. Chapter two then provided a literature review of PTSD, CI and SD, which culminated in three research questions, whilst this chapter presents a paper for submission to the *Australian Journal of Psychology*.

3.2 Copy of submission

Firefighter posttraumatic stress disorder, cognitive impairment and social desirability: A quantitative work-based study.

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The authors report there are no competing interests to declare.

The data is currently held in a draft record in the UniSQ CAYUSE repository awaiting ethics directions in relation to the potentially sensitive and traumatic content.

Firefighter posttraumatic stress disorder, cognitive impairment and social desirability: A quantitative work-based study.

Abstract

Objective

This study seeks to explore the levels of post-traumatic stress disorder (PTSD), cognitive impairment (CI) and social desirability (SD) and their relationships against background and demographic variables amongst full- and part-time employed firefighters in Queensland, Australia.

Method

This quantitative work-based study employed a cross-sectional design, whereby employed firefighters (*N*=134) completed standardised measures of PTSD (PCL-5), CI (AD8), and SD (Marlowe-Crowne Form C), as well as various background and demographic questions via an on-line survey tool.

Results

No differences were found between full- and part-time employed firefighters on PTSD, CI or SD on any measure except when grouped by age, gender and years of service. Those who scored higher on SD scored lower on PTSD and CI. Age, years of service and those who answered a subjective question scored higher on PTSD and CI. Furthermore, rates of firefighter CI were more than double those of firefighter PTSD.

Conclusions

These findings suggest that most firefighters give socially desirable answers to portray lower post-traumatic stress disorder and cognitive

impairment, while being older and/or having more years of service can contribute to more post-traumatic stress disorder and cognitive impairment. Interestingly, despite the vast amount of research on firefighter PTSD, firefighter cognitive impairment would appear to be a more prevalent and insidious affliction in Australian firefighters.

Keywords: firefighters, PTSD, cognitive impairment, social desirability.

Key Points

What is already known about this topic:

1. Firefighters have higher PTSD than the general population.
2. PTSD is associated with an increased risk of cognitive impairment.
3. Over- and under-reporting of mental health symptomology is associated with emergency service workers.

What this topic adds:

1. This study found that most firefighters give socially desirable answers which portrays significantly lower PTSD and cognitive impairment.
2. Older firefighters or those with more years of service have higher levels of PTSD and cognitive impairment.
3. Rates of firefighter cognitive impairment were found to be more than double those of firefighter PTSD.

Introduction

When one hears the word ‘firefighter’, the public image is a person who is an “action-oriented…highly dedicated, risk taker[s], highly motivated…to help and rescue others…and to be in control of the situation and themselves” (Fox & Bowlus, 1996, p.

41). Unfortunately, in this profession, being ‘in control of the situation and themselves’, can also be an occupational hazard with significant lifelong personal consequences.

Some of the above personal consequences can (depending on the individual) manifest into maladaptive psychopathology, such as Post-Traumatic Stress Disorder (PTSD) (American Psychiatric Association, 2022).

Concurrently, a lesser-known affliction may also develop, independently from, or in conjunction with, or because of PTSD. This affliction is insidious and could be due to any number of firefighter or personality variables whereby the firefighter may develop cognitive impairment (American Psychiatric Association, 2022).

Interestingly, when these firefighters’ psychological disorders are compared to the general population, significant disparities have been highlighted as some firefighters have higher PTSD than the general population (Chamberlin & Green, 2010; Forbes et al., 2007; Fullerton et al., 2004; Harvey et al., 2015; Noor et al., 2019; Paulus et al., 2018).

It has also been found that firefighters may have cognitive impairment (CI) resulting from the physical aspects of their employment, including dehydration and working in heat (Cvirn et al., 2019; Rodrigues et al., 2018). Additionally, longitudinal research into World Trade Centre (WTC) terrorist attack responders (Clouston et al., 2019) found PTSD and prolonged exposure was associated with CI. For firefighters specifically, Brackbill et al. (2019) found CI in those who worked at the WTC incident site.

Interestingly, if a firefighter has any PTSD and/or CI, we can also ask: are they really being honest with themselves, or are they being truthful with the organisations that support them? Being dishonest or malingering and/or giving socially desirable answers may be a problem for firefighters.

As there is an increasing awareness of PTSD symptomologies within firefighters, there is also “evidence that individuals” can give Socially Desirability (SD) answers with

"considerable proficiency" (Harvey et al., 2015, p. 29). In this context, firefighters may give socially desirable answers to over- or under-report their symptomology.

Post-Traumatic Stress Disorder

Primarily, post-traumatic stress results from exposure to a highly stressful or traumatic event and these symptoms may persevere long after the event has finished (Taylor, 2003). One of the earliest records of post-traumatic stress occurred as a result of the 1666 Great Fire of London, where a diarist who experienced this event was still suffering what is now known as post-traumatic stress six months after the fires (Barlow & Durand, 2005). The term "shell shock" from the First World War has been used synonymously with the words "post-traumatic stress" (Hodgkinson & Stewart, 1998, p. 20), a term first used by the *Diagnostic and statistical manual of mental disorders* (DSM) III in 1980 (Barlow & Durand, 2005). However, before this time, litigation courts referred to this condition as "nervous shock" (Schell, 1997, p. 17).

There are many instances which may trigger post-traumatic stress, typically tragic and traumatic events such as war (El Moujabber et al., 2023), natural disasters (Futterman et al., 2023), violence (Taylor et al., 2022), murder, hostage situations, major illness, terrorist attacks, physical assaults (including rape), sudden death of a family member and car accidents (American Psychiatric Association, 2022).

At the core of the above PTSD triggers are eight diagnostic criteria from the DSM 5TR, which has a general USA population rate of 6.8% (American Psychiatric Association, 2013). Interestingly, recent Australian data reports a slightly smaller 5.7% rate (Australian Bureau of Statistics, 2021).

Despite the general population numbers, "rates of PTSD are higher among veterans and others whose vocations increases the risk of traumatic exposure (e.g., Police, Firefighters)" (American Psychiatric Association, 2022)p. 276). From an Australian

perspective, recent research which included 2975 firefighter participants, drawn from all Australian firefighting organisations, found a lifetime diagnosis PTSD rate of 11.5% (Kyron et al., 2021).

The most recent research amongst Queensland firefighters found a PTSD rate of 12.4% (Chamberlin & Green, 2010, p. 554). Furthermore, the most current New South Wales Fire Brigade (NSWFB) research reported PTSD rates of 8% (Harvey et al., 2016). More concerning is that these same researchers went on to find that 18% of retired NSWFB firefighters had PTSD (Harvey et al., 2016).

In analysing the literature, it becomes increasingly evident there is significant variability in the percentage of firefighters with PTSD symptomology. Boffa et al. (2016) discovered 31.8% of 893 participants in a web-based survey of firefighters with a "probable PTSD diagnosis" (Boffa et al., 2016, p. 279). Other researchers have found significant variability in firefighter PTSD symptomology, ranging from 1.9% to 57% (Obuobi-Donkor et al., 2022).

To investigate the variability in PTSD rates, Del Ben et al. (2006) found that different types of PTSD instruments may influence the outcomes, whilst Serrano-Ibáñez et al. (2022) have conducted a systematic review which showed evidence of protective and risk factors of firefighter PTSD, which may have influenced research outcomes. Yet despite all the potential reasons for the variability, the majority of the above firefighter PTSD rates are still significantly higher than the Australian public prevalence rate of 5.7% (Australian Bureau of Statistics, 2021) and the world-wide public prevalence rate of 3.9% (American Psychiatric Association, 2022).

In conclusion, PTSD researchers have found significantly higher rates of firefighter PTSD than the general population and from a co-morbidity perspective, PTSD has been shown

to have a significant association with Major Neurocognitive Disorder (American Psychiatric Association, 2022)

Cognitive Impairment

While researching the DSM-5 for CI, it is possible to conclude that CI is similar to the diagnostic criteria for dementia. However, dementia has been subsumed into the entity of Major Neurocognitive Disorder (MND) as the DSM-5 also recognises the less severe form of Cognitive Impairment (CI) as Mild Neurocognitive Disorder (MiND) (American Psychiatric Association, 2013, 2022).

All forms of neurocognitive disorders can be triggered by a myriad of causes which have been classified as impaired cognitions. These were not present at birth or early in someone's life, and therefore this represents some sort of decline from a previously attained level of cognitive functioning (Sanford, 2017). Furthermore, CI, which has not been acquired through 'normal' human development, is developed through life experiences (Douglas & Bigby, 2020).

Firefighter CI has been associated with dehydration and working in heat conditions (Cvirn et al., 2019; Rodrigues et al., 2018), whilst research on the firefighters who attended the WTC terrorist attack disaster discovered that some firefighters who did not have PTSD still reported a functional impairment at home or at work (Brackbill et al., 2019)

Recently the results from longitudinal research into the WTC responders showed higher than expected incidences of mild CI if the responder had more prolonged WTC exposure, and there was also a "strong association" (Clouston et al., 2019, p. 632) with an increased occurrence of mild CI. Unfortunately, this in turn may portend higher future rates of MND within this population.

From an occupational perspective, Levy-Gigi et al. (2014, p. 7) found that CI varies within a "function of occupation", with firefighters struggling to learn cues of repeated

traumatic exposure with a negative outcome, which is actually associated with a positive outcome when presented later in a different context. The authors discovered that their participants with "repeated traumatic exposure" failed to adequately "encode" a traumatic association to the appropriate presentational context. As these researchers did not use "trauma related stimuli", they suggest that "repeated traumatic exposure" reflects a general CI, which is independent of PTSD symptomology. It therefore adds to the probability of another significant component of CI whereby "repeated traumatic exposure" is present, yet it is not detected in PTSD screening instruments.

According to the DSM 5TR (2022), the general USA population prevalence rate for mild cognitive impairment (which is substantially congruent with mild NCD) among older individuals is variable, ranging from 2% to 10% at age 65 and from 5% to 25% by age 85. From an Australian perspective, the CI prevalence rate is "at least 5%" (Douglas & Bigby, 2020, p. 434), but as "mild cognitive impairment has only recently been defined, there is limited research on it and there is much that we do not yet understand" (Dementia Australia, 2022, p. 1).

Recent research has found that prolonged exposure to an incident results in a multitude of hazards and that long term exposure to fine particles from smoke may cause dementia (Zhang et al., 2023). Zhang et al. (2023) further claimed that higher rates of dementia might be associated with the fine particulate matter that is generated from wildfires. Yet when age is considered, Ma et al. (2023) have discovered strong evidence that fine particulate pollution is a causal link between exposure and increased incidences of dementia in older adults.

From a firefighter's perspective, Clouston et al. (2019) have found a CI rate of 14.2% within an average age of 54.6-year-old WTC responders. Yet to the best of this author's

knowledge, there does not appear to be any Australian baseline for CI in the firefighter population.

Social Desirability

Social Desirability (SD) or giving socially desirable answers (often referred to as participant reactivity in quantitative research) is defined as the inclination of participants to represent themselves in a manner that they think will be viewed positively by others (VandenBos, 2016). The definition further explains the propensity of participants to give answers that they think are in accordance with the social norms of a group instead of giving a genuine response which actually represents their own personal views (VandenBos, 2016).

A participant giving socially desirable answers may either over- or under-report their behaviours and/or symptomology, which can seriously undermine research results when using self-report instruments (Paulhus, 2020). Not only do these biases interfere with the interpretation of average tendencies, as well as individual differences (Paulhus, 2020), but if enough participants give socially desirable answers, this may undermine the validity of any research.

Malingering, faking bad, faking good, tendency to agree or disagree, tendency to use extreme ratings, having a particular response bias, giving socially desirable answers, or in its most basic form, simply lying, have always been a problem for social science researchers (Harvey et al., 2015). When it comes to firefighters, there appears to be limited research on utilisation of an SD measure within this population's psychopathology. To the best of this author's knowledge, the only published SD prevalence rate was Wagner et al. (1998) who included a SD measure which discovered 22.9% of German firefighters gave socially desirable responses. This high level of SD

also resulted in significant mean differences between those with and those without SD in their PTSD scoring and other measures (Wagner et al., 1998).

There appears to be limited research, from a physiological perspective, which has found that firefighters who have high SD scores also have higher cortisol levels (Brody et al., 2000). If a firefighter has high cortisol levels, it indicates they could have high stress, which is a combination of poor stress coping, greater psychopathology (e.g., PTSD) and a significant risk of long-term "neuronal and immunologic damage" (Brody et al., 2000, p. 228). Brody et al. (2000) further suggested that because someone has elevated cortisol levels which suppress neuronal activity, they could also be interpreted as possibly having CI, which in turn would affect their SD responding (Brody et al., 2000), thus suggesting the occurrence of a negative feedback loop.

According to Greinacher et al. (2019), firefighters not only give SD answers when it comes to primary trauma exposure, but they also give SD answers by under-reporting any secondary trauma. This phenomenon is significant when it comes to some firefighters, as they may under-report any psychopathology and/or CI to try to fit into a perceived stereotype and/or pre-conceived perception (O'Neill & Rothbard, 2017), which can be a major problem for researchers (Harvey et al., 2015).

When it comes to over-reporting psychopathology, some firefighters may exaggerate their symptomology and/or they may malinger when compensation is involved (Harvey et al., 2015). As individuals are becoming more aware of PTSD causations and/or symptomology, some people are faking symptomology (Bostock-Matusko et al., 2013) with "considerable proficiency…particularly when using self-report symptom inventories" (Harvey et al., 2015, p. 29).

Conceptual model

For those employed within the firefighting profession, there is an increased risk of developing PTSD. The general Australian population prevalence rate of PTSD is 5.7%; however, it varies from 5% up to 31.8% within a firefighter population.

Firefighter CI is associated with the physical aspects of the job, yet there is limited research about this population and their associated psychopathology. Longitudinal researchers have found that the longer a firefighter is exposed at an incident, the higher the likelihood of an increased occurrence of CI. This supports other researchers who have reported that firefighters with repeated trauma exposure failed to adequately encode non-trauma associated stimuli, which suggests that CI is independent of PTSD.

SD encompasses over- and under-reporting of symptomology, which occurs regularly on self-report inventories. Over-reporting is typically seen in financial and/or compensation claims, whereas under-reporting is usually reported in relation to the perception of newer firefighters thinking they have to fit in with a preconceived stereotype of resilience. There is limited research on the utilisation of an SD instrument within firefighter psychopathology; however, one researcher found that high levels of SD affect PTSD scoring and other measures, while others have found that high stress can lead to CI which in turn may affect SD responding.

There is no current PTSD research on QFES firefighters. Additionally, there appears to be no Australian CI research on firefighters which relates to PTSD and/or any psychopathology. Finally, there also appears to be no SD screened research drawn from any Australian firefighter population, thereby making the present research particularly important.

This research has therefore investigated QFES firefighters PTSD symptomology with a contemporary instrument that reflects the DSM-5 PTSD diagnostic criteria. It has

investigated the same population with a CI instrument which has high sensitivity to MiND and reflects the DSM-5TR MiND classifications. SD was measured so that the most accurate representation of this population could be gained.

There are relationships between firefighters' PTSD and CI. There is also a suggestion that CI may be associated with SD; however, while this was investigated, it was predominantly used to exclude those respondents who gave SD answers.

Research questions

This work-based study quantitatively investigated firefighter post-traumatic stress disorder, cognitive impairment, and social desirability by asking three specific research questions:

1: What are the current levels of PTSD and CI in QFES firefighters and how do they relate to normative data?

2: Are any background and/or demographic variables associated with PTSD and/or CI in QFES firefighters?

3: Is SD associated with PTSD and/or CI in QFES firefighters?

Method

Participants and procedure

Participants consisted of 134 firefighters from the Queensland Fire and Emergency Services (QFES), Australia. This sample included 104 permanent (full-time) and 30 auxiliary (part-time) employed firefighters from across most of the state; no volunteer firefighters participated in the study. The participants to this study comprised 11.9 % (*n* = 16) female and 88.1% (*n* = 118) male firefighters from all employment ages of 18-64 (Queensland firefighters must legally retire at 65), with most participants within the 55-

59 age group. All ranks, educational levels, years of service, relationship statuses, prior experiences and time since their last shift were represented.

Once all QFES, Union and University of Southern Queensland (UniSQ) Human Ethics Committee approvals (H21REA285) were gained, an email invitation with an attached participant information sheet, including an embedded hyperlink, was sent out to all paid QFES firefighters, and participants were then taken to a UniSQ on-line survey tool. This procedure involved an initial email invitation, following by a follow-up after one month, culminating in a two-month data collection period from August 2022 until October 2022.

Measures

Background and demographics

Background and demographic questions were developed as ordinal or nominal variables to enable analysis of the other measures, as illustrated in Table 1.

Post-Traumatic Stress Disorder Checklist for DSM-5

For the first dependent variable measurement of PTSD, the current research utilised the PTSD Checklist for the DSM-5 (PCL-5), as Bowen-Salter et al. (2021) have recommended its use for "researchers when working with adults with PTSD with exposure to differing trauma" (p. 10), which is more representative of a firefighter's para-military work environment.

Table 1. Background and demographic variable descriptive data (N = 134).

Age Mean=5.8 St Dev=2.15				**Gender**				**Years of Service** Mean=3.93 St Dev=2.3				**Region**				**Employment Type**				**Prior Emergency Service/ Military Experiences**			
Code	Age Group	Count	% of Total	Code	Gender Group	Count	% of Total	Code	Service Groups	Count	% of Total	Code	Region	Count	% of Total	Code	Type	Count	% of Total	Code	Experiences	Count	% of Total
1	18-24	2	1.5%	1	Indeterminate	0	0	1	0-5	29	21.6%	1	Brisbane	39	29.1%	1	Auxiliary	30	22.4%	1	No	80	59.7%
2	25-29	10	7.5%	2	Female	16	11.9%	2	6-10	14	10.4%	2	South Eastern	24	17.9%	2	Permanent	104	77.6%	2	Yes	54	40.3%
3	30-34	10	7.5%	3	Male	118	88.1%	3	11-15	22	16.4%	3	South Western	10	7.5%								
4	35-39	16	11.9%					4	16-20	18	13.4%	4	North Coast	36	26.9%								
5	40-44	21	15.7%					5	21-25	10	7.5%	5	Central	0	0								
6	45-49	18	13.4%					6	26-30	15	11.2%	6	Northern	17	12.7%								
7	50-54	20	14.9%					7	31-35	17	12.7%	7	Far Northern	3	2.2%								
8	55-59	24	17.9%					8	36-40+	9	6.7%	8	BEL or State	5	3.7%								
9	60-65	13	9.7%																				

Education				**Relationship Status**				**Subjective Question**				**Last Shift** Mean=4.5 St Dev=1				**Indigenous Status**				**Rank** Mean=3.32 St Dev=0.96			
Code	Type	Count	% of Total	Code	Status	Count	% of Total	Code	Answer	Count	% of Total	Code	Answer	Count	% of Total	Code	Identity	Count	% of Total	Code	Rank	Count	% of Total
1	Up to Grade 12	23	17.2%	1	Never Married	8	6%	1	Unsure	30	22.4%	1	More than a month	8	6%	1	Both Aboriginal and Torres Strait Islander	0	0	1	Recruit	0	0
2	TAFE	28	20.9%	2	Married	111	82.8%	2	No	53	39.6%	2	2-4 weeks	0	0%	2	Torres Strait Islander	0	0	2	Firefighter	35	26%
3	Trade	41	30.6%	3	Separated/ Divorced	15	11.2%	3	Yes	51	38.1%	3	1-2 weeks	2	1.5%	3	Aboriginal	3	2%	3	Senior Firefighter/ Lieutenant	34	25.4%
4	Degree	21	15.7%									4	1-7 days	31	23.1%					4	Station Officer/ Captain	53	39.6%
5	Post-Grad Degree	21	15.7%									5	Currently working	93	69.4%					5	Senior Officer/ Scientific	12	9%

The PCL-5 is recommended for a military-specific population (Bowen-Salter et al., 2021) and it also measures the PTSD domains from the DSM-5 PTSD diagnostic criteria. Contemporary firefighter PTSD researchers (Boffa et al., 2016; Noor et al., 2019; Stanley et al., 2017) have utilised the PCL, thereby further justifying its usage for potential comparison purposes.

The PCL-5 is a 20-item, self-report measure, which is used to screen individuals for PTSD and is psychometrically validated and reliable; it is useful in quantifying PTSD symptomology severity and is sensitive over time (Blevins et al., 2015; Bowen-Salter et al., 2021). A Chronbach Alpha of α = .94 and α = .95 for the PCL-5 has been reported by Blevins et al. (2015)

This measure is scored on a Likert scale of '0 = not at all' to '4 = extremely', which are summed for a total score. The PCL-5 cut-off score of 33 was used to provide a conditional PTSD diagnosis. This current research investigated both the continuous data of 0 to 80, and another nominal variable, which was created to incorporate the cut-off score of ≤ 32 for 'No PTSD' and ≥ 33 for 'Likely PTSD'.

Aging and dementia eight

For the second dependent variable, cognitive impairment, the literature documents a plethora of instruments. However, as brevity and simplicity are at the heart of firefighter psychometric investigations, as well as the fact that this was exploratory research, the eight-item Informant Interview to Differentiate Aging and Dementia (AD8) was utilised because it is designed as a brief cognitive function test (Galvin et al., 2005).

It usually takes approximately two minutes to assess an individual's global cognitive status within MND, especially in its mildest stages (Galvin et al., 2005). The AD8 assesses an individual's awareness of their own CI and that awareness also varies across occupational groups, which is more likely to be noticed particularly in its mildest form.

The AD8 is used internationally (Svensson et al., 2020; Tainta et al., 2022; Tak et al., 2021), it has been validated (Larner, 2020; Tainta et al., 2022; Ziso & Larner, 2019), it is sensitive to cognitive impairment (Larner, 2015; Tainta et al., 2022), and can be reliably used as a screening tool (Dalmasso, 2018; Larner, 2020; Ziso & Larner, 2019). The internal consistency for this instrument has been reported as $\alpha = .84$ (Galvin et al., 2006). This measure has eight questions and is scored with one point for a yes response and no points for the other responses. If a participant score ≥ 2 then the AD8 measure suggests that cognitive impairment is likely to be present.

Marlowe and Crowne Social Desirability Scale

The Marlowe-Crowne Social Desirability Scale 13-item short form (Form C) was utilised to separate any potential dishonesty from any respondents who may fabricate or downplay their psychopathology, which continues to be a challenge for clinicians and researchers (Tracy & Rix, 2017). Due to the fact that the proposed research was self-report and experimental, the measure also required the inclusion of potential faking good or faking bad participants.

Crowne and Marlowe (1960) designed a 33-item SD measure that improved upon a previous measures, which subsequently showed sizable correlations with Minnesota Multiphasic Personality Inventory (MMPI) scales (Andrews & Meyer, 2003; Paulhus, 1991). From this measure, other researchers have found that 13 of the original 33 items can replace the longer measure while maintaining reliability and validity in a brief, easy-to-administer, measure (Andrews & Meyer, 2003; Reynolds, 1982).

The internal consistency for the Form C ranges from $r = 0.62–0.89$, and its scores correlate strongly with the scores on the full scale ($r = 0.91–0.96$) (Ballard, 1992; Barger, 2002; Fischer & Fick, 1993; Loo & Loewen, 2004; Loo & Thorpe, 2000; Reynolds, 1982; Vésteinsdóttir et al., 2015).

This measure is scored dichotomously with one point for either a 'True' or 'False' response, depending on whether the item is reversed or not. Points are added to find low (0 to ≤ 3), average (≥ 4 to ≤ 7) or high (≥ 8 to ≤ 13) SD scorers.

Data analysis

Data was analysed using Jamovi, an online statistical computing program (Jamovi, 2022). Due to the observational cross-sectional design, there was an investigation of all the measures as outlined above. To answer the research questions, all three psychological measures (PCL-5, AD8, and Form C) were analysed in both their continuous form of zero to its maximum score as well as the individual measure's recommended cut-off score for provisional clinical diagnosis, as outlined above.

For the PCL-5 continuous variable, there was a minimum score of zero and a maximum score of 80, which was named "PCL". By contrast, when using the instruments clinical cut-off score, another dichotomous variable called 'PTSD-New' was made up of '1' for No PTSD and '2' for Likely PTSD.

For the AD8 continuous variable, there is a minimum score of zero and a maximum score of 8 which is named "AD8", whereas when utilising the instruments clinical cut-off score, another dichotomous variable named 'AD8-New' was made and scored '1' for no CI and '2' for CI likely.

For the SD continuous variable, there is a minimum score of zero and a maximum score of 13; however, when utilising the instrument's cut-off scores, there was an ordinal variable called 'SD-New'. To avoid statistical miscalculations, this research incorporated a log transformation of 'zero' to 'one'. This then required the new cut-off scores to be 'low SD' (13 ≤ 16) 'average SD' (17 ≤ 20) and 'high SD' (21 ≤ 26).

Initially, descriptive, frequency and reliability analyses were conducted. These answered the first research question about the current level of PTSD and/or CI in QFES firefighters

which was compared to the normative data. One-way analyses of variances (ANOVAs) with Tukey's honestly significant difference (HSD) *post-hoc* tests, along with Pearson product moment correlation coefficient analyses (r = for correlations between interval variables), were conducted on all variables to answer the remaining research questions of whether there were any background and/or demographic variables associated with PTSD and/or CI in QFES firefighters, and whether SD was associated with PTSD and/or CI.

Results

For the dependent variables, Cronbach alpha coefficients were: PCL-5 α = .96; AD8 α = .75; and Form C α = .69, indicating that scores on the PCL-5 were significantly consistent whereas scores for AD8 and Form C were acceptably so.

When utilising the Form-C instrument's cut-off scores, it was found that there were insufficient 'low' (n = 7) SD score participants compared to the 'average' (n = 30) and 'high' (n = 97) SD scorers. To enable reliable analyses of this variable, it was decided to group the low and average participants (n = 37) to form the new low group and leave the high group as noted above.

Descriptive data, including means, standard deviations, skewness and kurtosis, are presented in Table 1 for background and demographic variables, and inferential statistics in Table 2 for dependant variables. Skewness was within acceptable normality limits for all variables except gender and 'time since last shift', whereas kurtosis was high in the variables gender, relationship status, and 'time since last shift'. However, these were generally within the limits of normality (George & Mallery, 2011). The data were therefore treated as normal and parametric analyses were performed.

Table 2. Dependent variable descriptive data (N = 134).

Variable		Mean	SD	%
PCL-	Overall total	17.7	17	
	High SD	15.3	15.7	
	Low SD	23.8	19	
PTSD- New-	Overall total	1.2	0.4	20.1
	High SD	1.15	0.36	15.5
	Low SD	1.32	0.47	32.4
AD8-	Overall total	17.7	2.33	
	High SD	17.3	2.09	
	Low SD	18.8	2.64	
AD8- New-	Overall total	1.43	0.5	43.3
	High SD	1.35	0.48	35.1
	Low SD	1.65	0.48	64.9
Form C-	Overall total	21.6	2.72	
	High SD	22.91	1.46	72.4
	Low SD	18.03	1.99	27.6

To investigate the current levels of firefighter PTSD and CI, the instruments' clinical cut-off scores were used. For PTSD, the current cut-off level was 20.1% for all participants, yet when broken down into the SD groups, the high SD group had 15.5% PTSD while the low SD group reported 32.4% PTSD. Additionally, when using the AD8 cut-off score for CI, the frequency data revealed the current level of CI from all participants to be 43.3%. Interestingly, the high SD group reported 35.1% CI whereas the low SD group reported 64.9% CI.

When investigating the second research question with tests of differences, one-way ANOVAs found that only two of the 11 background or demographic variables were statistically significant with all the PTSD and/or CI variables. Firefighters' 'years of service' were significant with the PCL ($F(7,126) = 5.37$, $p < .001$), PTSD-New ($F(7,126) = 4.81$, $p < .001$), AD8 ($F(7,126) = 2.69$, $p = .01$) and the AD8-New ($F(7,126) = 3.13$, p

= .004). The second variable asked firefighters to answer a 'subjective question' on whether they thought they had any psychopathology, whereby those who answered 'yes' were significantly higher with the PCL ($F(2,131) = 50.5$, $p < .001$), PTSD-New ($F(2,131) = 22.2$, $p < .001$), AD8 ($F(2,131) = 20.0$, $p < .001$), and the AD8-New ($F(2,131)=13.1$, $p<.001$).

There were two other background or demographic variables which reached statistical significance at or beyond the 95% level of confidence with some of the PTSD and/or CI dependent variables. The firefighters' 'age' variable found that older firefighters reported more (PTSD-New ($F(8,125) = 2.39$, $p = .02$), AD8-New ($F(8,125) = 2.35$, $p = .02$)) clinically reportable psychopathology. By contrast, female firefighters were significantly different from the males with the AD8-New ($F(1,19.5) = 5.11$, $p = .03$) 'gender' variable. Table 3 shows all one-way ANOVA results with significant group differences.

When investigating the second research question with correlations, Pearson's product moment correlational coefficients found that three ('age', 'years of service' and answering the 'subjective question') of the 11 background or demographic variables were correlated with all the PTSD and/or CI variables. Furthermore, a firefighter's 'rank' and 'gender' were only correlated with the AD8-New variable. Table 4 shows all correlational results.

When using the Form-C cut-off score for SD, frequency data revealed that the current level for low SD responding was 27.6% as opposed to 72.4% for high SD responding. This information helped address the last research question, which found that SD was associated with PTSD (PCL, $r = .68$ $p < .001$), PTSD-New ($r = .68$ $p < .001$), CI (AD8, $r = .68$ $p < .001$), and AD8-New ($r= .68$ $p < .001$) but was not associated with any background and/or demographic variables.

Table 3. One-way ANOVAs with the significant group differences.

Dependent variable	Background/ Demographic variable	*F*	Group	*M*	*SD*
PTSD-New	Age	2.39*	30-34	1*	0
			40-44	1.1*	.3
			60-65	1.54	.52
	Years of service	4.81***	0-5	1***	0
			16-20	1***	0
			31-35	1.53	.51
	Subjective question	22.2***	Unsure	1.13***	.35
			No	1***	0
			Yes	1.45	.5
	SD-New	4.9*	Low	1.32*	.47
			High	1.15	.36
AD8-New	Age	2.35*	30-34	1.1**	.316
			35-39	1.25*	.45
			60-65	1.85	.38
	Gender	5.11*	Male	1.4*	.5
			Female	1.69	.48
	Years of service	3.13**	0-5	1.21*	.41
			31-35	1.71	.47
	Subjective question	13.1***	Unsure	1.43	.5
			No	1.21***	.41
			Yes	1.67	.48
	SD-New	10.3**	Low	1.65**	.48
			High	1.35	.48
PCL	Years of service	5.37***	0-5	11.28***	8.5
			16-20	8.17***	7.7
			26-30	9.8**	14.12
			31-35	32.24	20.23
	Subjective question	50.5***	Unsure	16.51***	14.19
			No	5.55***	6.27
			Yes	30.94***	16.68
	SD-New	6.92**	Low	23.81**	18.98
			High	15.34	15.72
AD8	Years of service	2.69**	0-5	16.83**	1.44
			31-35	19.35	2.29
	Subjective question	20***	Unsure	17.63*	2.09
			No	16.51***	1.46
			Yes	19.06**	2.52
	SD-New	10.58**	Low	18.76**	2.64
			High	17.34	2.09

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

Table 4. Correlational matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. SD-New	–	**-.27****	**-.27****	**-.19***	**-.22****	**-.05**	**-.08**	**-.07**	**-.11**	**.01**	**.01**	**.06**	**-.16**	**-.01**	**-.07**	**.02**
2. AD8-New		–	**.79*****	**.46*****	**.56*****	**.19***	**.19***	**.23****	**.08**	**-.07**	**-.07**	**.2***	**.07**	**-.06**	**.24****	**-.01**
3. AD8			–	**.58*****	**.68*****	**.19***	**.11**	**.21***	**.07**	**-.02**	**-.05**	**.16**	**.07**	**-.07**	**.30*****	**-.12**
4. PTSD-New				–	**.87*****	**.28****	**.04**	**.31*****	**.04**	**.04**	**-.11**	**.16**	**.07**	**-.05**	**.36*****	**-.01**
5. PCL					–	**.21***	**.12**	**.25****	**.02**	**-.01**	**-.05**	**.13**	**.08**	**-.10**	**.40*****	**-.03**
6. Age						–	**-.28****	**.77*****	**.08**	**.23****	**-.09**	**.48*****	**.22****	**.03**	**.13**	**.06**
7. Gender							–	**-.30*****	**-.02**	**-.24****	**-.07**	**-.12**	**-.16**	**.08**	**.17**	**-.07**
8. Years of Service								–	**.04**	**.32*****	**-.18***	**.68*****	**.18***	**.04**	**.09**	**.14**
9. Region									–	**-.01**	**.01**	**.02**	**.02**	**-.04**	**.04**	**.03**
10. Employment										–	**.11**	**.29*****	**.24****	**.05**	**.02**	**.14**
11. Prior Exp											–	**-.17***	**.08**	**-.06**	**-.11**	**-.09**
12. Rank												–	**.07**	**.28****	**.08**	**.14**
13. Relationship Status													–	**-.01**	**.12**	**.06**
14. Education														–	**-.02**	**.02**
15. Sub-Q															–	**-.07**
16. Time Since Last Shift																–

Note. **p* < .05; ***p* < .01; ****p* <.001

Discussion and Conclusion

PTSD is a well-researched insidious occupational hazard which can result in significant debilitation for a disproportionate number of firefighters. CI, though not as well researched amongst firefighters, can also have significant long-term ramifications. PTSD and CI react individually, with SD responding affecting firefighter psychopathology rates. The aims of this work-based research were to investigate authentic firefighter PTSD and CI rates from within QFES.

The main results indicate that QFES firefighters have a high PTSD rate of 20.1% and an even higher CI rate of 43.3%, which answers the first research question.

When firefighters are separated into their respective SD groups for PTSD, the low group reported 32.4%, whereas the high group reported 15.5%. These figures are still higher than other firefighter PTSD findings of 12.4% for Queensland (Chamberlin & Green, 2010) and 8% for New South Wales (Harvey et al., 2016), remembering the firefighter literature varies from 5% up to 31.8%.

When firefighters were separated into their respective SD groups for CI, the low group reported 64.9%, while the high group reported 35.1%. Interestingly, this appears to be the first reporting of a CI resting baseline for Australian permanent, urban firefighters. For comparison purposes, Mueller et al. (2021, p. 806) found "cognitive concern" rates of 27% to 54% within a large American sample across four different firefighting organisations.

When investigating the second research question, firefighters who had more 'years of service' and those who answered a 'subjective question' on whether they thought they had any psychopathology were associated with all the dependent variables. Older firefighters reported more clinically reportable PTSD and CI, whereas female firefighters had more clinically reportable CI but did not differ from males with PTSD, which is in line with the findings of Onyedire et al. (2017) but in contrast to the findings of Noor et al. (2019).

When investigating the descriptive tables and plots with 95% confidence intervals, there was a definite upward trend on more PTSD and CI; however, the firefighters with more senior 'rank' were only significant with clinically reportable CI, which can be inherently related to the older firefighters and firefighters with more 'years of service'.

The final research question found that SD was significantly associated with both PTSD and CI, but the finding that SD was not associated with any background and/or demographic variables was surprising.

These results demonstrate that PTSD and CI is spread evenly in firefighters throughout the state of Queensland, and it apparently does not matter if one is employed in Cairns (a busy) or at Coolangatta (a relatively quiet) fire station, as PTSD and CI are not related to a firefighter's employment region. Therefore, these results suggest that it is not the number of 'jobs' or types of emergency incidents that contribute to PTSD and/or CI, which is something future researchers could investigate.

When it comes to firefighter employment type, it apparently does not matter if a firefighter is permanently employed or if they are an auxiliary firefighter, as the rates of PTSD and/or CI are the same across the state. Intuitively, the employment type is similar to the preceding statement about employment region, as again a permanently employed fire station will generally have more fire calls than an auxiliary employed fire station, which are inherently quiet.

This research has found that prior to joining QFES, a firefighter with any emergency and/or military service experiences will not have any PTSD and/or CI differences to others without those experiences. From an employment perspective, this finding can have recruiting ramifications in that QFES will be able to gain the skills and experiences from these applicants and be confident that their previous service has not resulted in recruits having PTSD and/or CI

differences, though this is a double-edged sword in that age and years of service do contribute to PTSD and/or CI.

Relationship status is another background variable that did not have any protective influences on PTSD and/or CI, which is contrary to Lebeaut et al. (2021, p. 58) who have suggested that "relationship status may potentially serve as a protective factor".

The interesting concept of asking participants to answer a subjective question if they "think" they may "have PTSD and/or Depression and/or Anxiety and/or Stress and/or Cognitive Impairment" was significant at $p < .001$ and has large F-values from 13.1 to 50.5. These strong results were further authenticated when this question was non-significant with the SD groups, meaning that those in both groups who answer 'yes' both had significant (at $p < .001$) PTSD and/or CI.

From a time perspective, it did not appear to matter how long since a firefighter's last shift, as someone could intuitively think that a firefighter may start recovering from PTSD or CI, but this was not the case, due to non-significant statistical analyses (despite the slight downward trend of the descriptive tables and plots). Harvey et al. (2016) found 8% of New South Wales (NSW) firefighters had PTSD; unfortunately, this figure jumped to 18% for retired NSW firefighters.

There were several significant inter-correlations between variables which are noteworthy. The subjective question, though significant for both PTSD and CI, was non-significant for any other background and/or demographic variable. This suggests that it does not matter who the firefighter is; if they think that they have PTSD or CI, then they will have PTSD or CI. Conversely, if they think they do not have PTSD or CI then they will not have it, yet, if the firefighter is unsure of their PTSD or CI, then their mean score will be between the 'no' and 'yes' responses. Moreover, there were no differences between the SD groups.

Asking a firefighter a subjective question about their psychopathology needs to be understood in the context of just asking a subjective question, which did not come from any validated psychological self-reporting instrument. Therefore, whilst answering the question, the majority of participants were intuitively accurate about their psychopathology.

Lastly, from a gender perspective, male firefighters in this research were older, had more years of service, and were more likely to be permanently employed, yet there were no gender differences in the differing ranks of QFES, which points to successful QFES gender equality promotional processes.

As with most research, there were methodological limitations in the research design of this study. For example, the research was supposed to be administered face-to-face; however, due to strict QFES requirements this research was only allowed to be administered online. As expected, and in accordance with Lindemann (2019), this online research was poorly attended as QFES has a total of 4,337 (Permanent and Auxiliary) firefighters (Queensland Government, 2022), yet only 161 participated. This represents just 3.7% of the entire firefighter population. Once the data were screened, this number dropped to $n = 27$ for partial and/or no responses and $n = 134$ for full responses, which represented just over 3% of the entire firefighter population. Another previously forecasted methodological consideration is that nearly 70% of participants would complete this research at work, which then leads into the obvious privacy considerations due to the uncontrolled placement of work computer screens, which may or not be visible to others. Furthermore, as this research went to a recipient's work email address, the vast majority of respondents were at work when they opened the email and most likely completed the research at the start of their individual shift pattern.

This is reflected in the 'time since last shift' variable, as skewness and kurtosis were an issue for this and the 'gender' variable. There was another obvious disparity due to more males being employed as firefighters, therefore being the majority who undertook the research.

The final and most glaring methodological issue, which in itself constitutes a research question, and which adds further salience for these results, is the SD. It must be remembered that the low SD group comprised both the low (5.2%) and average (22.4%) participants compared to the standalone high (72.4%) group. By virtue of the small number of 'low' participants, nearly 95% of firefighters would give average to high SD answers even though participants knew this was an anonymous survey. Furthermore, as the SD was not significantly different by group across all the background and/or demographic variables, this suggests that any firefighter was most likely going to give SD answers and downplay or under-report the presence of any psychopathology.

In conclusion, this research has demonstrated that QFES firefighters have significantly high PTSD and even higher CI. It has further shown that despite testing a large range of background and/or demographic variables, only older firefighters with more years of service, or those who thought they had any psychopathology, had high PTSD and CI. These results also illustrate firefighters will under-report PTSD and CI given the high levels of SD responding to an anonymous survey.

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CHAPTER 4: DISCUSSION AND CONCLUSION

4.1 Introduction

This chapter outlines the important research findings that are related to firefighters' psychopathology, namely, PTSD and CI. In section 6.2, the research findings related to the three research questions and other noteworthy findings are outlined. In section 6.3, limitations of this research are presented, with section 6.4 outlining the direction of future research. In Section 6.5 the learning outcomes are presented whilst section 6.6 concludes this chapter.

4.2 Research findings

After QFES (see Appendix A) and UniSQ Human Ethics Committee (H21REA285) approvals were gained, a participant consent form (see Appendix B) was sent to all particpants for this work-based study to investigate the research questions in a formal research setting. The first research question was designed to investigate the current levels of PTSD and CI amongst QFES firefighters and then compare these results to both historic and current levels. The second research question aimed to explore what background and/or demographic variables (see Appendix C) would either inhibit or exacerbate PTSD and/or CI. The final research question was borne out of subjective observations from previous research on PTSD within QFES firefighters. This exploratory study employed quantitative analyses which utilised relabile and valid psychometric instruments to measure participants' PTSD (see Appendix D) , CI (see Appendix E) and SD (see Appendix F).

4.2.1 RQ 1: What is the current level of Post-Traumatic Stress Disorder and Cognitive Impairment in Queensland Fire and Emergency Service Firefighters and how does this relate to the normative data?

For PTSD, this study found that the current level is 20.1%, which is significantly higher than the most recent 12.4% findings from the Chamberlin and Green (2010) sample of QFES firefighters. Furthermore, this is significantly higher than the 8% for NSW firefighters (Harvey et al., 2016).

Interestingly, when PTSD is broken down into the SD groups, the low SD group showed 32.4% whereas the high SD group showed 15.5%, again, and both of these figures are higher than the previous 12.4% QFES (Chamberlin& Green, 2010) and 8% NSW (Harvey et al., 2016) amongst firefighters.

It must be remembered that the current research used the PCL-5 measure which was designed to measure PTSD symptomology from the DSM 5 (Blevins et al,. 2015), thereby enabling comparisons to international firefighter PTSD reserachers who utilised the PCL-5. Boffa et al. (2017) had found that 31.8% had a “probable PTSD” (p. 279) diagnosis, whilst Noor et al. (2019) had found that 16% of their sample had PTSD symptoms. Furthermore, to highlight an example of the signficant variability within the firefighter PTSD literature, Stanley et al. (2017) reported a figure of 19.7%, and then went on to find a figure of 30.4% a year later (Stanley et al., 2018).

Finally, all of the current findings (high SD=15.5%, M=20.1%, low SD=32.4%) are significantly higher than the official Australian prevalance rate of 5.7% (Australian Bureau of Statistics, 2021) and the world-wide general population prevalence rate of 3.9% (American Psychiatric Association, 2022).

For CI, this research found the current level to be 43.3%. It appears these are the first reportable direct resting baseline CI rates for any Australian permanent urban firefighter group. Furthermore, when this figure is separated into the respective SD groups, it the low SD group showed 64.9% CI, whereas the high SD group showed only 35.1%.

This research finding appears to be the first amongst Australian firefighters, as an investigation of the DSM 5TR (American Psychiatric Association, 2022) mild neurocognitive disorders had not revealed any specific testing instruments, yet neuropsychological testing is a critical process to determine MND. Therefore, the current research utilised AD8, which can assess an individual's global cognitive status within MND, especially in its mildest stages (Galvin et al., 2005; Zhuang et al., 2021). When the current results were compared to the general population, the DSM 5 TR prevalence rate for MND was 2-10% at age 65 and 5-25% by aged 85 (American Psychiatric Association, 2022). Furthermore, Mueller et al. (2021, p. 806) found "cognitive concern" rates ranging from 27% to 54% within a large American sample across four different firefighting organisations (p. 806).

Thus, even when there is a lack of standardised CI tesing instruments that measure the DSM diagnostic criteria, these results are somewhat similar to American firefighter samples. More concerningly, the current research figures (high SD 35.1%, *M*= 43.3%, low SD 64.9%), with a mean participant age of 40-44 years old, are still significantly higher than the 5% to 25% for 85 year-olds in the general population.

4.2.2 RQ 2: Are any background and/or demographic variables associated with Post-Traumatic Stress Disorder and Cognitive Impairment amongst Queensland Fire and Emergency Service Firefighters?

When investigating the results related to this research question, it became evident that only four of the eleven background/demographic variables were associated with PTSD and/or CI.

Firefighters who have more 'years of service' and those who answered the 'subjective question' (on whether they thought they had any psychopathology) were significantly different for all the dependent variables. These results support previous QFES

research which found that the longer a firefighter served, the greater their psychological distress (Dean et al., 2003).

Older aged firefighters were only significant for the clinically reportable variables but not for the continuous dependent variables. The fourth and final variable of 'gender' showed that female firefighters had more clinically reportable CI but they did not differ statistically from the males with PTSD. This finding is in accordance with Onyedire et al. (2017), but contrasts with Noor et al. (2019) who found significant differences between the genders, with female firefighters having more PTSD than the males.

Interestingly, when investigating the descriptive tables and plots with 95% confidence intervals, there was a definite upward trend of more PTSD and CI for higher ranked firefighters. However, firefighters with a higher senior 'rank' were only significantly different on clinically reportable CI, which can be inherently related to the older aged firefighters and firefighters with more 'years of service'.

4.2.3 RQ 3: Is Social Desirability associated with Post-Traumatic Stress Disorder and Cognitive Impairment in Queensland Fire and Emergency Service Firefighters?

The third and final research question found that SD was significantly associated with both PTSD and CI, as explained by the response to research question one. Even more surprisingly, SD was not associated with any background and/or demographic variables.

Therefore, any firefighter, regardless of any demographic or background variable used in this research (age, gender, years of service, region, employment type, prior experience, rank, relationship status, educational status and time since their last shift), is likely to give SD answers and downplay any psychopathology.

4.2.4 Other noteworthy findings

Employment location

The results from the research demonstrate that PTSD and CI are spread evenly throughout the State of Queenland; therefore, it does not matter if a firefighter is employed in Cairns (a busy fire station) or over 1800 kms away at Coolangatta (a relatively quiet fire station), as PTSD and CI are not significantly different across QFES employment 'regions'. These results point to the fact that it is not the amount of 'jobs' or the location of the employment that contribute to PTSD and/or CI but rather the type of work itself that contributes to the psychological status of firefighters.

Employment type

When it comes to firefighter employment types, there are no differences between the permanently employed and auxiliary firefighters as the rates of PTSD and/or CI are the same across the whole state. The current research results contradict those of previous researchers who found that career (permanently employed) firefighters reported more psychological distress than auxiliary firefighters (Dean et al., 2003). Conversely, when comparisions are made to international firefighter populations, Stanley et al. (2017) investigated psychopathology differences between volunteer and career firefighters and found that volunteers reported significantly more elevated levels of depression, post-traumatic stress and suicidality. It must be remembered that in this example, 'volunteer' firefighters are the North American version of QFES paid auxillary firefighters and are therefore not the same as QFES Rural Fire Service members.

Thus, it does not matter if someone is employed as a permanent or as an auxillary firefighter, as there are not likely to be any PTSD and/or CI differences. Still, it is important to remember in this respect that a permanently employed fire station will

generally have more firecalls than an auxillary employed fire station, which is inherently quieter.

Prior experiences

Firefighting, like many other professions, relies on its employees to have a set of specialised skills which are difficult and expensive to gain. Therefore, it makes sense that if an emergency service organisation can utilise an individual's prior experiences it will save time and money in training. This then flows on to an individual's actual prior experiences. As the old firefighter saying goes: 'no two fires are the same'; sure, some incidents may be similar, but they will never be the same.

As the majority of firefighters want to perform at 100% and resolve any emergency incident, it makes further sense for an organisation to employ people who have those experiences as 'experience is the master teacher'. Thus, when it comes to critical incidents where lives hang in the balance, these prior experiences go a long way in helping the situation and by extension the community the organisation serves.

From an exploratory perspective, this research found that prior to joining QFES, a firefighter with any emergency and/or military service experiences would not show any differences in terms of PTSD and/or CI when compared to a firefighter without those experiences. Therefore, from an employment perspective, this finding has potential recruiting ramifications in that QFES will be able to capitalise on these applicants' previously aquired skills and experiences. The organisation can also be confident that their previous service may involve any PTSD and/or CI differences, though this is a double-edged sword in that age and years of service actually do contribute to PTSD and/or CI.

Relationship status

Interestingly, this current research investigated a range of variables which were expected to provide protection from PTSD and/or CI. Unfortunately however, in this research, 'relationship status' proved to be another background variable that did not provide any protective influences again PTSD and/or CI. These findings contrast with those of Lebeaut et al. (2021, p. 58) who suggested "relationship status may potentially serve as a protective factor" for firefighters (p. 58).

Time since last shift

To enable recovery from stress, anxiety and/or PTSD, a human's innate characteristic ensures that the longer a person is away from a stressful environment the less the impact of those stressors that produce the activations of an anxiety and/or PTSD response should become (Folk, 2021; Grissom & Bhatnagar, 2009). Therefore, a component of this research was to investigate if time away from employment would result in a change of PTSD and/or CI reaction for firefighters. It would then be expected that a firefighter may start recovering from PTSD or CI, yet this was not shown to be the case in this study as per its non-significant statistical analyses. However, further investigation of the descriptive tables and plots revealed a slight downward trend albeit non-significant. It must be remembered that Harvey et al. (2016) found that 8% of New South Wales (NSW) firefighters had PTSD, and this figure jumped to 18% for retired NSW Firefighters. These results would therefore indicate that even with the benefit of time away from firefighting employment, PTSD either continues to grow, or it is underreported in the first place, which is reinforced by this research. Maybe, it is a combination of both.

Subjective question

The subjective question was borne out of a psychologist supervision session, which was aimed at investigating the participant's self-awareness of their psychopathology. The subjective question was earlier reported in this research as being significant for both PTSD and CI, yet the subjective question was non-significant for any other background and/or demographic variable. This suggests for any firefighter that their self-awareness of their own psychopathology is accurate.

The subjective question was not adapted from any validated psychological self-reporting instrument and therefore whilst answering the question, participants were intuitively accurate about their psychopathology, yet at the same time, the vast majority were still giving SD answers. Therefore, the question remains whether firefighters were discriminating between the questions on the survey by giving SD answers to some questions and not to others.

Based on these results, the subjective question had large *F* values (13.1 to 50.5) which were significant ($p < .001$), thus justifiying the question's inclusion in the research. These strong results were further authenticated when this question was non-significant for the SD groups, suggesting that all firefighters were aware of their individual psychopathology.

Gender

This is the last noteworthy background and/or demographic variable. For this research male firefighters were older, had more years of service, and were more likely to be permanently employed. Another interesting finding was that there were no gender differences within the differing ranks or employment regions. This could point towards a successful QFES gender equality promotional process.

4.3. Limitations of the research

As with the majority of research, there will be methodological issues or limitations. It must be remembered that this was exploratory psychological work-based research and during the approvals process there was no understanding or consideration given to the fact that the principal investigator was an Australian registered psychologist with no restrictions.

Psychologists are bound by additional privacy and ethical rules, and they are also the only ones allowed to legally administer psychological instruments, unlike other researchers who must administer such instruments under the supervision of a registered psychologist.

This research was intially designed to research only female and Indigenous firefighters with face-to-face data gathering measures. After UniSQ HREC application process, approval was granted to allow face-to-face administration; unfortunately however, QFES would not support the face-to-face component that targeed female and Indigenous firefighters. After a meeting with QFES decision makers, approval was granted for the current format which then had to be reapproved by UniSQ HREC.

It must also be remembered that the author had previously conducted research without incident, which was subsequently published in a peer reviewed journal. That research was conducted in a face-to-face format which is why the original proposal incorporated that format. Therefore, if any participant had an adverse reaction whilst completing any of the psychological instruments, there would have been a psychologist on hand to help/monitor the individual. This serious consideration was overlooked when the online format was mandated and became an ethical concern for participants responding to the online format.

When the current online research was approved and then finally administered, it was predicted, in line with Lindemann (2019), that this online research would be poorly attended as QFES has a total of 4337 (Permanent and Auxiliary) firefighters (Queensland Government, 2022), and ultimately only 161 participated. This represents just 3.7% of the entire firefighter population. Once the data was screened, this number dropped to *n* = 27 for partial and/or no responses and *n* = 134 for full responses, which represents 3% of the entire firefighter population.

Another predicted online format methodological consideration is that nearly 70% of participants completed this research at work which led to obvious privacy considerations due to the uncontrolled placement of work computer screens which may be visible to others. Furthermore, as this research went to the recipients' work email address, the majority of respondents were at work when they opened the email and most likely completed the research at the start of their individual shift pattern.

This is obviously reflected in the 'time since last shift' variable, as skewness and kurtosis was an issue for this. The gender variable was another obvious disparity due to more males being employed as firefighters, thus leading to them being the majority to participate in the research.

Another issue was related to this research's methodological rigour as it was confined to an observation cross-sectional design without random selection of participants, thus limiting analytical generalisation. Furthermore, participants had to be computer literate and sufficently motivated to complete this research.

The final and most glaring methodological issue, which in itself was related to the research questions and which adds further salience to these results, was social desirability. It must be remembered that the low SD group was comprised of both the low (*n*= 7 or 5.2%) and average (*n* = 30 or 22.4%) participants compared to the

standalone high (*n* = 97 or 72.4%) group. By virtue of the small number of low participants, nearly 95% of firefighters were likely to give average-to-high SD answers even though participants knew this was an anonymous survey.

Furthermore, as SD was non-significant with all the background and/or demographic variables, any firefighter was most likely going to give SD answers and downplay any psychopathology.

4.4. Future research

There is a plethora of pathways future researchers into firefighter psychopathology could investigate. As a practicing psychologist and an operational firefighter, this previously published author recommends future research into a number of topic areas.

Cognitive Impairment

The concept of CI needs to be fully investigated in the context of the resting baseline rate of CI. From the benefit of over three decades of professional firefighting, I recognise that some firefighters may not only have PTSD but the majority could potentially have some level of CI, as shown by this research. Future researchers could investigate the causes of this phenomenon and then further investigate the assertion that depending upon some firefighters' internal belief system, they could either go down a pathway of developing PTSD or they could go down a pathway developing CI, but not both concurrently.

Initial research has found that particulate matter generated from wildfires is associated with an increased likelihood of developing dementia (Zhang et al., 2023). As CI is a possible precurser to dementia, this line of enquiry could also be investigated in relation to firefighters, in particular QFES rural firefighters.

Social Desirability

Another interesting phenomenon that needs further investigation is SD. Why is it that the vast majority of firefighter will give SD answers? As outlined earlier, it could be the high stress which can lead to CI, which in turn could affect firefighters' SD responding (Brody et al., 2000). Could it be that depending on how the firefighter conceptalises their job, they could either develop PTSD or CI or a combination of both, which would then affect their SD responding?

Future researchers could investigate what the magic number of incidents is, or how many years must be served, or how old a firefighter is before they start to develop PTSD and/or CI.

Personality variables

Epictetus, an infamous roman stoic philosopher, once said: "Men are not disturbed by things, but by the views they take of them" (Cavanna et al., 2023, p. 1864). Future investigations should therefor be focused on what the personality characteristics are that make a person PTSD and/or CI resistant, as this would have significant ramifications. Imagine if firefighting organisations can recruit persons who are PTSD and/or CI resilient. This could result in significant savings via a reduction in staff, absences, turnover and/or workcover claims, not to mention the reduction or elimination of the emotional cost to individuals.

A personality characteristic that could be investigated is empathy. Could empathy actually contribute to SD, as being a firefighter is like being part of a pseudo family, which is like living with others they might not like or necessarily get on with. Thus, a firefighter may not want to hurt another's feelings so they will tell them white lies (like 'you did a good job pumping') as encouragment, when in reality, they were terrible and should never have been employed in the first place.

Another personality variable that could have affected the current research, and which could therefore be investigated, is a firefighter's paranoia about the survey itself. The firefighter participants may have thought the survey was not confidential, yet, when answering the subjective question they were honest. In this way, SD is situational and at different times when the participants were undertaking the research and giving SD answers to some questions they could be honest in their responses to other questions.

Methodology

This type of research needs to be conducted in a face-to-face format and then compared to the online format. This would allow researchers to investigate any differences within the PTSD and/or CI and/or SD reporting. Conversely, if this research was only conducted face-to-face, it would also allow psychological monitoring of the participants responding to the psychometric instruments.

Another consideration should be to incorporate a sample of QFES rural firefighters and investigate any differences to the permanent and/or auxillary samples.

A final consideration could be that future researchers investigate SD in a different population for comparison purposes, for example office or construction workers.

4.5. Learning Objectives

The first LO was to contribute to the professional and firefighter psychopathological literature through the administration of contemporary psychological instruments, which will be achieved once the results are published in a peer reviewed journal. The second LO was to include a SD measure into the current research, which has already been achieved as evidenced in this thesis.

4.6. Conclusion

In conclusion, this research has demonstrated that QFES firefighters have significantly high PTSD and even higher CI. It has further shown that despite testing a large number

of background and/or demographic variables, only older firefighters with more years of service, or those who thought they had any psychopathology, had high PTSD and CI. These results also illustrate that firefighters are likely to underreport PTSD and CI given the high levels of SD in responses to an anonymous survey. However, this research did not find any PTSD gender differences in this respect.

This research has presented the most recent PTSD and CI information that was compared to other Australian and international firefighter research. SD is a concept that is not well-researched amongst Australian firefighters.

The significance of this research is simple. Like it or not, danger, destruction, and death are part of a firefighter's workplace. It is not a question of if these things will happen, but when: 'It's only a matter of time' we warn the eager probationary firefighters. If any part of this research can help just one firefighter avoid the insidious effects of adverse psychopathology, then that, in itself, is significant.

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APPENDIX A

From: Kevin Reading <AC.QFESpeople@qfes.qld.gov.au>

Sent: Wednesday, 17 August 2022 7:45 AM

To: allqfesstaff_DDG@qfes.qld.gov.au

Subject: REQUEST: Research participation- Firefighter Mental Health

*****PLEASE DISTRUBUTE WITHIN YOUR REGIONS*****

Attn: Fire & Rescue Senior Officers, Station Officers, Firefighters, Captains, Lieutenants and Auxiliary Firefighters

Good morning All,

This email is to inform you of valuable research and request for participation which is jointly endorsed by QFES, UFUQ & SOU.

If you were not aware QFES, in partnership with University of Southern Queensland (UniSQ), supports a Masters of Professional Studies- Research degree program. One of our operational Firefighters, currently enrolled in the program, is conducting research into Firefighter Mental Health and as such is seeking participants to inform the research outcomes.

This research is **100% private & confidential** with no identifying aspects for individuals. Participation will take approximately 5 to 15 minutes of your time with an average of 10 minutes.

Your participation in the research is entirely voluntary and please remember the purpose of this project is for educational purposes, however in the future it may be used to help inform research into mental health initiatives for Firefighters.

Attached to this email is the **Participants Consent and Information Sheet**. This outlines the research and the consent process. **It also contains the Hyperlink** that will take you to a research survey. For those interested, I encourage you to consider participating in this research.

Kind regards

Kevin Reading

Acting Assistant Commissioner

QFES People

Queensland Fire and Emergency Services

M [redacted]

APPENDIX B:

University of Southern Queensland

Participant Consent and Information Sheet

UniSQ HREC Approval number: H21REA285

Project Title

A Quantitative Study of Firefighter Post Traumatic Stress Disorder, Cognitive Impairment and Social Desirability.

Research team contact details

Principal Investigator Details:

Michael Chamberlin

[redacted]

Assistant Supervisors Details:

Dr L Fergusson

[redacted]

Description

This project is being undertaken as part of Master of Professional Studies (Research) through the University of Southern Queensland.

The purpose of this project is being conducted for educational purposes, however in the future it may be used to help Firefighters dealing with potentially traumatic incidents.

Participation

Your participation will involve the completion of four questionnaires that will take approximately 20 to 30 mins of your time.

Examples of questions may include: are you "feeling cut off or distant from other people" and/or "I always try to practice what I preach" and/or "do you have trouble remembering things"

Your participation in this project is entirely voluntary. If you do not wish to take part, you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

You will be unable to withdraw data collected about yourself after you have participated in the questionnaires as it is all non-identifiable and I won't know what's yours.

Your decision whether you take part, do not take part, or take part and then withdraw, will in no way impact your current or future relationship with QFES and/or University of Southern Queensland.

Expected benefits

Initially, it is expected that this project may not directly benefit you. However, in the future; it may benefit you and other Firefighters by a development of a QFES Mental Health Awareness training package.

Risks

In participating in the questionnaires, there are minimal risks such as answering questions about your psychological health that may potentially cause emotional or psychological distress. Sometimes, even just thinking about the sorts of issues raised in the questionnaire can create some uncomfortable or distressing feelings. Please contact **Fire & Emergency Services Support Network** (FESSN) on the details below and/or if you become distressed and would like assistance, please contact one of the following for further support:

- FESSN 24 hr counselling: 1800 805 980
- Firecare peer supporters via Firecom paging: 55 837 508

- Lifeline: 13 11 14

You may also wish to consider consulting your General Practitioner (GP) for additional support.

Privacy and confidentiality

All comments and responses are confidential unless required by law.

All data will NOT be made available for future research purposes. As this is non-identifiable research, data will be held by the researcher with the minimum storage option on one personal computer (only able to accessed by the researcher) which is password/ facial recognition protected and one secure cloud-based application (SPSS) via UniSQ access and one security enabled external hard drive which will be held in the researcher's home for backup purposes.

Furthermore, **unlike other researchers**, this researcher is a Psychologist and **also subject** to the Australian Psychological Society ethical guidelines **and further subjected** to Australian Health Practitioners Regulation Agency (AHPRA) guidelines. Suffice to say- the researcher would never risk his Psychologist registration because of poor data security and/or lack of confidentiality.

A summary of group results may be available from the researcher towards the end of 2022. Please contact Michael on the contact details above for this information.

Any data collected as a part of this project will be stored securely, as per University of Southern Queensland's Research Data and Primary Materials Management Procedure.

Consent to participate

Clicking on the `Submit' button at the conclusion of the questionnaire is accepted as an indication of your consent to participate in this project.

Questions

Please refer to the Research team contact details at the top of the form to have any questions answered or to request further information about this project.

Concerns or complaints

If you have any concerns or complaints about the ethical conduct of the project, you may contact the University of Southern Queensland, Manager of Research Integrity and Ethics on +61 7 4631 1839 or email researchintegrity@usq.edu.au. The Manager of Research Integrity and Ethics is not connected with the research project and can address your concern in an unbiased manner.

If you happy to start- Press Ctrl and Click on the Hyperlink below!

https://surveys.usq.edu.au/index.php/889161?lang=en

Thank you for taking the time to help with this research project. Please keep this document for your information.

APPENDIX C:

Example of the Demographic questions.

What is your Age (at last Birthday)?

18-24	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60-65**

What's your Gender?

Male	**Female**	Indeterminate

Do you identify as indigenous? ONLY IF YES- Please check box

Aboriginal	Torres Strait Islander	Both Aboriginal & Torres Strait Islander

What's your completed Years of Service?

0-5	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40+**

What Region are you from?

Brisbane	**South Eastern**	**South Western**	**North Coast**	**Central**	**Northern**	**Far Northern**	**BEL or State position**

Are you a Permanent and/or Auxilary Firefighter?

Permanent	**Auxilary**

Prior to joining QFES, did you have any previous Firefighting, Fire/AMB/POL Communications, Emergency Service and/or Military experiences?

Yes	**No**

What's your rank?

Recruit	**Firefighter**	**Senior Firefighter, Lieutenant**	**Station Officer, Captain**	**Senior Officer, Scientific**

What's your Relationship Status?

Never married	**Married or in a Defacto relationship**	**Separated or Divorced**

What's your Education history?

Up to and including Grade 12	**Completed a TAFE or equivalent qualification**	Completed a trade (for example- electrician, plumber etc)	**Completed a Bachelor degree**	**Completed a post (University) graduate degree)**

Do you think you have PTSD and/or Depression and/or Anxiety and/or Stress and/or Cognitive Impairment? (please check box and explain what you may have in the comment box)

Yes	**No**	**Unsure**

In days, when was your last QFES shift?

Currently on shift and/or working	1 to 7 days ago	1 to 2 weeks ago	2 to 4 weeks ago	More than a month ago

APPENDIX D:

Example of the PTSD Checklist (PCL–5)

Instructions: Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month. In the past month, how much were you bothered by:

0=Not at all, 1=A little bit, 2=Moderately, 3=Quite a bit, 4= Extremely

1. Repeated, disturbing, and unwanted memories of the stressful experience? 0 1 2 3 4
2. Repeated, disturbing dreams of the stressful experience? 0 1 2 3 4
3. Suddenly feeling or acting as if the stressful experience were actually happening again as if you were actually back there reliving it)? 0 1 2 3 4
4. Feeling very upset when something reminded you of the stressful experience? 0 1 2 3 4
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, rouble breathing, sweating)? 0 1 2 3 4
6. Avoiding memories, thoughts, or feelings related to the stressful experience? 0 1 2 3 4
7. Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)? 0 1 2 3 4
8. Trouble remembering important parts of the stressful experience? 0 1 2 3 4
9. Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)? 0 1 2 3 4
10. Blaming yourself or someone else for the stressful experience or what happened after it? 0 1 2 3 4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame? 0 1 2 3 4
12. Loss of interest in activities that you used to enjoy? 0 1 2 3 4
13. Feeling distant or cut off from other people? 0 1 2 3 4
14. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)? 0 1 2 3 4
15. Irritable behavior, angry outbursts, or acting aggressively? 0 1 2 3 4
16. Taking too many risks or doing things that could cause you harm? 0 1 2 3 4
17. Being “superalert” or watchful or on guard? 0 1 2 3 4
18. Feeling jumpy or easily startled? 0 1 2 3 4
19. Having difficulty concentrating? 0 1 2 3 4
20. Trouble falling or staying asleep? 0 1 2 3 4

Total=

APPENDIX E:

Example of the AD8

Remember, “Yes, a change” indicates that there has been a change in the last several years caused by cognitive (thinking and memory) problems.	YES, A change	NO, No change	N/A, Don’t know
1. Problems with judgment (e.g., problems making decisions, bad financial decisions, problems with thinking)			
2. Less interest in hobbies/activities			
3. Repeats the same things over and over (questions, stories, or statements)			
4. Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control)			
5. Forgets correct month or year			
6. Trouble handling complicated financial affairs (e.g., balancing checkbook, income taxes, paying bills)			
7. Trouble remembering appointments			
8. Daily problems with thinking and/or memory			

TOTAL AD8 SCORE

APPENDIX F:

Example of Marlowe-Crowne Social Desirability Scale- 13 items.

Please mark- T=True or F=False

1	It is sometimes hard for me to go on with my work if I am not encouraged.	T	F
2	I sometimes feel resentful when I don't get my way.	T	F
3	On a few occasions, I have given up something because I thought too little of my ability.	T	F
4	There have been times when I felt like rebelling against people in authority even though I knew they were right.	T	F
5	No matter who I'm talking to, I'm always a good listener.	T	F
6	There have been occasions when I have taken advantage of someone.	T	F
7	I'm always willing to admit it when I make a mistake.	T	F
8	I sometimes try to get even rather than forgive and forget.	T	F
9	I am always courteous, even to people who are disagreeable.	T	F
10	I have never been irked when people expressed ideas very different from my own.	T	F
11	There have been times when I was quite jealous of the good fortune of others.	T	F
12	I am sometimes irritated by people who ask favours of me.	T	F
13	I have never deliberately said something that hurt someone's feelings.	T	F