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Stress, coping and engagement among police officers: new methodological approaches

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RESUMO

O stress é um fator inevitável no dia-a-dia, e é o coping que determina os processos de adaptação, e a experiência de resultados positivos como o engagement. O trabalho de polícia tem sido reportado como sendo stressante. Esta tese de Doutoramento pretende melhorar o estado da arte na área da saúde ocupacional dos polícias. Especificamente, este trabalho pretende investigar: i) a avaliação de stress em contexto ecológico contemplando variáveis psicofisiológicas; ii) como é que a perceção de stress, o coping e o engagement se relacionam em recrutas durante o período de academia e um ano depois quando iniciam funções como polícias; iii) a frequência e a perceção de stressores diários, as estratégias de coping utilizadas e a sua eficácia; iv) o impacto do stress em termos fisiológicos, perceção psicológica e as estratégias de coping usadas em condições reais. Deste modo, uma revisão sistemática da literatura e três estudos empíricos foram desenvolvidos utilizando diferentes métodos. Os resultados, tendo em conta cada objetivo sugerem que: i) a literatura na área das abordagens ecológicas é vasta e controversa, e estudos futuros utilizando estas metodologias deverão ser sempre empiricamente e teóricamente sustentados. As avaliações de stress devem combinar e sincronizar medidas psicofisiológicas, concluindo-se que as abordagens ecológicas são um caminho promissor para a investigação na área da prevenção e reabilitação de stress; ii) os polícias que experienciam elevados níveis de controlo sobre os stressores, reportam maiores níveis de engagement. Parece também existir uma relação entre algumas estratégias de coping e o engagement. Os resultados sugerem ainda que o engagement em recrutas prediz o engagement em polícias; iii) os stressores mais reportados pelos polícias são operacionais. Apesar do coping focado na emoção ser o mais utilizado, o coping focado no problema foi reportado como sendo mais eficaz; iv) a polícia é uma profissão stressante e com impacto fisiológico negativo na saúde destes profissionais. Considerando as limitações e os desafios encontrados, foram descobertas importantes conclusões e debatidos potenciais benefícios com o objetivo de alcançar inovações metodológicas nesta área.

Palavras – chave : polícia; stress; coping; engagement

ABSTRACT

Stress is an inevitable factor in daily lives, and it is coping that makes the difference in adaptational processes and experience of positive outcomes such as engagement. Policing has been reported as a very stressful occupation. This Ph.D. work aims to improve the state of art in the area of occupational health among police officers. Particularly, this dissertation aimed to investigate: i) stress assessment under ecological settings, contemplating psychophysiological measures; ii) how stress appraisal, coping and engagement relates with police recruits during academy training and then one year later when on duty; iii) the frequency and the appraisal of daily stressors, the coping strategies used and their effectiveness; iv) the impact of stress in terms of physiological reactivity, psychological appraisal and coping strategies used under real world conditions. For this purpose one systematic review and three empirical studies were conducted using different methods. Findings for each aim of the Ph.D. suggested that: i) literature on ecological approaches is vast and controversial and future studies using this approaches should always be theoretically and empirically guided. Stress assessments should combine synchronized psychophysiological measures and it was concluded that Ambulatory Assessment approaches are a promising avenue for future prevention and rehabilitation stress research; ii) police officers that experience a high sense of control, report higher levels of engagement. There seems to be a relationship between some coping strategies and engagement levels. Moreover, the results showed that engagement among police recruits predicted engagement among police officers; iii) the most experienced stressors were operational-type. Although Emotion-Focused coping was mostly reported, Problem-Focused coping seems to be rated as most effective when dealing with stressors and iv) policing is a stressful occupation, with a negative physiological impact on officers' health. Acknowledging the limitations and challenges found, very important insights and potential future benefits can be addressed in order to reach methodological innovation in this area.

Keywords: police officers; stress, coping; engagement

RÉSUMÉ

Le stress est un facteur inévitable dans la vie quotidienne, et se débrouille fait la différence dans les adaptational processus et l'expérience des résultats positifs comme l'engagement. La police a été rapportée comme une occupation très stressant. Cette Ph.D. travail vise à améliorer l'état de l'art dans le domaine de la santé au travail les policiers. En particulier, cette thèse vise à étudier: i) l'évaluation du stress dans les paramètres écologiques, contemplant mesures psychophysiologiques; ii) comment l'évaluation du stress, l'adaptation et l'engagement se rapporte aux recrues de la police lors de la formation de l'académie et puis un an plus tard, lorsqu'ils sont en service; iii) la fréquence et l'évaluation des facteurs de stress quotidiens, les stratégies d'adaptation utilisées et leur efficacité; iv) l'impact du stress en termes de réactivité physiologique, évaluation psychologique et stratégies d'adaptation utilisées dans des conditions réelles. A cet effet, un examen systématique et trois études empiriques ont été menées en utilisant des méthodes différentes. Les résultats pour chaque objectif de l'Ph.D. a suggéré que: i) la littérature sur les approches écologiques est vastes et controversés et futurs études devrait toujours être théoriquement et empiriquement guidée. Évaluations de stress devraient combiner psychophysiologiques synchronisée mesures et il a été conclu que les approches d'évaluation ambulatoires sont une voie prometteuse pour future recherché sur la prévention et la réhabilitation du stress; ii) les agents de police qui éprouvent un sentiment de contrôle élevé, sont plus susceptibles de percevoir les événements comme étant positive, ayant des niveaux plus élevés d'engagement. Il semble y avoir une relation entre certaines stratégies d'adaptation et les niveaux d'engagement. En outre, les résultats ont montré que l'engagement chez les recrues prédit l'engagement chez les policiers; iii) les facteurs de stress les plus expérimentés étaient opérationnel. Bien que stratégies d´adaptation centrée dans les émotions sons principalement rapportés, les stratégies centrée dans le problème semble d'être considérés comme les plus efficaces et iv) la police est un métier stressant, avec un impact physiologique négatif sur la santé des agents. Reconnaissant les limites et les défis, trouver des idées très importantes et les avantages potentiels futurs peuvent être abordés afin d'atteindre l'innovation méthodologique dans ce domaine.

Mots-clés: agents de police; le stress, faire face; engagement

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LIST OF ABBREVIATIONS

AA – Ambulatory Assessment

ACC – Accelerometer

ANS – Autonomic Nervous System

BP – Blood Pressure

CFA - Confirmatory Factor Analysis

CFI – Comparative Fit Index

CI – Cardiovascular intensity

EF – Emotion-focused

ECG – Electrocardiography

EMA – Ecological Momentary Assessment

EMIs – Ecological Momentary Interventions

ESM – Experience Sampling Method

GAS – General Adaptation Syndrome

GFI - Goodness-of-Fit Index

GPS – Global Position System

GSR – Galvanic Skin Response

HF – High Frequency

HR – Heart Rate

HRV – Heart Rate Variability

LF – Low Frequency

M – Mean

PF – Problem-focused

PO – Police Officers

PSNS - Parasympathetic Nervous System

PTSD – Posttraumatic Stress Disorder

PJ – Polícia Judiciária

PSP – Polícia de Segurança Pública

RMSEA - Root Mean Square Error of Approximation

SAA – Society for Ambulatory Assessment

SCOPE – Stress and Coping among Portuguese Police Officers

SD – Standard Deviation

SEM – Structural Equation Model

SNS - Sympathetic Nervous System

SPSS – Statistical Package for Social Sciences

UWES - Utrecht Work Engagement Scale

UWES-S - Utrecht Work Engagement Scale for Students

VJ® – Vital Jacket

VR – Vital Responder

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INTRODUCTION

Stress is probably one of the most commonly used words in our society (Maracine, 2010). The term has been a topic of interest for several years. Past research has mainly focused on the negative aspects of stress and its association with negative outcomes, such as depression, anxiety, burnout and other diseases (Kohan & O´Connor, 2002). However, in recent years, positive psychology has changed the focus of investigation to the study of the positive aspects of the stress process, including positive outcomes such as personal transformation or growth that enhances the study of optimal functioning, instead of the study of dysfunctions and problems (e.g., Rothmann, Jorgensen, & Hill, 2011). Some of these studies emerged as an attempt to understand not only what stress is, but how people are dealing with it and how this can contribute to a more engaged and healthier population. This change of paradigm has contributed positively to stress research, since it allows the study of solutions to overcome its negative impact on a person's life.

Most people spend a considerable amount of their living time in the workplace, thus, the understanding of occupational stress, known as a particular form of stress that involves work (Dewe, O'Driscoll, & Cooper, 2010), should be of great concern, regarding the risks involved not only for the worker and organization, but also for the national economies (Cartwright & Cooper, 1997). Work stress is one of the major problems for health and safety in Europe. Accordingly, Maracine (2010) stated that approximately one in four workers suffer from stress, and the studies proposed that between 50% and 60% of work absence days are due to stress associated problems. In support of this, the EU-OSHA-European Agency for Safety and Health at Work, has recently developed a two-year campaign (2014-2015) called "Healthy Workplaces Manage Stress" for the worldwide creation of healthy workplaces (www.healthy-workplaces.eu/en). The campaign partners come from a variety of sectors across Europe and encompass employers' and workers' federations, technology platforms, non-governmental organizations and multinational companies. They are joined by campaign media partners, committed to communicate the importance of preventing and managing work-related stress and psychosocial risks, thus promoting workers health and safety. This is an example of a new direction in stress research and action, considering that academics and practitioners from different countries and cultures are working together on the solution of this universal phenomenon that is stress. Hence, research in this area must not only be focused on the recognition of this problem and its consequences, but also on what can be done to prevent and solve it.

An example of a profession that suffers strongly from stress epidemic is policing (Strahler & Ziegert, 2015). As suggested by Ransley and Mazerolle (2009) the 21st century has been particularly an epoch of uncertainty, bringing terrorism, insecurity, violence, poverty, and crime to different countries worldwide, calling for police forces to adapt quickly to these new demands. Knowing that high levels of work stress exist in this particular occupation, it may bring us to the question of how individuals cope with stress and whether the coping strategies used are in fact effective. Police officers (PO) are first responders to potentially stressful situations, so, in almost all cases they have to react quickly and in the most cases, their responses are not dependent on a pre-evaluation of a situation. This causes adrenaline to be released at high rates, heart rate (HR) increases and stress is a steady (Wienecke, 1999). Thus, their ability to successfully cope with stress is critical not only for their own mental and physical health, for example by being able to keep their own reactions and emotions under control (Waters & Ussery, 2007), but also for the welfare of society as a whole. Violanti and Aron (1995) suggested the importance of studying the process involved between the initial stimulus (stressor) and the officer physical reactivity/response to stressful events, while focusing on the psychological and physical wellbeing of these professionals, as a way to avoid and prevent future health problems.

As well as to other high risk occupations, academics, researchers and police administrators are showing great concern about PO health and wellbeing, even since their entrance in the academy (Violanti, 1992), thus providing a continuous evaluation of professionals. Following this trend, it is recommended that researchers should dedicate more attention to the study of PO stress and restrict its detrimental impact on the PO health and general public they serve. Furthermore, it is also crucial to understand police occupational stress and to implement strategies for reducing stressors or, if these cannot be reduced, it seems crucial to support officers to use effective coping skills when facing stress, enhancing therefore their engagement levels and wellbeing at work.

Despite the increase growth of studies regarding PO stress and coping, some methodological and conceptual shortcomings have been found in the literature that question the reliability of the previous results, generalizations of the findings and overall conclusions (Anshel, 2000; Hickman, Fricas, Strom, & Pope, 2011). Particularly, there seems to be a lack of occupational health research among Portuguese police (Recansens i Brunet, Bassanta, Agra, Queirós, & Selmini, 2009), and there is also a need for internationalization of findings in police science. Previous international comparisons

among different police societies have shown differences between countries (e.g., regarding the resources set aside for police institutions) and there are differences regarding the type of training PO receive and the duties delegated to the police service (Karp & Stenmark, 2011). Thus, it is also important to promote scientific awareness, by disseminating research findings in police occupational health in order to contribute to an improvement of worldwide policies and share best practices in the area. In support of this view, the current Ph.D. thesis was disseminated on several national and international conferences and workshops (see section Publications from thesis, included in the Appendices), through oral communications to a diversity of audiences including academics, researchers, applied practitioners and PO working in the field. Hence, disseminating police forces results, promoting debates for the development of best practices and solutions for the population.

Based on recent research recommendations across police science, stress, coping and engagement research (e.g., Anderson, Litzenberger, & Plecas, 2002; Folkman & Moskowitz, 2004; Trull & Ebner-Priemer, 2013) the overall aim of this Ph.D. thesis was to fully understand PO stress, coping strategies used and their relationship with engagement levels, while using new methodological approaches. For this purpose a thorough research plan was implemented including a systematic review and three empirical studies. Moreover, an exhaustive review including national and international literature was also conducted throughout all the stages of this Ph.D., supporting theoretical and empirical foundations for all the studies.

Firstly, in order to specifically understand how stress could be assessed in ecological settings, contemplating both psychological and physiological measurements, a systematic review was conducted (Study 1 – presented in Chapter II) providing the basis for the design of an ambulatory protocol to assess stress among PO, which was included in Study 4 of this Ph.D. programme.

Secondly, we aimed to understand the relationship between stress, coping and engagement among police recruits at the academy and one year later, when on duty. Additionally, we also aimed to understand the theoretical relationship between these variables, and for that purpose a longitudinal design based on self-report measures of stress, coping and engagement, and multivariate statistical technique, such as Structural Equation Model (SEM) was conducted (Study 2 – presented in Chapter III).

Thirdly, in order to fully understand stress and coping among PO while working on duty, two studies were conducted based on previous research recommendations. These included the design of novel methodologies, such as a daily diary design and an ecological

protocol aiming to understand police stress and coping on a daily basis. Hence, a daily diary design was used to specifically investigate the frequency and the appraisal of daily stressors, determine the preferred coping strategies and ascertain its effectiveness among police personnel during several consecutive working shifts (Study 3 – presented in Chapter IV). Additionally an Ambulatory Assessment (AA) protocol was developed in order to investigate the impact of stress on PO health, in terms of physiological stress reactivity, psychological appraisal and coping strategies used, under real world conditions (Study 4 – presented in Chapter V). The research design for each of the studies was consistent with previous methodological recommendations in this area, as explained throughout this thesis.

The current Ph.D. thesis is organized in five chapters. The first chapter presents the theoretical rationale underpinning each of the empirical studies main concepts, particularly stress, coping and engagement. The next four chapters, detail the different studies conducted during this Ph.D. The first study (Chapter II) is a systematic review article accepted for publication in an international peer reviewed journal (Rodrigues, Kaiseler, & Queirós, 2015). Each of the other three empirical studies will be described in this thesis respecting the structure of an article. This includes an introduction section, explaining the theoretical framework sustaining the study and the aims; the used methodology; display of results and its discussion, and the main conclusions drawn from the studies, including limitations and future recommendations. In the last chapter a final conclusion based on the findings from the aforementioned studies and body of knowledge in the area is presented. Additionally, this section also includes a discussion about the findings presented herein and its theoretical and practical implications to this field of research.

Summary the main goals of this Ph.D. research are:

1) Understanding how stress could be assessed in ecological settings, contemplating both psychological and physiological measures (Study 1).
2) Understanding how stress appraisal, coping and engagement operates on police recruits at the academy, and then one year later when working on duty (Study 2).
3) Investigating the frequency and the appraisal of PO daily stressors, as well as determining their coping strategies and its effectiveness (Study 3).
4) Investigating the impact of PO stressors and coping in terms of physiological stress reactivity and psychological appraisal under real world conditions (Study 4).

Information regarding studies ethical approval and the questionnaires used in the empirical studies are included in a separate document.

CHAPTER I – THEORETICAL FRAMEWORK

In this chapter, a comprehensive theoretical framework supporting this research programme will be presented. Additional information is provided in the systematic review article, as well as the introductory section of each of the following chapters. Particular emphasis is given to the rationale behind the aims of each empirical research.

A theoretical review about stress concept will be presented, by providing a historical description on the etymology and origins of the concept and the contribution of different disciplines to its conceptualization, as well as reflecting on their respective strengths and limitations. Additionally, stress will be briefly described in occupational settings in general, and then the focus will be in policing in particular, considering the nature of the profession and its occupational culture. This also includes a brief explanation of the Portuguese police context, particularly Polícia de Segurança Pública (PSP). Regarding the assessment of stress, this topic will be theoretically addressed on Chapter II, when describing Study 1 that includes a literature review on ecological assessments of stress. This study was also conducted in order to give theoretical support for the development of Study 4.

Concerning coping, its history on the evolution as a concept will be discussed. The main theoretical frameworks will be addressed focusing on the transactional model of stress and coping, proposed by Lazarus and Folkman (1984). Moreover, the two most used dimensions of coping (Problem-focused and Emotion-focused coping) will also be analyzed. Considering our theoretical rationale, coping effectiveness will also be refereed. Thereby, coping and coping effectiveness assessment will be addressed regarding new research directions on this area. A brief glance of how this concept operates in policing will also be included.

Finally, despite engagement was investigated in only one study, the concept will also be addressed, albeit more succinctly, in order to understand its definition and which variables may enhance it in general working contexts and in police context in particular.

1. Stress

1.1. Etymology and origins of the concept

"Stress" is an English word, but has etymological roots on the Latin words "stringere" and "strictus", that means "to draw tight" (Arnold, 2005). Nowadays, stress has become part of people´s day-to-day conversations, although the term exists since the beginning of the XIV century. It first meant hardship, straits, adversity or affliction (Lumsden, 1981). The concept gained significant meaning at the end of the XVII century, when the work of a scientist called Robert Hooke brought the concept into an engineering context (Cooper & Dewe, 2004). Hooke´s work with engineers was mainly focused on how man-made structures, such as bridges, could be made larger and capable of bearing heavy loads and resist buffeting by winds, earthquakes and other natural forces, without collapsing. The scientist perspective greatly influenced the way stress was perceived in physiology, psychology and sociology. Thus, stress was first perceived in mechanical terms as a load on a system whether biological, psychological or social (Lazarus, 1993). However, despite the term stress was firstly used in the context of the physical sciences, only in the early XIX century, its usage was made systematic and was increasingly applied to human existence, being described by social and biological sciences and being conceived as a basis of illness (Lazarus & Folkman, 1984). Even in the twenties, the term stress was steel coupled with words such as ''strain,'' or "hardship" as a reflection of its engineering roots (Cooper & Dewe, 2004).

Regarding the history of stress concept, it is worth it to backtrack in time to the Greek civilization, whose analysis of the human nature, human interaction and activities were the cornerstone for the creation of such concept. As described by Le Moal (2007) the Greeks used words such as balance, harmony, equilibrium, and a concept reminding ''steady state'' as a basic characteristic of life. When threatening forces were in action, counteracting forces were put forth to neutralize.

In the beginning of the Classic Era, Heraclitus (540–480 BC), suggested that a static condition, was not a natural state and the ability to undergo constant change was intrinsic to all things. Empedocle (495–435 BC) suggested that balance or harmony was a necessary condition for the survival of living organisms. Latter, Hippocrates, (460–375 BC), also known as the father of medicine, suggested that health was harmony, and disease disharmony, recognizing the healing power of nature (Selye, 1991). For Epicurus (341–270 BC) coping with emotional events and the ''impermeability'' of mind improved life

quality (Bolis, 1999; Chrousos & Gold, 1992). These perspectives, in particular the one proposed by Hippocrates, remained a relevant discussion topic, from the Roman Ages to Renaissance, and even during the XVII century (Le Moal, 2007).

During centuries, the modern views of stress was originated from the contributions of three ‘‘old masters’’ (Le Moal, 2007, p.4). In the XIX century, the French physiologist Claude Bernard recognized the negative consequences caused by organism imbalance and introduced the idea of harmony or equilibrium. Thus, despite changes in the external environment, the organism internal environment remains fairly constant (Monat & Lazarus, 1991). This theory emphasizes the idea that living things have an internal environment capable of maintaining the stability and constancy, despite external modifications (Bolis, 1999; Selye, 1991). Bernard’s work reflected the mechanicistic view of biology. In line with this view, Hergenhahn (1992) stated that ‘‘the behavior of all organisms, including humans, can be explained in the same way that the behavior of any machine can be explained – that is in terms of its parts and the laws governing those parts” (p.17). Some criticism emerged to this view and according to Cassidy (1999), this perspective was reductionist, since researchers were trying to explain and describe concepts of one field of research (human behavior) by using guidelines from other fields (e.g., biology-physiology) guidelines. However, despite Cassidy´s criticism, Wittkower (1977) highlighted the benefits of Bernard’s approach, by introducing new ideas, namely the explanation of disease through an “exact science” and the influence of psychological processes in physiological functioning.

The second author in line with Bernard’s idea, was Cannon. This physiologist was one of the first to explore the impact of stress and in 1930, the author suggested the word “homeostasis” as a process that living things use to actively maintain stable conditions necessary to survival. Cannon has demonstrated that the stimulation of the sympatho-adrenal system assures a homeostatic condition of internal environment, by preparing the body for “fight or flight” (Selye, 1991). While Bernard and Cannon had a great contribution to the philosophy of medical science and to the development of the stress concept centered on regulatory physiology and adaptation, a third one, Selye, was mostly centered on the maladaptation, pathology or distress side. Only in 1936, Selye used the term stress for the first time. This reaction was primarily described, as a “syndrome produced by diverse nocuous agents”, and later it became known as the General Adaptation Syndrome (GAS) or biological stress syndrome (Selye, 1936) (a more detailed description of this syndrome will be given hereafter). Selye´s work consolidated the

concept of stress and the author was even recognized as the father of stress research (Lovallo, 2005).

1.2. Overview of stress conceptualization over the years

According to the literature, (e.g., Buunk, de Jonge, Ybema & de Wolff, 1998; Friedman & Silver, 2006) there has been little agreement on how stress should be defined. One of the main reasons for this lack of agreement lies in the number of disciplines involved in stress research, such as biology, engineering, psychology, sociology, or epidemiology (Baum, 1990; Coyne & Holroyd, 1982; Dewe et al., 2010). As an example, stress for engineering and physics is defined as an applied force exerted, that results in a demand or load reaction, hence creating distortion (Cooper, Dewe, & O´Driscoll, 2001). Other example came from the area of botany, where Lichtenthaler (1996) defined plant stress as "any unfavorable condition or substance that affects or blocks a plant's metabolism, growth or development" (p.4).

Le Blanc, De Jange, and Shaufeli, (2008) stated that despite the lack of consensus involving stress definition, most researchers in the area do agree that the term stress can have three different meanings: stress as a stimulus, stress as a response, and stress as an interaction between the two.

In the 1960s, researchers such as Masuda and Holmes (1967) and Holmes and Rahe (1967), proposed the stimulus-based theory of stress. This approach focused on the environment, situational conditions or life events and the central theme of this approach is the identification of potential sources of stress (Lyon, 2012). In this perspective, the concept *stressor* gained significant meaning and numerous stressors taxonomies were defined by several authors, based on stressors content and formal characteristics, duration or chronicity. As an example, Lazarus and Cohen (1977) considered three types of stressors, based on the amplitude and intensity of the situation: i) major changes, that are characterized by cataclysms affecting a large number of people, like universally stressful threats that are out of control of any person, including natural disasters (e.g., tornadoes, earthquakes); ii) major changes that affect only one or few people (e.g., death of a loved one, life-threatening disease, losing a job, divorce, childbirth); and iii) day-to-day hassles that, although less dramatic than the previously presented situations, required adaptation efforts (e.g., arguing with someone). Additionally, Elliott and Eisdorfer (1982) referred four type of stressors based on stimulus duration: i) acute stressors, that are limited in the

time and are threatening only at a given time and for a brief period (e.g., finding a snake; parachute jumping); ii) sequential stressors, that are related with a series of events that occur during an extended period of time, as a result of an early event (e.g., divorce; being fired); iii) intermittently chronic stressors, that can occur in different periods of time, (e.g., once a day, once a week or month) such as sexual problems, and iv) chronic stressors, that persist continuously and stably over time (e.g., work-family problems; permanent disability). Stimulus-based conceptualizations have their roots in physics and engineering that view stress as an operate force resulting in a demand or reaction that leads to distortion (Weinberg, Sutherland, & Cooper, 2010.) According to this perspective, individuals are constantly assaulted and exposed to potential sources of stress known as stressors (Cooper et al., 2001). This approach was essential for the rapid industrialization, since early research into blue-collar stress intended to find sources of stress in the work environment, in order to provide better working conditions and optimal functioning levels on workers (Cooper & Smith, 1985). As a consequence, levels of productivity were expected to be higher. Thus, special attention was given to physical circumstances in the environment (e.g., heat, cold, noise). However, some criticisms emerged to the stimulus-based theory and following the example given above, it was stated that focusing merely on environmental external conditions is not enough. Moreover, individual differences are ignored, which is especially dangerous if we considered that variability in tolerance levels and expectations can lead to different reactions in the same situation (Cooper et al., 2001). Additionally, only one component of the stress process (the *stressor)* has been contemplated and little is known about the process itself (Cooper et al., 2001). Accordingly, as it was refereed by Stokes and Kite (2001) this model does not consider emotions, and we are not just machines that automatically react to environment. Although the stimulus conceptualization leads to conceptual problems, many researchers agree that there are subsets of stimuli which evoke strain in most individuals and that could be useful when identifying and categorizing common stressors themes that may affect the majority of professionals in occupational settings (Brief & George, 1991; Kahn & Byosiere, 1992).

The second perspective, known as the response-based perspective focused on stress outcomes or consequences, rather than on the nature of stress. The origins of this model can be found in biology and medicine, and it conceptualizes stress as a response, focusing more on physiological reactions as the crucial component of stress. Hence, stress exists if an individual shows a specific reaction pattern, regardless of situational characteristics (Selye, 1976). This means that all stressors, whether physical or psychological, would

cause the same physiological response. This approach was marked by the work of Selye in the 1930s and 1940s (Cooper et al. 2001). The author proposed in 1936 a stereotypical response pattern, known as the GAS that incorporates three stages: alarm reaction, stage of resistance and stage of exhaustion (Selye, 1976).

The first stage of the GAS, the alarm reaction, is the immediate psychophysiological reaction to a stressor and has two stages: the "shock phase" representing the initial and immediate effect of the noxious agent on tissue, characterized for example by the reduction of body temperature and the lowering of blood pressure. This phase of lowered resistance is followed by the "countershock" stage, characterized by active defensive efforts through the physiological system (Weinberg et al., 2010). It is reflected by an enlargement of the adrenal cortex and an increase in adrenal cortical secretions and produces a rise in blood pressure and often in body temperature (Lazarus & Folkman, 1984; Cooper et al., 2001). In this initial phase of stress, humans exhibit a "fight or flight" response, which prepares the body to rapidly react (Cannon, 1935). However, this initial response can also decrease the effectiveness of the immune system, making a person more susceptible to illness during this phase. If stress continues, the organism enters the stage of resistance, where the body adapts to the stressors it is exposed to. In this stage, the symptoms of the alarm reaction disappear, which seemingly indicates the organism's adaptation to the stressor (Cooper et al., 2001) This stage, is characterized by a triad of reactions: adrenal enlargement, shrinkage of the thymus gland and its associated reduction of lymphocytes, and gastrointestinal ulceration (Lazarus & Folkman, 1984). However, the resistance phase cannot be continued indefinitely, and if the alarm stage was too intense or frequent and lasts for too long, the energy needed for adaptation depleted and the next stage of exhaustion (or collapse) occurs (Selye, 1983). At this stage, the stress has continued for some time. The organism's capability of adapting to the stressor is exhausted, the symptoms of alarm reaction stage reappear, but resistance is no longer possible. This final phase leads to what Selye calls "diseases of adaptation," (e.g., anaphylactic shock, arthritis, or even death). This paradoxical term arises from the contrast between the immediate and short-term benefits presented by physiological response to stress (e.g., energy mobilization for an active behavioral response) to the long-term shortcomings (increased risk of certain stress related diseases). Selye's work influenced a whole generation of stress researchers, however the conceptualization of stress as a response also has its drawbacks as highlighted below.

Firstly, according to Monat and Lazarus (1991) it does not take into account that very different situations can result in different physiological response patterns, depending on the nature and appraisal of the stimulus, and that an individual's coping efforts may have an effect on this individual's reactions, thus altering the stress response.

Secondly, as it was suggested by Lazarus and Folkman (1984), Selye neglected the influence of psychological factors. Thus, by defining stress only as a physiological response, we cannot know what stress is and some responses could be considered stress, when in fact they are not (Graziani & Swendsen, 2007). As an example, the rise in HR of someone that is practicing any physical activity (e.g., jogging) could be interpreted according to this perspective as stress, however that may not be the case. Thus, because of the medical focus of Selye´s view, which underlines the organism's response, this model has also been criticized for not contemplating environmental factors in the stress process (Cooper et al., 2001). Selye (1976) proposed that despite the term stress has negative connotations, stress responses are not necessarily bad. Actually, a certain level of stress is sometimes essential for motivation, growth, development and change. This "positive" stress has been coined by Selye as "eustress", as opposed to responses to a demand or stressor that is harmful to the individual, also known as "negative" stress or "distress" (Cooper et al., 2001). "Eu" comes from the Greek root word for "good" (Seyle, 1980). Because stress is inherently a reaction, the associated stressor has been appraised as positive or challenging. Accordingly, "eustress" is related with positive changes or demands that do not interfere with the adaptation to new situations and it can be helpful in the achievement of new goals and increases productivity (Colligan & Higgins, 2005). As opposed, "distress" it is the most investigated aspect of stress and it is what in general terms, as well as throughout this dissertation, is understood by ''stress".

Finally, the third perspective defines stress as a process and aims to overcome the previous limitations on the stimulus and response conceptualizations of stress. The definition of stress as a process according to Lazarus and Folkman (1984) emphasizes the relationship between the person and the environment, and takes into account characteristics of the person (e.g., perceptions, expectations, interpretations) and the nature of the environment that is appraised by the person as taxing or exceeding personal resources and threatening wellbeing. The person experiencing stress is seen as an active agent who can influence the impact of a stressor through behavioral, cognitive and emotional strategies (Sarafino, 1994). In agreement with this, Gillis (1993) proposed that is not the circumstances that automatically lead to stress, but the person's appraisal of the situation.

What distinguishes this approach from the earlier ones is the focus on transaction, recognizing that stress does not rest merely in the individual or in the environment but in the interaction between these two components (Cooper et al., 2001). Considering that the transactional model from Lazarus and Folkman (1984) is one of the main supported models in this area, this will be the theoretical model underpinning the current research, and it will be fully explained in section 2.2.1.

1.3. Occupational stress

Research on work stress has appeared in the 1950s and 1960s and has its roots in the work on fatigue and mental hygiene influenced by the difficulties of two World Wars (Cooper & Dewe, 2004). This work led to important changes in social and economic aspects, creating an opportunity for applied psychological research in work scenarios. After World War II, there were periods of severe disturbance and conflict highlighting for the need to investigate sources of work-related stress and its consequences (Cooper et al., 2001).

Stress at work, also known as occupational stress, is widely recognized as a global challenge and has been the focus of concern by many researchers (Cartwright & Cooper, 1997). According to Schaufeli and Enzmann (1998) occupational stress refers "to any affect-laden negative experience that is caused by an imbalance between job demands and the response capability of the workers. When job demands are too high to cope with, stress reactions are likely to occur" (p.8).

Maracine (2010) raised an important issue, considering that (economic, social) changes in the contemporary world have caused several demands on employees that consequently increase work stress problems. As examples of these new demands, the author mentioned cutting and outsourcing services, the growing requirement for flexibility, regarding job position and skills, adopting an increasing number of fixed-term contracts, the uncertainty of employment and increased labor (with working volume and higher pressure), and an unstable balance of personal/family life and work. In agreement with this idea, Bakker (2009) also mentioned that contemporary organizations have to survive in a more competitive world, often having to restructure business processes and most of the time with negative and demanding consequences for workers.

Beehr and Newman (1978) called the attention for an essential topic when analyzing wellbeing and health that is the fact that most people spend more than half of

their waking lives at work, investing a large amount of time either working or having education training for working. In accordance with this, Mazzola, Schonfeld and Spector (2011) conducted a review aiming to analyze qualitative studies on occupational stress. The authors concluded that stressors at work were reported more frequently than stressors associated with other role areas which means that work is a major source of stress for employed people. On the other hand, Powell and Enright (1990) considered that "apart from providing financial income, work can satisfy a number of basic human needs – mental and physical exercise, social contact, feeling of self-worth, confidence, and competence" (p.8). According to Gonçalves, Neves, and Morin (2009) work is a central domain in people´s lives, soon after family and health. Thus, work is not merely a place or a profitable occupation, but an important activity for individuals that create positive expectations and look to obtain positive outcomes from it, in order to feel satisfied with their lives. However, this is not always possible to obtain, and work issues are likely to hardly affect people's lives.

Several studies on work stress research have been conducted in order to understand the causes (e.g., Seklecka, Marek, & Lacala, 2013) and consequences of occupational stress, namely its impact on health (e.g., Hickman et al., 2011), on social and family dimensions (e.g., Adams, King, & King, 1996) and on the individual working performance (e.g., Shane, 2013). The pioneering work on this area was from Kahn, Wolfe, Quinn, Snoek, and Rosenthal (1964) describing how their work emerged from the increasing growth on the importance of organizations in determining individual and social life. These researchers identified problems like role conflict, ambiguity and role overload as causes of work stress, resulting from the demands of the work. Nelson and Simmons (2002) defined some work stressors such as: role demands (e.g., role ambiguity, work-family conflict); interpersonal demands (e.g., diversity, leadership, team pressures, confidence, status); physical demands (e.g., temperature, internal climate, air quality, illumination, noise, internal design); demands associated with organizational policies (e.g., promotion, discrimination, benefits) and demands associated to work conditions (e.g., routines, work overload, stability, salary).

Regarding the consequences of occupational stress, several personal, organizational, and medical costs, are being associated with increased stress health problems such as heart disease, hypertension, upper respiratory tract infections, peptic ulcers, reduced immunity, migraines, alcoholism, depression, suicidal tendencies, anxiety, as well as other mental disorders (Babatunde, 2013; Smith, Karsh, Carayon, & Conway,

2003). According to Ferreira and Assmar (2008) behavioral modifications such as substance abuse (e.g., alcohol, tobacco and drugs) and a more tendency to have accidents, are the first visible signs to appear. Within organizations, stress effects lead to a decreased in performance and motivation, increased health care costs, disability payments, sick leave, absenteeism and turnover (Aldana, Sutton, Jacobson, & Quirk, 1996; Slate, Johnson, & Wells, 2000).

One common reaction to chronic or extreme stress is professional burnout. This concept is strongly related to occupational stress and has been widely used across occupational health settings (Suresh, Anantharaman, Angusamy, & Ganesan, 2013). Burnout can be viewed as a unique and intense form of job-related stress that can result from chronic exposure to work stress (Cooper et al., 2010). There are many definitions proposed by researchers for explaining burnout. As an example, Freudenberger (1975) defined burnout as a physical, emotional and mental exhaustion as well as an absence of job involvement, dehumanization and decreased sense of accomplishment. Additionally, Edelwich and Brodsky (1980) defined burnout as a "progressive loss of idealism, purpose, energy and concern as a result of conditions of work" (p.162). However, the most widely accepted definition of burnout is the one presented by Maslach and Jackson (1981) that describes the concept as a response to chronic work stress and it includes three components: emotional exhaustion, depersonalization and reduced personal accomplishment, whereas emotional exhaustion refers to a situation of depletion of energy or of one's emotional resources; depersonalization is characterized by negative attitudes and feelings towards the job and people involved in the job; and reduced personal accomplishment refers to the tendency of professionals to evaluate themselves negatively. Additionally, Greenglass, Burke, and Konarski (1998) referred that an individual´s burnout levels depend not only on stressful events in the work context, but also on the availability of coping resources. This phenomenon has been described to occur in several occupational groups such as nurses (e.g., Buhler & Land, 2003); police forces (e.g., De la Fuente Solana, Aguayo Extremera, Vargas Pecino, & Cañadas de la Fuente, 2013), teachers (Chang, 2009), and doctors (e.g., Wu, et al., 2013). Burnout has been shown to hold significant negative career implications (Schaufeli, Leiter, & Maslach, 2009), leading to reduced job performance, career dissatisfaction (Becker, Milad, & Klock, 2006; Keeton, Fenner, Johnson, & Hayward, 2007) and severe health problems (Shirom, 2010).

In sum, it can be concluded that occupational stress is a serious problem in contemporary societies considering the risks involved not only for the worker, but also for

the organization he/she works for. As a result, occupational stress has been a priority area in terms of investigation and intervention. Thus, it is important not only to understand and optimize the organizational environment in order to create healthier working places with engaged workers, but also provide and enhance workers individual resources (e.g., coping skills) to help them dealing with the daily demands of this working society we all live in.

1.4. Police stress and occupational culture

Police research studies in the area of stress, draw attention to the fact that police organizations have a unique culture. Thus, some police stressors are related to the particular nature of police institution (Webster, 2013).

The police occupational culture has been a topic of interest since the 1960s (O´Neill, Marks, & Singh, 2007). This culture starts influencing PO as soon as their entry in the police academy. This process has been called by theorists as "organizational socialization" that is the process by which an organizational member learns what behaviors are appropriate and therefore are likely to be used by police (Manning, 1970; Schein, 1968; 1961; Wheeler, 1966). As an example, Reiser (1973) labeled the "John Wayne syndrome", typical in younger officers, that refers to a condition in which the officer tends to swagger and talk tough. There is no room for the expression of emotions and feelings, and there is a strongly belief that they are invulnerable and able to deal with any kind of danger. According to Van Maanen (1975) the socialization process in police start with police recruits and encompasses a four-stage process: 1) *Entry*, characterized by a long and arduous selection procedure, developed to ensure that those who join the occupation will have strong positive attitudes toward their careers; 2) *Introduction,* where the newcomer is introduced to the often arbitrary discipline of the organization; 3) *Encounter*, where the novice is introduced to the complexities of the "street" and it is during this period that the reality shock involving the total recognition of being a PO is likely to happen and 4) *Metamorphosis*, the last stage where recruits attitudes begin to approximate to those of their more experienced colleagues.

One of the most inclusive definitions of police culture has been given by Manning (1989) considering it as a set of "accepted practices, rules, and principles of conduct that are situationally applied and generalized rationales and beliefs" (p. 360). Most connotations of police culture are negative, such as a lack of accountability, resistance to innovation, adverse treatment of members, among others (Terpstra & Schaap, 2013).

Furthermore, the organization has a quasi-military structure that is characterized by rigid authority, resistance, impersonality and an authoritarian chain of command. However, there are also positive aspects of police culture like camaraderie, fellowship, complicity, abetting and the mutual solidarity among colleagues. This collectiveness of culture helps to buffer the stress that officers face on a daily basis and protect against outside threats (Waddington, 1999). Additionally, Chopko (2010) suggested that officers can also have positive psychological benefits from their work as helpers and protectors, since they may feel a sense of appreciation and accomplishing for community, family, and colleagues. In agreement with this Cumming, Cumming, and Edell (1965) referred to "Policeman as philosopher, guide, and friend" (p. 276).

Apart from this culture in which PO are included, the truth is that PO are ordinary individuals with discretionary authority to arrest, search and detain citizens and use legitimate force in order to enforce the law (Loftus, 2010). As suggested by McLaughlin and Muncie (2001), officers became important decision makers in the interaction process between the community and the criminal justice system. However, this is becoming a more demanding and complex task (Meylan, Boillat, & Morel, 2009). For example, PO may face ambivalent attitudes from citizens. In other words, citizens often want more security and tough punishments for the authors of crimes but, paradoxically react negatively towards PO when it comes to them being punished by crimes. Another common problem faced by PO is public criticism. Suresh et al. (2013) conducted a study among 220 Indian police personnel aiming to understand police stress. Among other relevant results, the authors found that police public criticism was one of the seventh major sources of police stress. As stated by the authors the media, especially cinema illustrates the police force in a very bad manner, leading to poor public image.

Being a PO is an overwhelming and consuming job, with increased experience of stress during tasks that aim to ensure public safety through crime prevention and law enforcement (Stone, 2004). Thus, policing is considered a "high risk" occupational group (Buker & Wiecko, 2007; Burke, 1993; Coman & Evans, 1991; Crank & Caldero, 1991; Liberman et al., 2002; McCarty, Zhao, Garland, 2007; Papazoglou & Andersen, 2014; Violanti, Burchiefel, Miller, & Andrew, 2006).

Police organizations began to take notice of PO stress in the mid to late 20th century (Lindemann, 1944; Maslach & Jackson, 1979), which matches with the development of applied psychology after World War II. With the growth of community psychology, it was recognized that contextual and cultural aspects have a strong influence on mental health,

particularly in responses to crises. Some authors found a relationship between police stress and police culture (Chan, 2007). Accordingly, Reiner (2000) stated that the police culture influences the way officers cope with daily stress. As an example, Van Maanen (1978) viewed police cynicism as a possible reaction of PO to the daily exposure to citizens that do not want to be blamed for their own infractions and tell officers regular lies and excuses.

The concept of "police stress" has been the subject of many research studies over the years (e.g., Hart, Wearing, & Headey, 1993; Kop, Euwema, & Schaufeli, 1999; Maran,Varetto, Zedda, & Ieraci, 2015; Stinchcomb, 2004). Lindemann (1944) conducted a pioneering study with the survivors of the Cocoanut Grove nightclub fire in Boston, where 492 people died in order to understand traumatic stress symptoms. The author identified common emotional reactions among victims (e.g., preoccupation, guilt, anger and somatic complaints) that he called "normal grief reactions", typical of acute stress symptoms. This study led the way for the investigation on the impact of traumatic events on the development of a broad range of symptoms that were later identified in several occupational groups, such as PO.

In response to stress related problems, some police institutions have established employee assistance programs, fund conferences, conducted research, and established prevention programs. However, the incidence of police stress continued to increase (Waters & Ussery, 2007). Actually, most officers have not looked for these services when experiencing psychological problems (Graf, 1986; Greenstone, 2000; Jones, 1995; Wester, Arndt, Sedivy, & Arndt, 2010; Wester & Lyubelsky, 2005). Additionally, there seems to be several reasons why PO do not contact mental health professionals as further explained.

Firstly, according to Waters and Ussery (2007), there is a lack of confidence between officers and clinicians. Police culture can be a plausible cause for this. PO project the idea of a superman, thus the expression of psychological stress, by any officer, could be viewed as a sign of weakness (Anshel, 2000). This is also probably associated with the fact that PO are individuals who are viewed as independent, competent, and trained to take care of dangerous situations, and to protect the public. Moreover, as proposed by Shepherdson (2014) this stereotype of masculinity among PO tends to be reinforced by mass media (e.g., movies or television series and shows).

Secondly, there is also a tendency to ignore symptoms of depression as a decrease in energy, feelings of sadness or worry, and the sense of desperation (Waters & Ussery, 2007).

Thirdly, it is possible that PO fear negative job consequences, such as loss of weapon, personal weakness, among others (Wester et al., 2010). Thus, PO must be good psychologists of themselves, at the same time they have to ensure overall community safety and being always able to maintain their own reactions under control (Kitaeff, 2011).

Finally, Wester and Lyubelsky (2005) found that PO are hesitant to seek psychological support, mainly due to their relative distrust of those outside their police culture and fear of being stigmatized. Accordingly, Davis (2002) considered that this resistance and avoidant behavior may be a maladaptive coping mechanism.

As a consequence of this demanding occupation, the continuous activation of the stress response systems (e.g., the hypothalamus-pituitary-adrenal axis and the autonomic nervous system (ANS)) can lead to modifications on the neuroautonomic and endocrinal balance, creating higher levels of physiological problems such as hypertension, coronary heart disease, gastrointestinal malfunctions, metabolic syndrome and even cancer (Fenici, Brisinda, & Sorbo, 2011). Stress can also lead to psychological or emotional problems such as severe nervous conditions and neuroses (e.g., depression, anxiety), resulting in sickness, absenteeism, burnout, early retirement, higher levels of suicide, divorce rates and substance abuse than the majority of occupational groups (Anshel, 2000; Burke, 1993; Evans, Coman, Stanley, & Butrows, 1993). In support of this, O'Brien and Reznik (1988) and Westerink (1990) found, in two comparisons studies between police from New South Wales in Australia, and the general population of this state, more significantly frequent and severe psychological and physical disturbances in the police group when compared with the general population. Additionally, based on the assumption that stressful situations can lead to a misinterpretation of the events as being threatening and consequently make officers react aggressively. In agreement with this argument, Queirós, Kaiseler, and Silva (2013) conducted a study with 274 male Portuguese PO, aiming to investigate whether burnout is a predictor of aggressivity among this population. The authors found that burnout, more than socio-demographic characteristics, predicted 13% to 22% of PO aggressivity. This is a very important finding, considering that contemporary societies strictly criticize the use of force by PO, without understanding its causes, calling for the need to prevent occupational stress and consequences like burnout and aggressivity.

Some studies found that stress not only affects PO but also their families (Burke, 1988; Havassy, 1994; Zakir & Murat, 2011). An example of this, Ryan and Brewster (1994) conducted a study with 12 PO that went recently through a critical incident, in order to understand their symptoms and how this can affect their relationship with their

spouse/mate. Results showed that both the marital dyad can share common emotional consequences and symptoms following traumatic events. This suggests that police culture has a powerful influence in officer's personal lives. Moreover, as stated by Suresh et al. (2013) considering that police work is a 24 hours duty, PO have very little time to be with family, which may result in strained relationships with family members, leading sometimes to alcoholism and divorce. According to Johnson, Todd, and Subramanian (2005), individuals who marry PO, also marry with police institutions, and are expected to accept and share its norms and values, due to the great level of commitment expected from PO towards the institution. In agreement with this, Inwald, Willman, and Inwald (2011) stated that "training police couples, their families, and/or individual officers in the area of police stress inoculation, along with confidential counseling as an early intervention, is appropriate in order to prevent poor work performance, domestic violence, divorce and even suicide" (p. 239).

Bittner (1975) draw the attention for the fact that police work is highly demanding, considering that the police force is an institution open 24h per day, and continuously accessible and prepared to quickly respond at any time. PO experience a vast range of stressors even within one shift. For instance, an officer may be solving a confrontation with an offender, and simultaneously be called upon to help a family of a road-trauma victim (Williams, Ciarrochi, & Deane, 2010). One important issue when analyzing police stress is the differentiation between operational and organizational work experiences (Huddleston, Stephens, & Paton, 2007; Shane, 2013; Violanti & Aron, 1995). The operational work is associated with the unique nature of the work carried out by police forces and refers to policing duties in the field. Examples of operational stressors are exposure to traumatic events, murder, assaults, shootings episodes (Violanti & Paton, 1999); dealing with crime victims and perpetrators, aggressive people, high speed chasings (Patterson, 2002); death of a partner; killing someone on duty (Brubaker, 2002); recovering bodies from motor vehicle accidents, witnessing domestic or community violence, and responding to cases involving child battery (Gulle, Tredoux & Foster, 1998).

The organizational type stressors are described as resulting from the policies and practices of the police organization and the organizational structures and numerous management practices. Examples of organizational stressors are the bureaucratic nature of the police organization (Violanti & Aron, 1993); the quasi-military nature of police institutions, with many instructions and very little individual input (Coman & Evans, 1991); equipment concerns; shift work (Rudofossi, 2007); staff shortages and unsettling

turnover rates, insufficient finance or resources, lack of consultation and communication, mundane administrative tasks or paperwork (Brown, Cooper, & Kirkcaldy, 1996); workload, responsibility for others, role conflict and role ambiguity (Lord, 1996; Stinchcomb, 2004).

Support has emerged for the belief that organizational stressors are the strongest predictors of stress among PO (Brandt, 1993; Coman & Evans, 1991; Malach-Pines & Keinan, 2006; Kop et al., 1999). As an example, the study conducted by Suresh et al. (2013) found that organizational stressors were more prevalent than task-oriented stressors.

It is important to highlight that most of the studies analyzing stress among PO used retrospective and cross-sectional designs what is believed to influence the type of stressors reported by PO (further discussion on this topic will be provided in Chapter IV and V). Additionally, stress has only been studied based on subjective self-report measures. In order to overcome some of the existing limitations, it is recommended that future stress-related studies implement ecological approaches (Stone & Shiffman, 1994). It is also suggested that physiological measures should be combined with self-reports. An example a pilot study including both measures was conducted by Hickman et al. (2011). This study analyzed a single PO, and showed that continuous physiological measurement (e.g., HR) is possible during working shifts and provides reliable information about time, location, and reasoning of the experienced stress.

Regarding the topic of occupational stress among this population, Anshel (2000) conducted focused interviews with 22 PO aiming to understand police stress. Findings suggested that PO recognize that stress is inevitable in their profession, so they consider that they must learn to better deal with it. Several officers emphasized the need to be engaged in meaningful involvements and distractions in order to better cope with stress. Examples of outlets that were mentioned in the groups included hunting, playing tennis, traveling, sponsoring sports teams, remodeling one's home, wood carving, weight lifting, walking one's dog, watching television, and going to movies, playing with children, among others. However, despite their personal efforts and strategies to deal with stress, interviewed officers agreed that there was a clear need for stress-reducing assistance given by the institution. As an example, officers under stress referred the need for retreats, support, peer counseling and assistance, help with family problems, and caring police executives.

1.5. Portuguese police: the case of Policia de Segurança Pública (PSP)

In the last decades, several authors (e.g., Ainsworth, 2002) highlighted the need for the scientific study of police institutions, considering that their role in the society is too important to be ignored. However, as it was referred by Monjardet (1996) police resists to become the object of the study. Only at the sixties of the 20th century, psychological, sociological and ethnographic research across police area started to progress in several countries (Oliveira & Queirós, 2012). Particularly in Portugal, the way people perceive the police has resulted more from the mass media dissemination rather than from systematic knowledge with scientific reasoning. Accordingly, Recansens et al. (2009) brought attention to the fact that Portugal has lived for long years under a restrictive dictatorial political regime. Security forces have been closely controlled by the regime, blocking the access to this population, particularly for investigation targets. Additionally, during this period (1933-1974) the police image was characterized by the use of force and oppression (Durão, 2009). Consequently, very few studies exist regarding psychological issues, understating the comprehension of the PO as a human being, with emotions, problems and internal conflicts (Oliveira & Queirós, 2012). Only in the late nineties of the 20th century, the research in this area started to significantly emerge in Portugal.

Studies regarding police stress have become a topic of interest to some Portuguese researchers. Hence the main areas investigated so far are: sources of stress during police service (e.g., Soeiro & Bettencourt, 2003), nature of police stress in relation to coping and wellbeing (e.g., Martins, 2010), identification of critical incidents during daily routines (e.g., Manuel, 2009), analyses of ideation/suicidal behavior due to potentially disruptive professional experiences (e.g., Santos, 2007), the relationship between stress and burnout (e.g., Gonçalves & Neves, 2004), stress effects in organizational commitment (e.g., Gonçalo, Gomes, Barbosa, & Afonso, 2010), burnout and personality relationships (Silva & Queirós, 2013). Additionally, researchers have dedicated attention to the study of stress among police personnel while undergoing academy training (e.g., Kaiseler, Queirós, Passos, & Sousa, 2014). Lately, a new line of investigation has emerged in Portugal investigating psychophysiological stress and coping assessment among PO, using innovative and interdisciplinary approaches incorporated in the SCOPE project - Stress and Coping among Portuguese Police Officers (http://www.fpce.up.pt/scope/index.html).

It is important to highlight that Portugal has several criminal police organizations that can be classified according to different criteria (e.g., administration; territorial scope;

internal security system inclusion; juridical nature and attributions). As a result there are several different police forces in Portugal, such as PSP, Guarda Nacional Republicana (GNR), Policia Judiciária (PJ), Policia Marítima, Serviços de Estrangeiros e Fronteiras (SEF), among others. Considering the variety of police forces in Portugal, it was difficult to investigate all of them. Therefore the current Ph.D. will only concentrate in PO from PSP.

The origin of PSP dates back to the reign of King D. Luis I., who established, in 2nd of July of 1867, the civil polices in Lisbon and Oporto that subsequently widened to all Portugal district capitals in the dependence of civil governors (Branco, 2010). Over the years PSP has undergone several restructurings (Cosme, 2006). Nowadays, PSP is a security, uniformed and armed force, with administrative autonomy. PSP is organized in: national direction; police units, particularly police special unit, police territorial commanders and police schools, particularly Police Practical School and High Institute of Police Sciences and Internal Security.

According to the law 53/2007 of August 31st (available at www.psp.pt) PSP has different functions: i) ensure public order and safety; ii) prevent criminality; iii) develop criminal investigation actions; iv) ensure the implementation of administrative acts issued by the competent authority wishing to prevent any breach of the law or its continued violation; v) monitor the entry and exit of people and goods in the country; vi) keep vigilance, safety and protection of people and public infrastructures; vii) ensure safety in recreational and leisure activities; viii) prevent and detect drug traffic situations; ix) ensure compliance with laws and regulations related to environmental protection; x) participate in international operations and missions; xi) control the manufacture, storages, sales, use and transportation of weapons, ammunitions and explosive substances, which do not belong to armed forces and other forces and security services; xii) ensure the personal safety of government members and other important personalities, as well as other citizens in a risky situation.

It is clear that, PSP has an important, as well as complex mission to accomplish. In agreement with this argument, some studies developed among this population show some considerable stress levels. As an example, a study conducted by Gonçalo et al. (2010) among 95 Portuguese PO from PSP and 237 prison officers, aiming to understand occupational stress, burnout and job satisfaction, has found significant levels of pressure and tension among participants, with higher levels of occupational stress and burnout in the prison officers sample. Regarding job satisfaction, the results suggested higher levels

of professional dissatisfaction and almost half of prison officers would not choose their current job again if they had the possibility to. Moreover, Magalhães, Fonseca, and Costa (1999) conducted a study among 528 PO from PSP and the results showed that variables such as internal relationships with colleagues and superiors, dealing with violence, relationship with external environment, death and pain were the main stressors cited by Portuguese PO. Additionally, according to recent data from the Psychological Department of PSP, there has been an increasing search for psychological services by very younger officers, some of them still undergoing training, due to stress problems (Passos, 2008).

Stress can lead to suicidal behaviors, and considering the increased number of suicide rates among Portuguese security forces, the Portuguese Ministry of Internal Affairs in the year 2006 asked the Portuguese Society of Suicidology to conduct research on this topic and propose a suicidal prevention program for the security forces (Poiares, 2009). In agreement with this, Baker and Baker (1996) stated that police are dying more rapidly at their own hands than by the hands of criminals.

Some other progresses have been made in the area of Police occupational health in Portugal in order to prevent stress problems. Particularly for PSP, academic education on psychology has been ministered during the PO education; a free SOS phone service has been provided to police members in order to give mental health support. Furthermore, PSP has a psychology service that offers psychological support for the police personnel (Passos, 2001).

Considering that the Portuguese reality is quite different from other police institutions across the world, careful should be drawn when generalizing findings from studies among Portuguese police to other countries. Therefore, each police institution should conduct individualized research, attending to the PO needs and requirements when investigating stress. During these investigations, differences between samples and subjects may occur, and may be due to a variety of factors. These comprise historical roots, mission, competencies, uniform wearing, vehicles and equipment used. Thereby, it seems crucial to specify the nature of police role, when investigating stress among this population. Previous Portuguese studies suggested the existence of different stressors among different police forces and even inside the same police force (e.g., PSP). This suggests that different roles assigned to a professional can emerge different stressors (e.g., Carvalho, 2010), thus explaining the aforementioned need to specify police role and possibly correlate it with the stress indicators.

2. Coping

2.1. Concept definition

The definition of coping remounts to the 19th century, with the beginning of the psychoanalytic movement (Freud, 1936; Haan, 1977; Parker & Endler, 1996; Vaillant, 1977). According to these perspectives of ego psychology, coping refers to adaptive or mature defense of unconscious processes developed to solve problems and thereby to reduce stress (Lazarus & Folkman, 1991).

One of the earliest formulations of coping based on psychoanalytic approaches was provided by Menninger (1963). This author proposed that coping is characterized by what he called "coping devices", that are strategies used for reducing tensions caused by stressful episodes that lead to internal disruption and disorganization. The author suggested five levels of regulatory devices, ranked according to the level of internal disorganization. Thus, at the top of his hierarchy were "coping devices" that include self-control, humor, crying, swearing, weeping, boasting, talking it out, thinking through and working off energy. These strategies are viewed as idiosyncratic features. However, if these strategies became inappropriately or abusive (e.g., when a person talks too much; laughs too easily), they are viewed as symptoms that indicate internal disequilibrium and lack of control. The greater the internal disorganization, the more primitive the coping devices become. Coming down on the hierarchy are second-order devices that include withdrawal by dissociation (e.g., narcolepsy, depersonalization), withdrawal by displacement of aggression (e.g., aversion, phobias) substitution of symbols and modalities for more hostile discharge (e.g., compulsions, rituals) and replacement of the self (e.g., self-intoxication, humiliation). Third-order devices are characterized by episodic, explosive outbursts (e.g., convulsions, panic attacks). Fourth-order represents increased internal disorganization and the fifth-order poses a total ego disintegration (Lazarus & Folkman, 1991; Menninger, 1963). Thus, coping based on ego-psychology framework was essentially focused on the pathology and based on unconscientious and defensive mechanisms (Folkman & Moskowitz, 2004).

Coping really only began to become a topic of interest, with important practical implications on different areas (e.g., Psychology, Health and Education) in the 1970s and 1980s through the work of theorists such as Pearlin and Schooler (1978), Lazarus and Folkman (1984), Billings and Moos (1984), and Kobasa (1979). These theorists, among others, have developed a range of different coping approaches. According to Latack and

Havlovic (1992), there were over 30 definitions of coping. However, the dominant perspective of coping emerged in the 1970s with the work of Lazarus and his colleagues.

As opposed to psychodynamic theories, Lazarus and Folkman (1984) proposed a process-based model, describing coping as "constantly changing cognitive and behavioral efforts to manage the specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (p. 141**).** This definition addresses the cognitive, affective, and behavioral aspects of the coping process and also focuses on the effort associated with an individual's response. Thus, coping is not limited to successful efforts, but includes all purposeful efforts to manage stress regardless of their effectiveness.

More recently, Frydenberg (2014) in agreement with Lazarus and Folkman perspective, considered that coping efforts are initiated as a response to a stressful event that is personally significant and taxes or exceeds individual's resources. Thus, it is not stress that determines adaptive outcomes, but more importantly, is the way people perceive and deal with adversity that is crucial for health and wellbeing (Zeidner & Endler, 1996). Although the concept has a long history of research and theoretical development, a lot of work still remains to be done in order to get a consensual comprehension of coping.

2.2. Theoretical Approaches to Coping

Similarly to what happened when defining stress, literature provides different definitions and descriptions of coping strategies. Thus, coping can be defined from a person-based, situational-based, and interactive or transactional perspective.

The person-based, or dispositional approach, assumed that people develop habitual ways of dealing with stress and that coping styles can affect their reaction in new situations (Carver & Scheier, 1994). It refers to broad and stable traits (Perrez & Reicherts, 1992) such as hardiness, locus of control or personality antecedents, such as type A behavior (Edwards, 1988), that are stable across time and not specific to a situation. This research is limited to usual ways of coping or coping styles (Cohen, 1991).

The situational-based approach suggests that environmental or situational factors have the major influence on behavior and determine coping preferences (Mischel, 1968). Hence, the coping strategies are related to what a person did to manage stress in specific situations or periods of time. Accordingly, coping is a response to specific stressful events rather than a stable trait. As an example, Feifel and Strack (1989) investigated coping responses to five conflict situations such as: decision-making; defeat in a competitive

circumstance, frustration, authority conflict and peer disagreement, among a sample of 182 middle-aged and elderly men. However, the dynamic and interactive nature of coping process is being neglected by merely focusing on the influence of the environmental or situational factors in determining coping responses.

Finally, the transactional perspective proposed by Lazarus and Folkman (1984), suggests that coping with stress is a dynamic process that involves a transaction between a person's internal (e.g., goals, values) and external (e.g., situational) environments. In this view, the characteristics of the stressful situation, personality, coping responses, and the nature of the situation expressed in terms of changeability, controllability and valance (Pearlin & Schooler, 1978) are contemplated. This approach requires a larger and contextualized perspective and suggests that coping preferences may change in response to its effects on the situation (Lazarus & Folkman, 1984). The transactional approach values cognitive activities in order to understand and explain the nature of a stressful transaction (Dewe & Cooper, 2007; Singer & Davidson, 1991). The transactional approach formulated by Lazarus and Folkman is the most widely recognized and used. A comprehensive description of this approach can be found subsequently in this document.

2.2.1. The transactional model of stress and coping

In order to explain how people cope with stress, Lazarus and Folkman (1984) proposed the transactional model of stress and coping as observed in Figure 1.

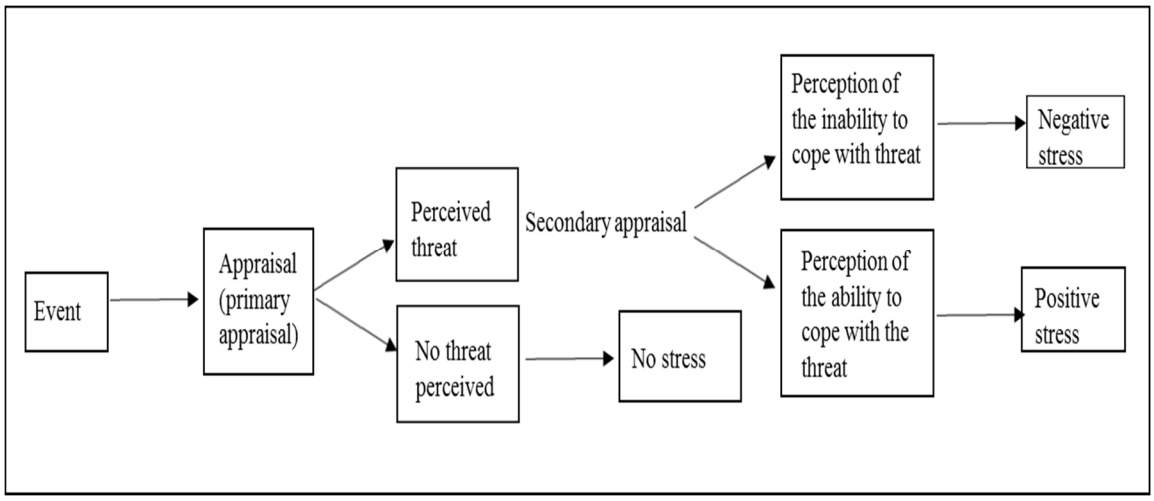

Figure 1. Transactional model of stress (Lazarus & Folkman, 1984).

According to this model, stress and coping is a dynamic and recursive process that includes interactions between the environment, individual appraisal and efforts to cope with the implications originated by these events (Porter & Stone, 1996). The key issue in this model, is the appraisal, thus, physical or psychological stressors will only lead to a stressful response if they are perceived as being threatening to the person (Singer & Davidson, 1991). Accordingly, an event is perceived as stressful, when the demands of a situation exceed the resources of the individual to deal with that situation.

Lazarus and Folkman´s model take a cognitive view of how people understand the world (Lovallo, 2005), since the appraisal process is an evaluative procedure that influences the emotional reaction in a specific situation. Cognitive appraisal encompasses two types of appraisal: primary and secondary. Primary appraisal refers to the meaning an individual associates to an event, focusing on the question "Do I have a problem?". Lazarus and Folkman (1984) proposed three kinds of distinguishable primary appraisal: (1) irrelevant, (2) benign-positive, and (3) stressful. Irrelevant appraisals occur when an encounter with the environment brings no implication for a person's wellbeing. The person has no investment in the possible outcomes, since nothing is to be lost or gained in the transaction. Benign-positive appraisals happen if the outcome of an encounter is interpreted as being positive, that is, if it preserves or increases wellbeing or intends to do so. Stress appraisals include harm/loss, threat or challenge (Folkman & Lazarus, 1985). In harm/loss, some damage to the person has already been sustained, for example an incapacitating injury or illness, recognition of some damage to self- or social esteem. Threat regards harms or losses that have not yet taken place but are anticipated. Threat has a primary adaptational significance, as opposed to harm/loss, since it allows for anticipatory coping. Considering that humans can anticipate and plan the future, they can work through some of the difficulties in advance (Lazarus & Folkman, 1984). Challenge appraisals have much in common with threat appraisals, since they also allow for the mobilization of coping efforts. The main difference is that challenge appraisals focus on the possible gain or growth inherent to an encounter and they are characterized by pleasurable emotions such as excitement and joy. Conversely, threat focuses on the potential harms or losses and is characterized by negative emotions such as fear, anxiety, and anger (Lazarus & Folkman, 1984).

When an event is appraised as being a threat to the individual's wellbeing, the secondary appraisal process begins. Secondary appraisal is a complex evaluative process, in which the individual assesses what can be done to deal with the situation, with the

available resources and also perform a judgment of what can be done regarding their own goals and perceived benefits or consequences ("What am I going to do about it?"). These two appraisals are crucial to the stress and coping process understanding (Cooper et al., 2001). Both types of appraisal occur as part of a complex process and each one is dependent on the other, and they should be considered as part of the same process (Lazarus, 1999).

The main principle of Lazarus and Folkman's transactional model is that primary appraisal, secondary appraisal and coping strategies mediate the relationship between the stressor and the individual's stress outcomes (Goh, Sawang, & Oei, 2010). Although the transactional approach contemplating stress appraisal has been widely accepted in the Psychology area, less agreement has been found among the work stress field (Cooper et al., 2001; Jones & Bright, 2001). Considering that the transactional model sustains that stress occurs essentially at an individual level, Brief and George (1991) stated that the difficulty when contemplating working settings, is that this personal level of analysis may not regard "those working conditions that are likely to affect the wellbeing of most workers" (p. 16). In agreement with this, Harris (1991) and Schaubroeck (1999) considered that focusing on individuals' personal appraisals and meanings can limit the generalizations of results among employees, what consequently restricts the impact of interventions. However, as suggested by Lazarus (1991), sources of stress are always personal and idiosyncratic, as are the coping strategies that people use to cope with them. Therefore, it seems crucial to consider these when analyzing stress in the work setting. In support of this, Harris (1991) and Perrewe and Zellars (1999), suggested that considering individual´s appraisals of stress in the work setting offers a more dynamic and complete overview of work stress. Thus, ignoring the importance of individual appraisals is to ignore what are, potentially, the most significant explanatory variables in the understanding of the coping process.

2.2.2. Dimensions of Coping: Problem-focused and Emotion-focused

A hierarchical organization of coping was proposed by Gaudreau, El Ali, and Marivain (2005) who categorized coping actions into coping strategies and coping strategies were categorized into higher-order dimensions of coping. Accordingly, Lazarus and Folkman (1984) identified two higher order categories or dimensions of coping: Problem focused (PF) and Emotion-focused (EF) coping. This classification of coping has been widely accepted and used across several studies (Folkman & Moskowitz, 2004). PF

coping involves efforts to alter the situation, a person obtains information about what to do and evaluate the pros and cons of and then mobilizes actions for the purpose of changing the person-environment (Lazarus, 1999). Examples of PF coping strategies are problem solving, planning, increasing efforts, time management, goal settings and seeking information.

On the other hand, EF coping involves efforts to deal with the emotional disturbance resulting from those demands (Lazarus, 1999). Examples of EF coping strategies are relaxation, acceptance, seeking social support, wishful thinking, rationalization, cognitive restructuring, minimization, humor, talking to caring people, use of drugs and alcohol. The coping strategy that a person employs depends on the person's appraisal of the situation (Edwards & Holden, 2001). Recently, Krohne (1993) proposed a third higher order factor, known as avoidance coping. This includes both behavioral (e.g., removing the self from the situation) and psychological (e.g., cognitive distancing) efforts to disengage from stressful events.

As an alternative to PF and EF coping categorization, coping behavior has also been classified as being approach-based and avoidance-based (Ben-Zur, 2009). It is generally accepted that most approach-based coping strategies are related with PF coping (adaptive and associated with positive outcomes) and avoidance-based coping is associated with EF coping (maladaptive and linked with negative outcomes) (Pooley, Cohen, O'Connor, & Taylor, 2013). However, still no consensus has been reached on to how best classify coping strategies (Cooper et al., 2001).

2.3. Coping effectiveness

According to Anshel, Umscheid, and Brinthaupt (2013) a central motivation for studying coping is the belief that some types of coping are more effective in promoting wellbeing than others. Nicholls (2010) has recently defined coping effectiveness as the "degree in which a coping strategy or a combination of strategies is or are successful in alleviating stress" (p. 264).

Zeidner and Saklofske (1996) defined seven criteria to consider when analyzing coping effectiveness. Thus, effective coping strategies should be able to alleviate the stressful situation, reduce physiological activation to stress, allow the person to react with a socially accepted conduct, permit individuals the returning to their normal daily activities, generate emotional wellbeing and positive self-esteem, Also, coping strategies employed

should be perceived as being effective. However, these authors in agreement with Lazarus and Folkman (1984), stated that coping effectiveness is a critical topic to investigate, regarding the complexity of coping process, and coping strategies are not inherently good or bad. This means that coping might be judged to be effective with respect to one criteria, but that same coping strategy might be ineffective when judged against other criteria and within other contexts.

Lazarus and Folkman (1984) draw the attention for the importance of two coping functions: the regulation of distress (EF coping) and the management of the problem that is causing the distress (PF coping). Coping effectiveness is based on both functions. As an example, a person who manages a problem effectively but with a great emotional cost cannot be said to be coping effectively. On the other hand, a person who manages his or her emotions successfully but does not deal with the source of the problem cannot be said to be coping effectively. Hence, in order to fully understand coping effectiveness it is important to consider the context where the stressful event occur, since a coping strategy that is effective in one situation may be ineffective in another, and vice versa. Furthermore, the extent to which the situation is controllable, should also be considered when analyzing coping effectiveness. Thus, people who select coping strategies that fit the appraised controllability of an event will have better outcomes than those who do not (Folkman & Moskovitz, 2004). In agreement with this, Folkman (1992) proposed the examination of coping effectiveness by employing the goodness-of-fit hypotheses (these hypotheses will be fully described in the following sub heading).

An alternative approach to study coping effectiveness is considering the relationship between coping and its outcomes that are normally assessed considering indices of psychological and physical wellbeing and/or overall satisfaction with the coping strategy used (Dewe et al., 2010; Lazarus & Folkman, 1984). As an example, a study conducted by Baker and Berenbaum (2007) with 89 undergraduate students aiming to examine for whom and under what circumstances EF coping and PF coping are differentially more effective, assessed coping effectiveness by measuring positive affect, negative affect, and physical symptoms.

Previous research, particularly in the area of sport psychology (e.g., Levy, Nicholls, Marchant, & Polman, 2009; Nicholls, Holt, & Polman, 2005; Nicholls, Polman, Levy, Taylor, & Cobley, 2007) has dedicated further attention to the study of coping effectiveness and its importance in performance. Based on their work with athletes, the authors found that the effectiveness of a coping strategy fluctuated from day-to-day and

even during the same event. Acknowledging the diversity of physical and psychological demands experienced by PO in their role, it would be interesting to understand whether these findings can be replicated also among this population. These findings support the notion that coping effectiveness fluctuates across situations (Lazarus, 2000). This is in accordance with the idea of coping flexibility proposed by Folkman and Moskowitz (2004) meaning that coping strategies can change according to the demands of dynamic contexts and situations, which impacts the ability to define coping effectiveness. This can probably explain the fact that some researchers suggested that EF coping is ineffective and increases stress in some situations (Baker & Berenbaum, 2007; Lazarus & Folkman, 1984), although the opposite has also been described thoroughly (Baum, Fleming, & Singer, 1983).

Even though researchers have not ignored the issue of coping effectiveness, it is still a controversial issue, since it is not an easy variable to measure and the existing literature is not consistent about which forms of coping are, in fact, effective in dealing with stress (Lazarus, 2000). In support of this point, Dewe et al. (2010) mentioned that this controversy is related to the fact that little attention has been given to the transactional nature of stress, particularly the role of primary appraisal in stress and coping process. Moreover, the context in which coping takes place is commonly ignored. Additionally, Cooper et al. (2001) suggested that conclusions in this area are limited, mainly due to differences between individuals and situations that do not allow to draw trustworthy conclusions about the efficiency of a strategy. Therefore, based on the perspective of the transactional model of stress and coping, coping effectiveness studies should assess the cognitive processes involved in coping responses. Accordingly, it is important to explore both primary and secondary appraisals in particular events, in order to understand why people use specific responses to stressors and if they are, in fact, effective (Dewe et al., 2010).

In sum, considering that coping is a complex process, research on this area may need to integrate combined methodologies in order to obtain a systematic assessment of coping and coping effectiveness and must be viewed as multivariate construct and judged according to a number of criteria, depending on the aim of the studies (Dewe et al., 2010; Zeidner & Saklofske, 1996).

2.4. Assessing coping and coping effectiveness: new research directions

The coping concept has a long history of research and theoretical development, resulting in the elaboration of several questionnaires and checklists. Some examples of validated coping measures include *The Ways of Coping* (Folkman & Lazarus, 1980; 1988); *The COPE* (Carver, Scheier, & Weintraub, 1989); *Coping Response's Inventory* (Moos, 1993); *Coping Strategy Indicator* (Amirkhan, 1990); *Coping Inventory for Stressful Situations* (Endler & Parker, 1990). However, despite its undeniable importance, there is no clear agreement on how coping should be measured (Aldwin, 2000; Skinner, Edge, Altman, & Sherwood, 2003; Somerfield & McCrae, 2000).

Considering that coping first definitions were based on the psychoanalytic movement (Lazarus & Folkman, 1991), coping unconscious mechanisms were primarily assessed through clinical observation and projective techniques (Cohen, 1987). Additionally, some self-report measures based on this view were also developed to assess coping (e.g., Bond, 1986). However, conceptual and measurement criticism emerged to this psychoanalytic perspective, encouraging the development of novel instruments in which participants were asked to reflect on their conscious efforts to cope with adverse conditions (Billings & Moos, 1981). Actually, the assessment of coping is dependent on its conceptualization (Porter & Stone, 1996). So far, coping strategies have been assessed in two different ways, as a trait or style or as a process (Carver & Scheier, 1994).

The first way refers to dispositional coping (or trait coping). According to this view, it is believed that people develop usual ways of dealing with stress, thus emphasizing stability in coping rather than change (Carver & Scheier, 1994). Thus, it is commonly assessed by interviews and personality tests that ask individuals how they generally cope with stressful encounters in their lives (Carver et al., 1989; Holahan, Moos, & Schaefer, 1996; Monat & Lazarus, 1991). Although the dispositional approach provides a tendency view of how the person normally copes, several criticisms were made by Lazarus and Folkman (1984) to its conceptual and methodological validity. Firstly, personal traits are poor predictors of situational appraisals and coping behaviors. Secondly, coping processes are not actually measured, instead they are inferred from other variables measurement (e.g., personality). Thirdly, this perspective assumes that coping is essentially unidimensional and stable. As opposed, empirical research (e.g., Kaiseler, Polman, & Nicholls, 2012) has shown the multidimensionality and the dynamic nature of coping responses. In sum, although the trait approach helps to reduce the complexity of coping

assessment, it wrongly assumes that contextual variability is not important to understand coping.

The second and alternative way, known as the process approach, stated that coping is defined not as a personality style, but rather as specific thoughts and behaviors that are conducted in response to stressful events, thus changing over time and situations (Porter & Stone, 1996). An example of an instrument used to assess coping based on this view is the *Ways of Coping Questionnaire* (Folkman & Lazarus, 1988), which contains a wide range of thoughts and actions that people use to deal with the internal and/or external demands of specific stressful encounters strategies.

Despite the fact that inventories are a helpful way of assessing coping by allowing for multidimensional self-reported descriptions of situation-specific coping strategies, there are several shortcomings and design faults to these checklists approaches (Dewe et al., 2010). Therefore, Folkman, and Moskowitz (2004) suggested that researchers should pay attention to the potential conflict between overly long checklists and the need to adequately cover a range of coping strategies, ambiguities surrounding item meanings, problem of retrospective report and the unreliability of recall. In line with this idea, Coyne (1997) suggested that checklists should be considered only as first steps in the research process, instead of the only assessment method of coping. Additionally, Carver and Connor-Smith (2010) also highlighted some common problems on coping assessment. These include the reproduction of coping measures with structures that cannot be replicated, the exaggeratedly use of broad categories, and the solely use of self-reports excluding information from observational and multiple informant approaches. The authors also appeal for the need to replace cross-sectional designs for the use of prospective designs, since "coping is viewed as an ever-changing response evolving situational demands and most coping research fail to reflect this view" (Carver & Connor-Smith, 2010, p. 696).

More recently, developments in coping assessment have been influenced by the transactional theory of stress and coping. According to Lazarus and Folkman (1984), when assessing coping, it is important to consider the idiosyncratic meaning that a person gives to a stressful event, considering that is not the situation, but the perception of it that determines stress responses. This means that the assessment of coping must include the analysis of the individual appraisal of the situation, and should be related to a specific stressor instead of a variety of stressors. To ignore the way individuals appraise and give meaning to a stressful encounter is to overlook the processes that are beyond coping decisions, and hence the context within which coping occurs (Dewe et al., 2010). Although

this model has been widely accepted, its practical application is difficult, especially in working settings (as discussed earlier in section 2.2.1.).

In order to overcome previous limitations on coping research and following the recommendations from the transactional perspective of coping, Monat and Lazarus (1991) draw attention for the advantages of using alternative methods that include the assessment of coping in vivo. As an example, a number of researchers (e.g., DeLongis, Hemphill, Lehman, 1992; Eckenrode & Bolger, 1995) have recently enhanced the beneficial use of daily diaries in the study of coping and stress process, as opposed to the traditional use of questionnaires. Arguments underpinning this idea are varied.

Firstly, it was suggested by Tennen, Affleck, Armeli, and Carney (2000) that daily process designs are consistent with current conceptualizations of stress and coping as an evolving and constantly changing process. Considering that daily diaries repeatedly measure variables of interest, they are appropriate to study within subject variability and how coping changes over time.

Secondly, daily diaries can increase the reliability and validity of self-reported data since data is collected closed to the event, making the chances of forgetting and biasing the recall reduced (DeLongis et al., 1992).

Finally, diaries allow exploring the participant´s everyday thoughts, feelings and behaviors, thus strengthening the ecological validity of the reports (DeLongis et al., 1992). Following these recommendations the current Ph.D. work has used daily diaries to investigate stress and coping among a sample of Portuguese PO (see Chapter IV and V). Additionally, Stone, Schwartz, Neale, Shiffman, and Marco (1998) presented a momentary assessment methodology, allowing for momentary coping assessments in real time and real world settings by using electronic diaries. Participants were prompted by the computer to answer about ongoing problems, and coping strategies used to deal with the reported situations. The authors found that there was relatively poor correspondence between the two types of assessments, suggesting that retrospective reports of coping may not be that accurate to capture participants real coping efforts, as reflected in ecological assessments. This drew the attention to the fact that trustworthy conclusions about real time coping should be carefully consider, especially when these are only based on retrospective reports.

Folkman and Moskovitz (2004) proposed the use of narrative approaches as an alternative method for assessing coping. These approaches include asking people to give narratives about stressful events, by reporting what happened, emotions experienced, thoughts and actions during the situation. As an example, Keley and Clifford (1997)

conducted a study aiming to examine the usefulness of a narrative approach to a therapeutic work group of people with fibromyalgia. The authors found that narrative approaches helped participants find their own strengths and examine the means of coping strategies deployed. Keeping these vicissitudes in mind, Dewe et al. (2010) suggested that researchers should contribute to the development of the coping assessment, rather than being restricted to the solely use of traditional methods and conventional criteria. In fact, Lazarus (2000) stated that these alternative methods are crucial for understanding coping and act as a reliable complement to existing research strategies, since we should not see them as a substitute for the traditional approach. Previous experiences from those that have already surrender to this new challenge (e.g., Stone et al., 1998; Tennen et al., 2000) have shown the richness of what can be accomplished and learnt from a complex and dynamic process as it is coping.

Another common problem when assessing coping has to do with its hierarchical organization, raising doubts whether it should be assessed at a strategy or higher-order dimension level (Skinner et al., 2003). Compas, Worsham, Ey, and Howell (1996) stated that a single coping strategy could be classified within more than one dimension, making it impossible to accurately classify a coping strategy, when higher-order dimensions are considered. On the other hand, Lazarus (1996) argued that measuring coping at the strategy level shows better the way people actually deal to stress. Carver et al. (1989) also highlighted the controversial use of assessing coping at a strategy or higher-order dimension level, when aiming to understand coping effectiveness. As an example, considering that EF coping, encompasses a lot of strategies like denial, focusing on and venting of emotions, positive reinterpretation of events, and seeking out social support, the effectiveness of EF coping depends on the particular EF strategy employed. However, the predominant trend followed in the stress and coping literature is based on coping dimensions, commonly assuming that EF coping in general is ineffective (Baker & Berenbaum, 2007).

It has been argued that the understanding of coping process is not sufficient by merely describing the coping strategies used and developing coping tendencies (Lazarus & Folkman, 1984). As stated by Folkman (1991; 1992), it is crucial to evaluate if the strategies used are effective or ineffective in alleviating/removing the stressors. Thus, coping effectiveness measures should always be contemplated. Lazarus and Folkman (1984) and Folkman (1991; 1992) agreed that this should be done considering not only its effects in dealing with stressful encounters, but also its impact in the long term. In order to

measure the immediate impact of the used coping strategies, people can report if their choice had an impact on their mood, if it helped them solve the problem or change the stressful situation at that particular moment. To measure long term effects of coping effectiveness, indices of psychological and physical wellbeing, positive affective states and/or overall satisfaction with the coping strategy used could be reported. However, Folkman (1991; 1992) has suggested that coping effectiveness should not be assessed only by considering its short and long-term outcome effects. As it was stated above, coping effectiveness could also be assessed by considering the goodness-of-fit model of coping effectiveness from Lazarus (1992). Two fits need to be tested based on this model. First, the match between the real situation in the person-environment transaction and the individual appraisal of that transaction should be evaluated. For example, a situation can be misappraisal or erroneously evaluated as being more demanding and problematic that actually is. The second fit comprehends the assessment of the congruence between situation appraisals of controllably and reported coping strategies (secondary appraisal). Thus, when an individual appraised a situation as amenable to change (with more personal control), it is expected the use of more PF coping compared with situations that are appraised as being uncontrollable, where is expected the use of more EF coping.

Several researchers have suggested that qualitative research may help provide a basis for understanding coping effectiveness (Lazarus, 1999; Somerfield & McCrae, 2000). However, little studies evaluated the effectiveness of coping strategies (Anshel et al., 2013; Ntoumanis & Biddle, 1998) and the majority of those that contemplated this measure (e.g., Alexander & Walker, 1994) have been mainly cross-sectional, rather than longitudinal in nature. Thus, it seems crucial to consider coping effectiveness measures otherwise no conclusions on the coping effectiveness can be drawn.

2.5. Coping and coping effectiveness among police officers

Coping strategies are very important to the way PO deal with their daily life stress. Accordingly, Violanti et al. (2006) suggested that exposure to stress can affect PO performance indicators, such as normal thinking patterns. Thus, previous adaptive coping strategies can be ignored or become inaccessible and changes in behavior may occur by the use of ineffective coping strategies, which can cause a negative impact in an officer health and professional behavior. Previous research in this area, suggested that a possible cause for police personnel stress related problems is their limited and probably ineffective coping

abilities (e.g., Anshel, 2000; Anshel et al., 2013; Pasillas, Follette, & Perumean-Chaney, 2006; Toch, 2000).

The earliest empirical work on the study of police coping resources was conducted by Violanti, Marshall, and Howe (1985) among 500 PO in the United States, aiming to examine the relationship between police job demands, stress, coping, and alcohol use. The authors found that cynicism and alcohol were ineffective police stress responses that might be considered coping attempts. Researchers on this field show great concerned about the way PO are dealing with their daily stress (Anshel, 2000; Evans et al., 1993; Ortega, Brenner, & Leather, 2007). In support of this idea, Graf (1986) conducted a study among 77 PO in Canada, aiming to investigate the relationship between perceived social support and their perceived job stress. The author found that at least two-thirds of the PO never or almost never dealt successfully with work problems, did not feel confident about their ability to cope with those problems, and were not coping effectively with important changes at work. Additionally, in a study by Alexander and Walker (1994) aiming to understand coping strategies among 758 Scottish PO, 65% and 73% of the officers respectively thought that the strategies they used to cope off duty and on duty were only slightly or not at all effective. Moreover, Evans et al. (1993) examined the stress-coping strategies used to deal with stressors among 271 Australian police. The authors concluded that officers used more PF and direct action coping strategies, however many of them were not dealing effectively with their EF concerns.

Results concerning the type of coping preferred by PO are also ambiguous, given that some studies found that PO used more PF coping while other studies have reported the opposite pattern. As an example, a study conducted by Brown et al. (1996) with 500 senior United Kingdom PO aiming to understand occupational stress, found that most officers used coping strategies such as anticipated planning, dealing with problems immediately, priorities establishment, try to deal objectively with the situations and maintain stable relationships in order to deal with stress. Similarly, the study conducted by Evans et al. (1993) (described above), found that most PO preferred PF and direct actions of coping rather than social supports, self-blame or wishful thinking. These studies support the view that PO have a tendency to use more PF. On the other hand, Bishop, Tong, Diong, Enkelmann, and Why (2001) conducted a study among 243 PO from the Singapore Police Force aiming to understand the relationship between coping styles and personality. The authors found that the most commonly used coping strategies were EF such as positive reinterpretation and growth, followed by planning, acceptance, and instrumental social

support. Additionally, in the study conducted by Alexander and Walker (1994) the authors concluded that officers typically used coping strategies such as talk with colleagues, work more and keep things to themselves. Hence, these studies found PF as the most frequently reported by PO.

Considering these results, we can conclude that PO use a variety of coping strategies to deal with the experienced stress. However, little is known about their effectiveness, probably because the majority of studies only measured coping "usage" (i.e., how much a certain coping strategy was used) (e.g., Evans et al., 1993) instead of the extent to which that strategy was effective in alleviating stress. Those that contemplated this measure found a tendency to consider PF coping as being more effective. As an example, Hart, Wearing, and Heady (1995) obtained data from 527 Australian PO during two related studies, aiming to understand the personal and work related factors contributing to PO psychological wellbeing. Results suggested that the use of more PF coping resulted in the experience of more work uplifts and wellbeing, whereas EF coping was associated with work hassles and stress. Thus, according to these findings, it seems that when PO attempt to cope with stressful encounters by managing or dealing with their emotional response, they are more likely to feel an increase in work hassles. On the other hand, when PO attempted to cope by managing or dealing directly with the stressful events, they are more likely to experience work uplifts. Although these findings are important, scarce attention has been dedicated to the study of coping effectiveness among PO, what restricts conclusions in the area. Moreover, the limited studies found that contemplated this measure, may be plagued by methodological limitations such as the use of cross-sectional designs that only provide an indication of perceived coping effectiveness with memory bias and distortions. Thus, future studies analyzing coping should contemplate coping effectiveness measurements and researchers should conduct novel longitudinal and qualitative designs, as complementary methods for traditional research methodologies among PO.

In sum, it is important to conduct further research in the area of coping and coping effectiveness, aiming to understand and promote effective coping strategies, considering that coping skills are a crucial predictor of an efficient police force (Evans et al., 1993). In support of this recommendation Anshel (2000) emphasized that a limitation of PO training is the lack of psychological interventions to improve coping skills. As suggested by the same author, these interventions would help PO deal with stress and would ultimately have a positive impact in their health. Hence there is a need to foster a culture of effective

coping strategies to replace the avoidant, dysfunctional coping behaviors used by many officers that are of great concern for police administrators and academics (Lindsay & Shelley, 2009).

3. Engagement

3.1. Conceptualization

For many years, research has been mainly focused on the negative aspects of work, like stress or burnout. However, in recent years there has been a change on the focus of investigation, moving away from a more problem-orientated research to a strengths-based line of investigation. Positive psychology has a crucial role in this change of paradigm, by enhancing the study of optimal functioning, as opposed to dysfunctions and problems (Seligman & Csikszentmihalyi, 2000). Accordingly, Bakker (2009) suggested that engagement can make a true contribution to organizations.

Engagement is a positive, fulfilling, work-related state of mind, characterized by vigor, dedication and absorption (Schaufeli, Salanova, González-Romá, & Bakker, 2002). Vigor is characterized by high levels of energy and mental resilience while working. Dedication means being strongly involved in work tasks and experiencing a sense of significance, enthusiasm, and challenge. Absorption is characterized by being fully concentrated and immersed in one's work, feeling that time flies while working (Schaufeli & Bakker, 2004). Essentially, engaged workers perceive their work as stimulating and energetic, for which they dedicate time and effort (vigor), as an important and meaningful achievement (dedication) and as absorbing and something on which they are fully focused in (absorption) (Bakker, Schaufeli, Leiter, & Taris, 2008). Because of their positive approach and high activity level, engaged employees generate their own positive feedback, in terms of appreciation, recognition, and success, which is very positive and beneficial not only for the worker, but also for the place they work for (Bakker & Leiter, 2010).

Previous research has consistently revealed that job resources and personal resources are important predictors of work engagement (Bakker, Albrecht, & Leiter, 2011). These resources are crucial for work-related goals and they satisfy basic psychological needs as explained below. Job resources in particular, refer to those physical, social, or organizational characteristics of the job that could reduce job demands and the associated physiological and psychological costs; be efficient in accomplishing work aims, encourage

personal growth, learning, and development (Bakker & Demerouti, 2007; Schaufeli & Bakker, 2004). Examples of job resources refer to social support from colleagues and supervisors, performance feedback, skill variety, autonomy, and learning opportunities that are positively associated with work engagement (Bakker & Demerouti, 2007; Schaufeli & Salanova, 2007).

Several studies have shown a positive relationship between job resources and work engagement (Halbesleben, 2010). For example, Schaufeli and Bakker (2004) conducted a study among 1698 Dutch employees working in an insurance company, an occupational health and safety Service Company, a pension fund company, and a home care institution. By using a SEM the authors found that job resources (not job demands) exclusively predicted engagement, and that engagement was a mediator of the relationship between job resources and turnover intentions. This study was replicated in a sample of 2038 Finnish teachers by Hakanen, Bakker, and Schaufeli, (2006) and results showed that job control, information, supervisory support, innovative climate and social climate were all positively related to work engagement. More recently, Hakanen, Schaufeli, and Ahola (2008) conducted a longitudinal design study among a sample of 2555 Finnish dentists. The authors found that job resources including craftsmanship (the possibility to work with one's hands), professional contacts (interacting with colleagues), and long-term and immediate results of work (e.g., seeing the good results of treatment) influenced future work engagement. Hence, it can be concluded that positive work characteristics are essential predictors of work engagement. This is very important not only for work administrators that want committed employees, but also for employees itself in order to be more motivated and pleased with their work. However, as it was referred above the characteristics of work are not the only predictor of engagement. Personal resources are also an important aspect to consider.

Based on the statement that engaged workers also seem to be engaged outside work life, some researchers started to examine the relationship between personal characteristics and work engagement. As an example Langelaan, Bakker, Schaufeli and Van Doornen (2006) conducted a study among 572 Dutch employees in order to relate work engagement to temperament and two personality factors—neuroticism and extraversion. Results suggested that engaged workers were characterized by high levels of mobility, low neuroticism, and high extraversion. This means that engaged workers are able to adequately respond to changes in environmental demands, since they adjust quickly to new contexts and easily change between different tasks. Additionally, highly engaged

employees do not show the common tendency to experience the negative emotions such as fear, depression, and frustration that is characteristic of neurotics. As opposed, they seem to have a disposition for optimism, sociability, and high activity (extraversion). Acknowledging the positive outcomes of engagement, the following section will analyze the concept in the context of PO.

3.2. Engagement among police officers

Most of the studies in the area of occupational health among PO had mainly focused on negative concepts of health (e.g., stress, burnout) and very few had focused on the analysis of positive outcomes, such as engagement (Sced & Baur, 2007). Clearly, it is important to note that stress problems need to be addressed, in order to find its causes and impact on PO health. However, as proposed by positive psychology, research should go beyond that, and find ways to understand what causes PO wellbeing in order to provide PO and administrators a clear understanding of this concept. Hence, providing objective hints of what can be done to improve engagement and consequently reduce stress among this population.

Engagement has been studied among PO in relation to other variables, such as coping. An example of this is a study conducted by Rothmann et al. (2011) with a sample of 3178 South Africa participants from three occupational groups, including a subgroup of 2145 PO. This study aimed to understand the relationship between coping strategies and work engagement across three occupational groups. Results for the police sample suggested that some types of coping (e.g., PF coping, seeking social support, turning to religion and low ventilation of emotions) were the strongest predictors of work engagement.

In other studies engagement was also investigated in relationship to personality traits and stress. As an example, Mostert and Rothmann (2006) conducted a study among 1794 South African PO, aiming to examine whether background variables, job stress, and personality traits, could predict PO engagement. Results suggested that background variables (e.g., gender, age, race) are themselves a minor contribution to work engagement. On the other hand, work engagement was best predicted by other factors such as conscientiousness, emotional stability, extraversion and low stress.

Engagement was also studied in relationship to emotional labor. Accordingly, Bechtoldt, Rohrmann, De Pater, and Beersma (2011) conducted a study among 42 German

PO aiming to analyze the role of emotional intelligence in the process of emotional labor. Results suggested that workers with high emotion recognition engaging in emotional labor reported higher work engagement. These studies reinforce the idea that personal resources, are important predictors of work engagement (Bakker, Albrecht, & Leiter, 2011). Hence, it seems that engagement is related to some coping strategies, (especially PF ones), personality traits and emotional recognition. Moreover, low stress also seems to be related with work engagement.

Hence, applied practitioners should develop effective coping strategies interventions in order to prevent stress and enhance engagement among this population. Regarding the importance of emotional recognition, police organizations should train officers on emotion recognition, because as concluded by Bechtold et al. (2011) when they lack this capacity, they have more problems in understanding others' emotions, more difficulties with responding effectively and more difficulties in adapting their behavior. Consequently, low emotion recognition has a negative impact on workers' engagement.

Other studies were conducted with this population regarding the influence of job resources in the promotion of work engagement. As an example, engagement was investigated in relation to team environment. Bakker, van Emmerik, and Euwema (2006) investigated engagement among a sample of 2229 Royal Dutch constabulary officers. This study explored the crossover of work engagement and burnout in a team environment. The authors concluded that those who were part of highly engaged teams evidenced higher levels of vigor, dedication and absorption. These results reinforce the advantages of healthy working environments and the importance of peer support.

Finally, Gillet, Huart, Colombat, and Fouquereau (2013) conducted a study with two samples of French PO, aiming to identify the mechanisms underlying PO engagement levels. The authors concluded that PO who felt supported by their organization showed higher levels of self-determined motivation and work engagement. In contrast, Talarico and Swanson (1983) stated that when officers perceive a lack of leadership and supervisory support, these may increase feelings of distrust toward police supervisors and administrators and simultaneous performance levels tend to decrease. These findings have some practical implications for promoting PO engagement. Thus, in order to emphasize the importance of perceived organizational support, applied practitioners, such as psychologists, could design programs that include more participant-centered activities, and emphasize cooperative activities and fairness. Moreover, police administrators could emphasize the importance of perceived organizational support by establishing career

management systems that promote easy access to training and skills development. Finally, considering that high self-determined motivation among PO is also a predictor of PO work engagement, Gillet et al. (2013) suggested that this aspect should be taken into consideration during the recruitment process for example, by including a global motivation scale in the selection procedure.

Concluding, acknowledging that work engagement is beneficial for both the PO themselves and for the organization, police organizations should support PO to reduce stress, by developing more effective coping and emotion recognition interventions, by strengthen their self-determined motivation and by promoting team building. However, further research is warranted understanding how to develop engagement levels among this population.

When analyzing engagement levels among Portuguese PO it was found that very few studies addressed this concept. As an example Silva (2012) conducted a longitudinal study among 91 Portuguese PO from the Municipal Police of Porto aiming to investigate the emotional exhaustion and motivation strategies of agents. Results suggested that PO have higher levels of engagement, when they are less exposed to risky situations, have better working conditions and higher wages. Additionally, Kaiseler et al. (2014) conducted a study among 387 Portuguese police recruits, investigating stress, coping and engagement. The authors concluded that future applied interventions should reinforce perceptions of control over a stressor as well as active coping strategies. Other studies were conducted in Portugal in the line with positive psychology, however they do addressed a different concept of engagement, more related with subjective wellbeing (e.g., Gonçalves & Neves, 2010).

Based on the theoretical framework presented during this first chapter, four studies were developed. The next chapter will address a systematic review article and the following three chapters will describe the empirical studies conducted during this Ph.D. work.

CHAPTER II

STUDY 1: PSYCHOPHYSIOLOGICAL ASSESSMENT OF STRESS UNDER ECOLOGICAL SETTINGS

A SYSTEMATIC REVIEW

1. Introduction [1]

Several attention has been dedicated to the study of stress, however little agreement still exists among the academic community with respect to its conceptualization and assessment (Monroe, 2008). For years studies investigating stress in Psychology area have largely relied in retrospective and cross-sectional designs, usually questionnaire or interview-based. As suggested by Segerstrom and O´Connor (2012) data collected may be plagued by memory biases or distortions associated with time delays, challenging the validity and reliability of the reports. In support of this idea, several studies revealed significant discrepancies between real-time assessments and retrospective recall. As an example, Hufford et al. (2001) suggested that participants are more likely to report experiences that have more personal meaning, occurred more recently, are unusual in meaning, or consistent with their current mood. Laboratory designs are one commonly used solution to the limitations presented above, since they avoid retrospective report problems and can add the rigor of an experimental design (Smith & Stone, 2003). Additionally, laboratory designs also allow physiological stress responses monitoring (Zanstra & Johnston, 2011). However, it is important to bear in mind, that laboratory baseline conditions may not represent real-world conditions. This can be explained by the inherent artificial conditions, which are likely to increase the risk of biasing results. In agreement with this idea, Monroe (2008) suggested that laboratory research assessing stress rarely, if ever, includes aspects of the social environment which is an important part of the stress concept. According to Zanstra and Johnston (2011) stress reactions should be investigated in relation to discrete and objective stressful situations. Additionally, considering that stress is an interdisciplinary topic, interdisciplinary research methods are needed in order to fully understand the concept (Goldstein & Kopin, 2007).

In an attempt to overcome previous research limitations, the 21st century science recommends research methods such as Experience Sampling Method (ESM, Larson & Cskszentmihalyi, 1983), Ecological Momentary Assessment (EMA, Stone & Shiffman, 1994) and Ambulatory Assessment (AA, Fahrenberg, Myrtek, Pawlik, & Perrez, 2007) to investigate a variety of behaviors, experiences, and conditions, including the experience of stress. ESM is an ecologically-valid methodology, developed to understand the dynamic process of person-context interactions. Participants in ESM are signaled with a device

[1] This chapter is presented in the scientific article published in the *European Psychologist* (Rodrigues, Kaiseler, & Queirós, 2015).

(e.g., pager) at random times within a fixed time period and booklets where they are required to report their activity, mood and/or thoughts (Kimhy et al., 2010).

In 1994 a new approach was proposed denominated EMA (Stone & Shiffman, 1994). Following technological development trends the assessment goals of EMA have expanded beyond self-reported subjective states to the monitoring of physiological conditions. AA is another commonly used term in the literature and is often referred to the monitoring of physiological processes through the use of computer-assisted procedures, sometimes accompanied by diary self-reports of subjective states or contexts (Trull & Ebner-Priemer, 2009). Although a definition of the different research approaches can be found in the literature, the terms are used interchangeably as being conceptually the same. Recently, Trull and Ebner-Priemer (2013) suggested that "AA represent a methodological umbrella that encompasses increasingly computerized or digitized methods of experience sampling, ecological momentary assessment, and continuous psychophysiological, biological, and behavior monitoring". However, the same authors in 2009 appealed for the use of EMA as an "umbrella" (p. 42) term that attempts to integrate all these assessment traditions with similar goals. Hence, it is clear that there are a variety of terminologies used to denominate assessment of real world activities. As suggested by Fahrenberg (2006), this multiplicity of terms may be due to a disclosure of the author's personal interests in emphasizing their own contribution, or it can be a result of commercial memberships or claims. Despite the lack of agreement in the use of a common terminology, the methodologies share some similar features and are essentially modern day tools, allowing for a within-person assessment in natural environments, and contemplating an idiographic approach (Trull & Ebner-Priemer, 2009). For the purpose of the current systematic review the term ecological approaches will be used to refer to all real world assessment methods, including ESM, EMA and AA.

Considering the relationship between stress and physical illness (Jansson, Wallander, Johansson, Johnsen, & Hveem, 2010) an important advantage of these holistic stress approaches is the opportunity to objectively investigate the cognitive processes and behaviors leading to the physical illness. In other words, ecological approaches allow a further understanding of the relationship between subjective psychological and objective physiological parameters of stress and health conditions (Yoshiuchi, Yamamoto, & Akabayashi, 2008). Thus, several studies have been conducted with clinical (e.g., Kimhy et al., 2010) and non-clinical populations (e.g., Sausen, Lovallo, Pincomb, & Wilson, 1992) in order to better understand this relationship and its influence on health outcomes. As an

example, this ecological studies could give an important practical contribute in the prevention and promotion of better health conditions among professionals who are subjected to high stress, as policing.

According to recent investigations in the area of police stress, PO show severe health problems (e.g. coronary heart disease) (Fenici et al., 2011) resulting in emotional and behavioral alterations (e.g., depression; isolation; suicide) that can cause a negative impact on PO lives and the community safety. Therefore, this new line of research seems crucial, since it is focused on the understanding of psychological and physiological stress-related problems in a health perspective. Furthermore, these approaches provide an interesting opportunity to study daily life events (Fahrenberg et al., 2007) across medicine (e.g., Kalpakjian, Farrel, Albright, Chiodo, & Young, 2009) and psychology fields (e.g., Bishop et al., 2003) combining multidisciplinary teams.

Regarding the techniques used by ecological approaches to assess psychological measures of stress, some examples were found such as paper diaries (e.g., Barnett, Steptoe, & Gareis, 2005), daily phone interviews (e.g., Almeida, Wethington, & Kesseler, 2002), and electronic diaries (e.g., Kimhy et al., 2010). Due to the fast technological advances more complex and sophisticated protocols have emerged recently (Shiffman, Stone, & Hufford, 2008) matching closely to the population needs and study aims (e.g., Kuntsche & Labhart, 2013).

In what concerns to the physiological measures of stress, the most commonly used are cortisol (e.g., Collip et al., 2011), HR, Heart Rate Variability (HRV) (e.g., Dockray et al., 2010) and Blood Pressure (BP) (e.g., Ewart & Jorgensen, 2004). Regarding methods used to collect physiological measures of stress under ecological conditions these include Salivette (e.g., Collip et al., 2011), ambulatory BP and HR monitors (e.g., Muraoka, Carlson, & Chemtob, 1998) and more recently wearable T-shirts incorporating ECG (e.g., Kaiseler, Rodrigues, Ribeiro, Aguiar, & Cunha, 2013).

When contemplating physiological measures of stress, attention should be drawn to confounders' variables such as physical activity levels and posture, since these are directly related to cardiac activation and can possibly bias results (Schwerdtfeger, Konermann, & Schonhofen, 2008). In an attempt to overcome this challenge, new methods such as accelerometry or actigraphy, including novel technologies were proposed as a possible resource to control for confounders variables (Wilhelm & Grossman, 2010). Another important aspect to consider when assessing stress under ecological conditions is the design of the study. Particularly, ecological approaches designs can be divided into event-

based sampling and time-based sampling schemes, varying according to the study purposes (Shiffman et al., 2008). The main difference between these two sampling schemes is that in an event-based scheme a recording is made each time a predefined event occurs, whereas in the time-based sampling a recording is solicited based on a time schedule, often based on random time intervals, without a predefined focus (Shiffman et al., 2008). A combination design can also be used, when the researcher is interested in the conditions that are associated with a target event (Bolger, Davis, & Rafaeli, 2003).

Research on ecological assessments of stress has been privileged by the rapid technological development and benefits from multidisciplinary expertise across different life settings allowing for 24h continuous monitoring of physiological data, without interfering with participants daily life (Houtveen & Geus, 2009). An important aspect to consider is measurement synchronization that allows for the temporal associating of psychological stress measures and physiological data, offering unique opportunities to fully understand the stress experience (Kimhy et al., 2010). In support of this argument Wilhelm and Grossman (2010) suggested that when conducting "multichannel studies" with different measures it is important to highlight the need for these measures synchronization.

Acknowledging the importance of stress ecological studies in contemporary life and their contribution to the development of knowledge, it seems crucial to reflect on the current methodological challenges of this task. This need seems to be reinforced by novelty of the research area, which results in a growing number of studies across disciplines aiming to assess similar stress conceptualization but using different terminologies, methods, techniques and designs, limiting development of knowledge. Thus, the current systematic review aims to summarize, evaluate and synthesize previous research assessing stress in ecological settings combining psycho-physiological measures. For this purpose, the current paper reviewed over 22 years of research in this area across the disciplines of medicine and psychology. This systematic review will not only contribute to the development of knowledge in this area but will also provide research recommendations for future studies.

2. Method

2.1. Search strategy

Eight electronic databases (Medline with full text; Psyarticles; Psycritiques; Psybooks; Psychological and Behavioral Science Collection; Psyinfo; Socindex with full text; Fonte Académica) in Ebsco were searched in addiction with the Society for Ambulatory Assessment (SAA) database (http://www.ambulatory-assessment.org/typo3/ambulatory/index.php?id=35). The search in Ebsco was conducted using the keyword "stress" combined with each one of the following terminologies: "Ecological Momentary Assessment"; "Experience Sampling Method"; "Ambulatory Monitoring". The years of publication were limited between 1990 to December 2012. All articles were searched in SAA database, between 2006 and 2012.

The methodology used for systematic review was based on the guidelines defined by Chalmers and Haynes (1995), Lloyd Jones (2004) and Mulrow (1995). Lloyd Jones (2004) recommended sifting papers in three stages such as review them by title, then abstract and finally by full text, excluding those at each step that did not satisfy the inclusion criteria. Due to the difficulty of identifying studies relevant to the research question by only reviewing their title, this criterion was not used in the current review. Instead, all papers were reviewed by abstract and then by full text to determine whether they met the inclusion criteria. One thousand, eight hundred and three references were removed after reading their abstract. A total of 322 articles were screened, 270 of which were excluded. Furthermore, the reference lists of all papers were also checked for relevant studies, and another eight studies were screened, five of which were excluded. In total, 55 studies were included in this systematic review (Figure 2). Each article considered for inclusion was reviewed independently by the first two authors and if differences were found, the article was reconsidered. The first and second authors agreed on 51 out of the 55 reviewed articles (93%) reported. In the cases of disagreement, discussion was followed with the third author and a decision was made.

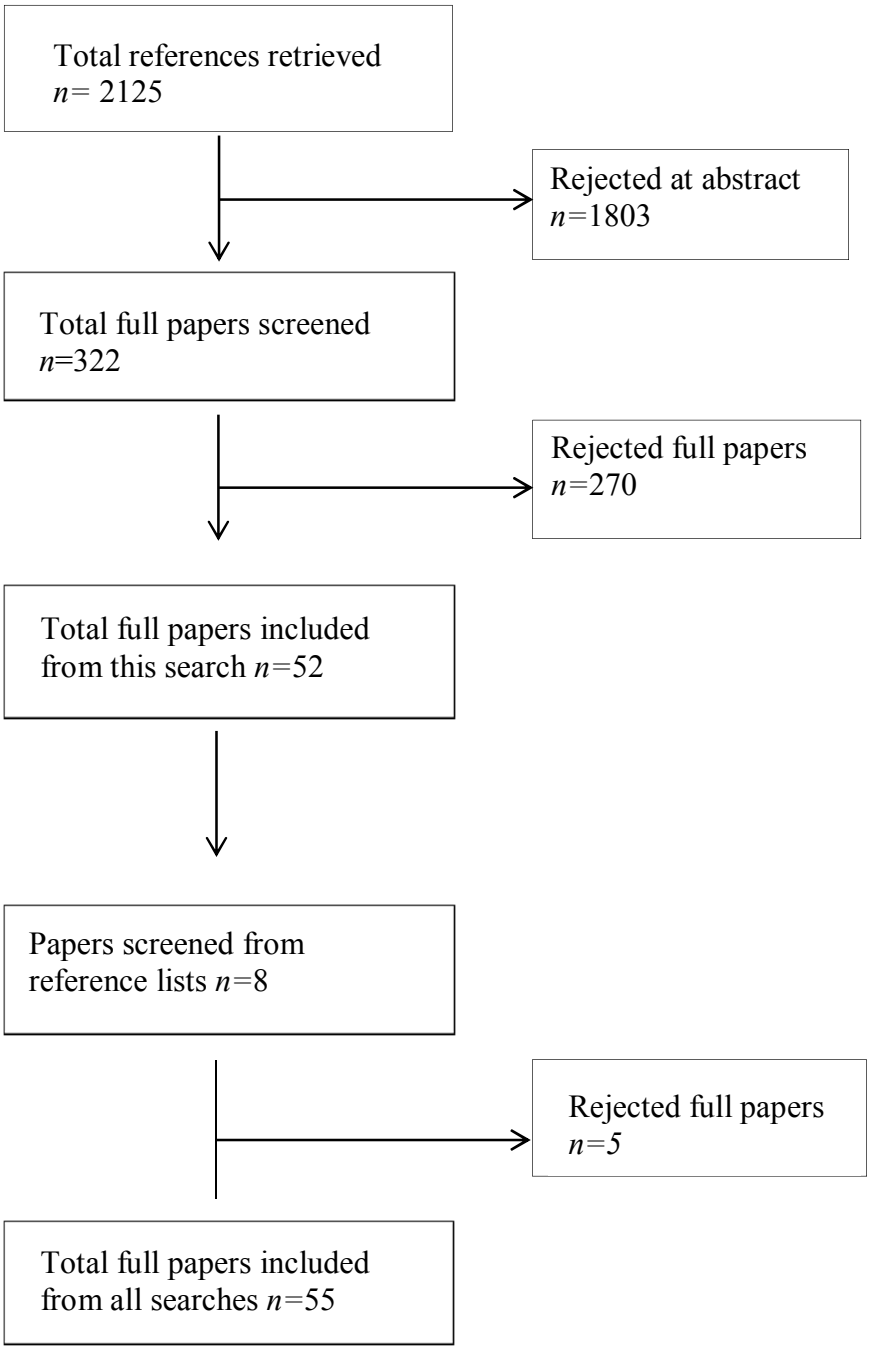

Figure 2. Summary of study selection and exclusion – all literature searched.

2.2. Inclusion criteria

Studies were considered for inclusion if they provided both psychological and physiological measures of stress under real world conditions and were published as full papers. As suggested by Knipschild (1995) studies published as abstracts or conference proceedings were excluded. Studies that did not assess stress in real world settings were also excluded. It is worth noting that not all included studies considered stress assessment as a primary goal, since in some cases this aim was assessed on a post-hoc basis.

3. Results

The initial search resulted in a total of 2125 papers, of which 55 articles deemed potentially relevant. A total of 1813 were excluded for not assessing stress; 149 articles were excluded due to lack of physiological measures; 19 due to lack of psychological measures; 12 were development only in laboratory settings, 27 were not empirical studies and 50 were duplicated. The selected studies were displayed into several themes. These include 1) the terminology used for the methodologies, 2) research population, 3) study design, 4) measurement (psychological and physiological) and 5) technology. Findings are displayed in Table 1.

Table 1.

Summary table of the reviewed studies using ecological approaches on stress assessment.

Authors	Aim	Research population	Study design	Measurement		Stress measurement synchronization	Technology	Terminology used for the methodology
				Psychological	Physiological			
Barnett et al. (2005)	Estimate the relationship between marital-role quality and 3 psychobiological stress indicators	105 middle-age adults	Time – based (fixed intervals) during 1 day	Subjective stress; Marital-role quality; negative affect	Cortisol, BP	Yes	Paper diaries; SpaceLabs 90217; Salivette	Momentary Experience Sampling; AM;
Beckham et al. (2005)	Investigate the association between smoking and situational cues	63 smokers with PTSD and 32 smokers without PTSD	Time – based (random intervals) during 1 day	Mood states (feeling distressed); PTSD symptoms; psychopathology	HR; BP	10 minutes before	Paper diaries; Accutracker II	AM
Beckham et al. (2000)	Investigate the relationship between daily diary affect ratings and ambulatory CV activity	117 male Vietnam combat veterans (61 with PTSD and 56 without PTSD)	Time – based (fixed intervals) during 12 to 14 hours	PTSD symptoms; psychopathology; mood states (stressed)	HR; BP	10 minutes before	Paper diaries; Accutracker II	AM

Bedford et al. (2011)	Examine whether negative eating/body attitudes were associated with cortisol and ABP	120 non-obese, healthy women aged 19 –35	Time – based (fixed intervals) during 1 day	Eating and body attitudes; perceived stress	Cortisol; HR; BP	No	Aliquots; Spacelabs 90207	AM
Benotsch et al. (1997)	Compare ABP and investigate interpersonal daily stress as a possible mediational mechanism	48 students pre-selected for high and low hostility scores	Time – based (quasi random intervals) during 2 days	Perceived social support; hostility; daily interpersonal stress	HR; BP	No	Paper diaries; Accutracker II	AM
Bishop et al. (2003)	Test de demand-control model for coronary disease	118 police patrol officers	Time – based (fixed intervals) during a morning shift	Occupational stress (job demands; decisional control)	BP; HR	Yes	Electronic diaries; Accutracker II; BP monitors	AM; EMA
Brondolo et al. (2009)	Investigate trait hostility and CV reactivity to potentially stressful social interactions	73 (39 women) New York City traffic enforcement agents	Time – based (fixed intervals) during 1 day	Mood; Hostility; state affect; Quality of interactions	BP; HR	Yes	Paper diaries; Suntech Accutracker II	EMA
Buckley et al. (2004)	Examine the relationships between	2 groups:19 with chronic PTSD and 17	Time – based (fixed intervals)	Personality and behavior traits, PTSD symptoms;	HR; BP	Yes	Electronic diaries; Dinamap	AM

	diagnostic status, basal CV activity, and CV reactivity to stress	without PTSD	during 1 day	depressive symptomatology; state and trait anxiety, affective distress			automated BP monitor; Dynapulse 5000A	
Campbell et al. (2006)	Investigate between peak expiratory flow rate (PEFR) and high frequency heart rate variability (HFHRV) during periods of negative affect and physical activity associations	53 patients with mild to moderate asthma	Time- based (fixed intervals) with continuous monitoring of HRV during 1 day	Asthma self-efficacy; mood (stressed; frustrated, sad, tense)	Airflow assessment; HFHRV	Yes	Paper diaries; Timex wristwatch; Polar R–R monitor; Mini-Wright Peak Flow Meter	AA
Carels et al. (2000)	Examine the relationship between marital distress and BP during daily life	50 married employed women	Time – based (random intervals) during 1 day	mood (angry, sad, stressed, frustrated, tense, happy, in control) marital distress	BP; HR	Yes	Paper diaries; Accutracker II	AM
Collip et al. (2011)	Investigate whether HPA axis functioning is	60 siblings of patients with a psychotic disorder and	Time – based (random intervals) during 6 days	Event stress; psychotic symptomatology; negative affect,	Cortisol	Yes	Paper diaries; Digital wristwatch;	ESM

	altered in individuals at above average genetic risk for psychotic disorder	healthy comparison group (N=63)		Trait psychosis liability; childhood trauma			Salivette	
Compton et al. (2007)	Examine individual differences in error-related self-regulation predict emotion regulation in daily life	47 participants	Time-based (fixed intervals with a frequency of one per day) during 14 days ERN was recorded continuously	Personality; stress; anxiety	ERN	No	Electroencephalographic Recording and Signal Processing	ESM
Conley and Lehman (2012)	Examine CV activity when an academic stressor was occurring and when an academic stressor was not occurring.	99 undergraduate students	Time – based (fixed intervals with a frequency of one per day) during 4 days	Stress events; anxiety; depression	BP; HR	No	Electronic diaries; Spacelabs Healthcare	AM
Dennis et al. (2007)	Investigate gender differences regarding the association	63 smokers with PTSD and 32 without PTSD.	Time – based (fixed intervals) during 1 day	Psychopathology; affect; PTSD symptoms; restlessness; worry; hunger	HR; BP	Yes	Paper diaries; Accutracker II	AM

	between smoking and situational cues							
DeSantis, et al. (2007)	Identify potential physiological pathways to racial disparities in health outcomes	255 adolescents	Time – based (fixed intervals) during 3 days	Negative emotion; chronic stress; episodic life stress; personality	Cortisol	Yes	Paper diaries; programmed watch; Saliva swabs	ESM
Doane and Adam (2010)	Understand momentary/daily changes in loneliness or chronic, ongoing feelings of isolation and loneliness with HPA axis activity	108 participants	Time – based (fixed intervals) during 1 day	Mood (stressed); anxiety; stress (chronic and episodic); loneliness trait	Cortisol	Yes	Paper diaries; Actiwatch Score; Straws; Mechanical Kitchen Timer; Straws;	EMA (Momentary diary method)
Dockray et al. (2010)	Validate DRM affect ratings by comparison with contemporaneous EMA ratings	94 women aged 21-54 years working at University college London	Time – based (fixed intervals) during 2 days	Happiness, tiredness, stress, anger/frustration	Cortisol; HR; HRV	Yes	Paper diaries; DRM online entries; Saliva swabs (the other instruments were not	EMA; DRM

							described here)	
Dollan et al. (1992)	Understand coping styles in the relation between real-life stress and BP	20 male college students	Time – based (random intervals) during 2 typical school days 1 with an examination	mental effort; emotional stress, anger, coping	BP; HR	Yes	Paper diaries; Accutracker 102	AM
Ebner-Priemer et al. (2008)	Investigate the relation between psychological distress and components of affective dysregulation	50 BPD and 50 healthy controls	Time - based (fixed intervals) during 1 day with continuous monitoring of ECG	Psychological distress; emotions	HR; PA	Yes	Electronic diaries; Vitaport II;	AM
Entringer et al. (2011)	Assess whether EMA of cortisol sampling improves the ability to predict the length of human gestation	25 healthy pregnant women	Time – based (EMA random intervals and fixed sampling design for measures of cortisol) during 4 days	Negative affect (stressed)	Cortisol	No	Electronic diaries; Medication Event Monitoring System; Salivette	EMA
Ewart and Jorgensen	Test Social Competence	187 Black and White	Time – based (fixed	Social Competence;	BP	No	Paper diaries;	AM

(2004)	Model on adolescents who completed the SCI and later underwent ABP monitoring	adolescents	intervals) during 1 day	Social Impact; stress; interpersonal skills, styles and strivings			Dinamap Vital Signs Monitor:ECG; Accutracker DX monitor; Interview audiotapes	
Giesbrecht et al. (2012)	Assess the plausibility of cortisol as a biological link between maternal psychological distress during pregnancy and fetal development	83 women (gestational ages 6—37 weeks)	Time – based (quasi random intervals) during 3 days	Mood; psychological distress; daily stress; depression; anxiety; stress history	Cortisol;	Yes	Electronic diaries; Salivette	EMA
Habets et al. (2012)	Examine the association between pituitary volume, real-life stress reactivity and genetic liability for psychotic disorder	20 patients with psychotic disorder, 37 non-psychotic siblings of these patients, and 32 controls	Time – based (random intervals) during 6 days	Psychotic symptoms Event stress; Social stress; Emotional stress;	Cortisol	Yes	Paper diaries; MRI scans; Freesurfer stable release v5.0. digital wristwatch; Salivette; GIANT	ESM
Hallman and Lyskov	Investigate autonomic nervous system	23 subjects with chronic muscle pain	Time-based (fixed intervals) and	Perceived stress; energy; pain	HRV; PA	Yes	Paper diaries; Bipolar	AM

(2012)	regulation, PA and perceived stress and energy during daily activities	in the neck–shoulders (trapezius myalgia) and 22 symptom-free controls	HRV continuous monitoring during 1 day				electrocardiogram; Intelligent Device for Energy Expenditure and Activity	
Hanson and Chen (2010)	Explore the relationship between childhood family environments, daily stress and daily biological outcomes	87 participants, ages 19 to 25	Time – based (fixed intervals) during 7 days	Childhood family psychosocial environment; daily stress; sleep	Cortisol	No	Paper diaries; Actiwatch; Salivette; MEMS 6 TrackCap Monitor	None
Holt-Lunstad et al. (2009)	Examine the competing predictions regarding the directional influence of parental status and its interaction with gender	198 married males and females	Time – based (random intervals) during 1 day	Dyadic adjustment; depression; perceived stress; sleep quality; satisfaction with life	BP	No	Accutracker II	AM
Holt-Lunstad et al. (2008)	Examine the influence of marital status, relationship quality, and network	204 married and 99 single males and females	Time – based (random intervals) during 1 day	Marital quality; network support; mental health; depression; satisfaction with life; perceived	BP	No	Accutracker II	AM

	support on measures of psychological and CV health.			stress				
Hoppman n and Klumb (2006)	Examine the relationship between the personal relevance of daily activities with respect to self-set work and family goals and affective and neuroendocrine stress reactions	53 dual-earner couples with preschool children	Time-based (fixed intervals) during 6 days	Personal goals; goal relevance of daily activities; affect quality	Cortisol	Yes	Electronic diary; Salivette	Interval-sampling methodology
Houtveen and van Doornen (2007)	Examine the relationship between MUS and peripheral stress physiology	74 participants with heterogeneous MUS were compared with 71 healthy controls	Time – based (fixed intervals) during 1 day	Momentary experienced somatic complaints; mood	Cortisol; HR; Cardiac autonomic activity; Respiration	Yes	Electronic diaries; VU-AMS; Capnometer; Salivette	AM
Kalpakjian et al. (2009)	Examine the diurnal variation of salivary	51 persons: 25 persons with Spinal Cord Injury	Time – based (random intervals) during 2 days	Stress and mood	Cortisol	Yes	Paper Diaries; Salivette; electronic	EMA (includes ESM as a structured diary

	cortisol in adults Spinal Cord Injury and the effect of stressors on cortisol and mood	and 26 without.					pager	technique)
Kamarck et al. (2012)	Examine associations between the perception of ongoing psychological demands by EMA and 6-year changes in carotid artery atherosclerosis.	270 initially healthy participants	Time-based (fixed intervals) during 3 days	Psychosocial stress	IMT, BP	Yes	Electronic diaries; B-mode ultrasound; Accutracker DX	EMA
Kamarck et al. (2007)	Examine correlates of 3-year carotid artery disease progression using longitudinal design	335 healthy individuals	Time – based (fixed intervals) during 6 days	Job strain; Psychosocial stress	BP; HR; Carotid Artery Atherosclerosis	Yes	Electronic diary; Accutracker DX; B-mode ultrasound scanner	EMA
Kamarck et al. (2004)	Evaluate the role of psychological demands and decision	337 healthy adults	Time – based (fixed intervals) two 3-days period	Perceived stress ; Depression; Hate and anger; Job strain	BP; Carotid Artery Atherosclerosis	Yes	Electronic diaries; Accutracker DX;; B-mode	EMA

	latitude as correlates of subclinical carotid disease						ultrasound scanner	
Kamarck et al. (2003)	Examine the correspondence between laboratory measures of CVR and within-person changes in CV activity during daily life	335 Healthy adults	Time – based (fixed intervals) during 6 days	Mood; psychosocial demands (Negative affect; Arousal; Task demand; Decisional control; Social conflict)	HR; BP	Yes	Electronic diaries; Accutracker DX; Two-lead EKG; impedance cardiography ; IBM 486 PC	AM
Kimhy et al. (2010)	Test the feasibility and validity of a novel methodology designed to measure concurrent stress and arousal	20 patients with psychosis	Time – based (random intervals) during 2 days and 36 hours of arousal continuous monitoring	Subjective stress (negative mood) anxiety; loneliness; irritation; sadness; happiness/relaxation;	HR	Yes	Electronic diaries; Holter monitor; Lifeshirt system	ESM ; AA
Kneipp et al. (2007)	Examine psychosocial stress, salivary cortisol, 24-hr ambulatory BP and HR and health among	40 single mothers before and after exiting TANF	Time – based (fixed intervals) during 1 day	Psychosocial stress; depression; general health;	Cortisol; BP	No	Paper diaries; Salivette; Spacelabs Medical 90207; alarm	AA

	single mothers before and after exiting Temporary Assistance for Needy Families (TANF)							
Kudielka, et al. (2007)	Understand Circadian cortisol profiles and psychological self-reports in shift workers with and without recent change in the shift rotation system	102 healthy permanent day and night shift workers (comparison groups) and former permanent day and night shift workers	Time-based (fixed intervals) during 2 morning shifts, 2 evening shifts, and up to 3 night shifts, followed by 1–4 days off.	health status, sleep, vital exhaustion, perceived chronic stress, effort–reward imbalance and overcommitment.	Cortisol	No	Sallivette	None
Linden et al. (2008)	Investigate the nondipping phenomenon	62 patients (30 nondippers)	Time – based (fixed intervals) during 1 day	Anger, hostility, coping, depression, anxiety and perceived stress	BP; HR	No	Spacelabs 90207	AM
Luecken et al. (2009)	Examine stress sensitization and inoculation models of the impact of early parental death on stress exposure and	91 late adolescents/young adults (43 early bereaved, 48 non bereaved).	Time – based (fixed intervals) during 1 day	Parental caring; depression; anxiety trait; stress; positive and negative affect	BP	Yes	Electronic diaries; Suntech Oscar II ABP monitors	AM

	reactivity in late adolescence/young adulthood							
Maina et al. (2011)	Examine the association between two job stress models—the job strain and the effort-reward imbalance model—and ambulatory BP monitoring	100 call handler operators	Time – based (fixed intervals) during 2 days	Perceived stress; job strain	BP; HR	No	Paper diaries; BP One OPCB Monitor	AM
Muraoka et al. (1998)	Examine the CV correlates of PTSD using 24-hr ABP and HR monitoring	11 veterans with PTSD and 7 without PTSD.	Time – based (random intervals) during 1 day	PTSD symptoms; depressive symptoms; mood (stress; anxiety and anger)	HR; BP	Yes	Paper diaries; Accutracker II	AA
Parshuram et al. (2004)	Examine the workload and the level of fatigue and physical stress	11 senior fellows	Continuous monitoring during 35 shifts	Workload stress; fatigue	HRV; Physical stress (steps); urine (specific gravity and ketones)	No	Pedometer; Marquette Series 8500 recorders MultiStix 10 SG	AM
Pieper et al. (2007)	Hypothesize that increased	73 teachers	Time – based (fixed	Job strain; trait worry;	HR; HRV	Yes	Electronic diaries ;	Momentary Assessment;

	HR and decreased HRV occurs not only during stressful events but also during episodes in which stress is cognitively represented		intervals) during 4 days	depression; anxiety; hostility			VU-AMS device with an accelerometer	AA
Piferi and Lawler (2006)	Investigate the relationship between giving and ambulatory BP	96 undergraduates	Time – based (fixed intervals) during 1 day	Tendency to give social support; perceived stress; socially supportive behaviors; self-esteem; self-efficacy; depression	BP; HR	Yes	Paper diaries ; DynaPulse 5000A	AM
Rau (2006)	Examine the relationship between work-related stress and hypertension	126 healthy men employed in white collar jobs	Time – based (fixed intervals) during 1 day	Work related stress, relaxation-related experiences; Disturbed ability to relax; vital exhaustion	BP	No	BOSO TM2420; Physiomodul	AM
Richman et al. (2010)	Examine the impact of perceived discrimination on ABP and daily level	63 participants	Time – based (random intervals) during 1 day	Perceived discrimination; hostility; neuroticism; affective states (stressed)	BP; HR	Yes	Electronic diaries; AccuTracker II ABP	AM

	affect during social interaction							
Sausen et al. (1992)	Examine hemodynamic responses to systematic variations in occupational stress using ABP monitors	44 healthy male medical students	Event-based	Psychological stress (mood)	HR; BP	Yes	Accutracker BP and HR monitor; Dinamap vital signs monitor	AM
Schlotz et al. (2006)	Examine the associations of specific task-related stressors and negative affective states on salivary cortisol and explores the mediating and moderating role of state negative affect and trait anxiety, respectively.	71 participants	Time – based (fixed intervals) during 2 days	Subjective stress; state affect; trait anxiety	Cortisol	Yes	Electronic diaries; Salivette; Medication Event Monitoring System	None
Schoentha ler et al. (2010)	Examine the effect of psychosocial	240 unmedicated black and	Time – based (fixed intervals)	Daily interpersonal stress	BP; HR	Yes	Electronic diaries; OMRON	AM

	stressors on Masked Hypertension .	Latino(a) adults with optimal office BP readings (≤120/80 mm Hg)	during 1 day				HEM 704; Suntech; Accutracker II	
Schwerdtfeger et al. (2008)	Examine the psychobiological correlates of self-efficacy	Study 1:58 school teachers Study 2: 50 school teachers	Continuous monitoring during a day	Study 1: self-efficacy; perceived stress; burnout; affect Study 2: self-efficacy; Physical complaints	Study 1: HR; HRV; Locomotor activity Study 2: saliva cortisol	No	Study 1: Three-dimensional Accelerosensor; VARIOPORT-b; ECG Study 2: Salivette	AM
Smith et al. (2012)	Measure the momentary experience of social-evaluative threat, concerns about physical appearance, and confidence in abilities, and related these factors to concurrent variation in ABP	94 married, working couples	Time-based (random intervals) during 1 day	Negative affect (stressed)	BP	Yes	Electronic diaries; Oscar 2 - Suntech monitor	AM

Steptoe et al. (2005)	Show that positive affect is associated with reduced neuroendocrine inflammatory, and CV activity	116 men and 100 women	Time–based (fixed intervals) during 1 day	Positive affect; Stress; Control; Tiredness; Psychological distress; Psychopathology	Cortisol; BP; HR; Plasma fibrinogen	Yes	Paper diaries; Space Labs 90217 monitor; Salliva tubes; Portapres-2	AM; ESM
Steptoe et al. (2000)	Analyze associations between CV Stress Reactivity and BP and HR in everyday life	102 female and 60 male school teachers	Time – based (fixed intervals) during 1 day	Pressures	HR; BP	Yes	Paper diaries; BPM – spacelabs 90217; A&D UA-751 electronic sphygmoma nometer,Bed font portable smokerlyze	AM
Tobe et al. (2007)	Evaluate whether job strain and marital cohesion continued to be associated with ABP in a longitudinal design	248 participants	Time-based (fixed intervals) during 1 day	Job strain; marital cohesion	BP	No	Spacelabs Medical	AM
Uchino et al. (2006)	Examine the association between age and daily stress processes that	428 middle-aged to older adults	Time-based (random intervals) during 1 day	Negative affective states (feeling stressed)	BP	Yes	Paper diaries; Accutracker II	AA

	might have implications for CV disease

Note. AA- Ambulatory Assessment; AM – Ambulatory monitoring; BP – Blood Pressure; BPD – Borderline Personality Disorder; CAPS – Clinical Administrated PTSD- Post-Traumatic Stress Disorder; CV – Cardiovascular; DRM – Day Reconstruction Method; ERN – Error-related negativity; EMA – Ecological Momentary Assessment; MRI -Magnetic Resonance Imaging; GIANT - General Image Analysis Tools; HPA - Hypothalamic-pituitary-adrenocortical HR- Heart Rate; HRV – Heart Rate Variability; IMT - Intima-Medial Thickness; MUS – Medically Unexplained Symptms; PA – Physical Activity; PDA – Personal Digital Assistant; PTSD- Posttraumatic Stress Disorder; SFC- Self-focused-coping SCI – Social Competence Interview.

3.1. Terminology used for methodologies

Different terminologies were found across the reviewed studies. As an example, 38 studies used Ambulatory terminology, 9 used EMA and 6 used ESM. Additionally, when searching in the SAA database, since no keywords were used, other different terminologies were found, these included Momentary diary assessment (1), Momentary assessment (1), Interval-sampling Methodology (1), Momentary experience sampling (1) and 3 studies did not use any particular terminology.

3.2. Research population

The reviewed studies aimed to address particular clinical questions among both clinical and non-clinical populations. Out of the 55 studies reviewed, 39 were conducted among non-clinical population and 16 studies were conducted among subjects with particular clinical conditions such as Posttraumatic stress disorder (PTSD) (5), asthma (1), psychotic disorders (3), borderline personality disorder (1), medically unexplained symptoms (1), nondipping phenomena (1), chronic muscle pain (1), spinal cord injury (1) and 2 with a specific population, pregnant women.

3.3. Study design

This systematic review has found different ecological sampling and assessment schemes. As an example, 52 studies used time based-protocols, from which 36 used a time-based protocol with fixed intervals, 15 used random intervals and one used both time and random intervals. An event based protocol was found in one study. Seven studies recorded physiological data continuously.

3.4. Measurement

Different stress conceptualizations were found across studies, leading to different ways of measuring the concept. Particularly, when analyzing psychological measures of stress, studies used emotion, affect or mood measures (25), event-related stress (12) interpersonal stress (3), psychosocial and social stress (5), chronic stress (4), acute stress (1), pressures (1) and perceived stress (9). When analyzing physiological measures of

stress, the most commonly used measures were BP (35), HR (29), cortisol (18) and HRV (6). Additionally, other complementary biological and physiological markers were used such as physiological stress, using locomotor activity (1), steps counting (1) and physical activity (1); airflow assessment (1) and respiration (1), error related negativity (1), carotid artery atherosclerosis (2), intima-medial thickness (1), urine (specific gravity and ketones) (1) and plasma fibrinogen (1). When considering synchronization of measures, out of the 55 papers, 38 synchronized both physiological and psychological measures of stress.

3.5. Technology

Out of the 55 studies reviewed, 43 used diary techniques, from which 25 used paper diaries, and 19 used electronic diaries. All studies included the complementary use of questionnaires. In what concerns to psychological stress assessment, 11 studies used only questionnaires (cross-sectional design), and 29 collected psychological stress data on a daily basis using diary based measures. Out of these 29 studies, 15 included daily diaries and complementary questionnaires to assess stress. Regarding physiological measures, out of the 55 studies reviewed, 41 used ambulatory BP and HR monitors (41), life shirt system (1), salivette (13), saliva swabs (2), saliva tubes (1), aliquots (1) and straws (1). Additionally, some studies have also used other complementary biological and physiological measurement equipment including mini-wright peak flow meter (1), portable capnometer (1), electroencephalographic recording and signal processing (1), magnetic resonance imaging (1) and B-mode ultrasound (1). Furthermore, reviewed studies used a variety of additional technology to prompt participants for assessments such as audible devices like electronic pagers (1), digital wristwatches (6), and alarms (1). Finally, 6 studies also used technology to assess physical activity levels such as pedometer (1), accelerometer (3), physiomodul (1) and actiwatch (1).

4. Discussion

The aim of this study was to evaluate and synthesize previous research assessing stress using an ecological approach and combining psychophysiological measures. An overview of these innovative psychophysiological stress assessment methods will be discussed, focusing on the benefits of these research approaches, and reflecting on the associated challenges. Findings will be discussed following the results section structure: i)

the terminology used, ii) the research population, iii) the study design, iv) stress measurement considerations and the v) technology used.

Firstly it is worth reflecting on the existence controversy across the terminology used for the methodologies. As an example, a study by Stiglmayr et al. (2008) investigating the interaction of dissociative symptoms and subjective assessments of stress within participants over time, referred the "use of EMA, also known as ambulatory assessment or experience sampling method" (p. 140). As mentioned above, despite the similarities, there are differences across these methodologies that should be considered (Trull & Ebner-Priemer, 2009). It is believed that this limitation restricts conclusions in the understanding of what exactly each method aims for and what research measures should be contemplated. Additionally, when conducting a search across the SAA database we found that other terminologies were used to address the same type of methodology (e.g., Interval-sampling methodology, Momentary experience sampling). This terminological confusion can impair scientific rigor. Thus, it is important to find consistency in the terminologies in order to choose the correct term that best fits this type of methodology. Results showed that the majority of studies (38) found in the current systematic review used the ambulatory terminology. According to Wilhelm and Grossman (2010) AA has progressed more rapidly in medical application, when compared to the psychology field. Thus, a possible explanation for the use of this terminology (AA) across most of the reviewed studies may be the fact that most of these studies were multidisciplinary in nature, concentrating in the disciplines of medicine and psychology across the health and organizational settings.

Secondly, when analyzing the research population, the majority of ecological approaches studies (39) seem to be conducted among non-clinical populations. These findings support previous recommendations suggesting the importance of studying stress from a prevention perspective (e.g., Holt-Lunstad et al., 2008). Furthermore, ecological approaches seem also to be appropriate and useful among clinical populations. As an example, an ambulatory psychophysiological study, with a multidisciplinary team conducted by Ebner-Priemer et al. (2008) among patients with Bipolar disorder, used a combination of physiological and psychological measures to understand the relationship between psychological distress and affective dysregulation. The authors found that conflictive emotions were related to psychological distress and psychological distress was related to physiological arousal (HR). Indeed, multidisciplinary ecological approaches provide accurate information about physiological and psychological symptoms and their

relationship with health conditions in clinical and non-clinical populations (Yoshiuchi et al., 2008).

Thirdly, regarding the study design, the majority of studies (52) were time-based. These findings support Shiffman et al. (2008) suggestion that time-based sampling is usually concerned with ongoing experiences that can be assessed within the course of a typical period and aim to characterize experience in a more broadly and inclusively way. On the other hand, according to the same authors, rare or highly specific experiences are difficult to be evaluated by using a time-based design and should be studied using an event-based design. Event-based schemes are focused on particular discrete events in which assessments are prompted by the occurrence of a predefined event of interest to the investigator. As an example, a study conducted by Sausen et al. (1992) aiming to investigate psychological stress in medical students, conducted assessments only before, during, and after specific events such as the lecture and examination day. It is important to highlight that future studies contemplating event-based schemes should pay special attention to compliance, since it may be difficult to assess or verify whether occurred events were entered or not, or if entries were made for events that did not occur (Shiffman et al., 2008). Additionally, it is also important to consider also the risk that the participant may not reliably identify relevant events and event-based responses should not be overgeneralize to the person's general experience (Bolger et al., 2003). Ecological study designs have different schedules or intervals that should be theoretically and/or empirically guided. Thus, in this review there are designs with fixed schedules (e.g., Barnett et al., 2005), variable (e.g., Carels et al., 2000) or combined (e.g., Entringer et al., 2011). As suggested by Bolger et al. (2003) when using a fixed-time schedule, one of the greatest challenges is to decide the suitable spacing of intervals between the assessments. Thus, long intervals may error natural cycles, exclude important events and also contribute to the risk of biased recall. On the other hand, intervals that are too short may miss slower processes (e.g., day-to-day changes), so they are more suitable to be used when assessing processes that change quickly (e.g., mood) and may also increase participant's burden (Iida, Shrout, Laurenceau, & Bolger, 2012). Alternatively, researchers may use variable or mixed schedule designs that allow the possibility to randomly sample moments, which may reduce the potential for biased reports (Bolger et al., 2003). According to Shiffman et al. (2008), when using time-based assessment schedules, especially with variable intervals, ecological studies should include some method of signaling participants when an assessment is scheduled.

Fourthly, when considering stress measurement it is important to address how stress is defined, according to the literature, definitions of stress can differ in the extent to which they valorize stressful events, responses or individual assessments of situations (Cohen, Kessler, & Underwood Gordon, 1995). When considering psychological stress measures, some limitations can be found. As an example, in the reviewed studies conducted by Kamarck et al. (2004; 2007) one of the limitations addressed was the subjectivity of the reports, since they involved a cognitive appraisal and inferences from the participant. Additionally, in a reviewed study conducted by Buckley, 2004), the authors highlighted that psychological measurements were limited to "yes" or "no" answers as to whether participants felt "stressed". However, these single one item answers do not provide a complete assessment of the concept, since other dimensions of stress are not being contemplated. It seems crucial to appeal for the complementary use of objective physiological data, considering the complexity of the stress concept. In the reviewed studies, BP, HR, Cortisol and HRV were the most commonly used measures, known as being robust indicators of the stress response. However, caution should be drawn when analyzing this data during real world settings since "variation in physical activity and posture, social interaction and ingestion across the assessment can mask more subtle emotion effects on dependent variables" (Wilhelm & Grossman, 2010, p.566). In order to overcome this limitation, some traditional studies relied on self-reported physical activity, excluding physiological data from the analysis for times when physical activity was reported. In agreement with this idea, 24 studies in this review rely on self-report measures to indicate the activity and the contextual information, after or during each record. As an example, a study conducted by Brondolo et al. (2009) with 73 police traffic agents, aiming to investigate trait hostility and cardiovascular reactivity in potential stressful situations, assessed mood and BP variables. In order to address control variables that can influence BP readings, the authors included in the ambulatory diary additional questions including participants' activities, location, and posture at the time of each cuff inflation. Although an attempt was made to control confounder variables in this study, the method used may be simplistic and unreliable, since the exact time of the changes in behavior are dependent on the participant availability/willingness to record the data. Hence, in order to control these confounder variables, several modern tools (Houtveen & Geus, 2009) discussed in the following paragraph should be considered. Additionally, as pointed by Wilhelm and Grossman (2010) the synchronization of data is a very importance aspect when aiming to fully understand the impact of stress responses. In this review, out

of the 55 reviewed studies, 38 synchronized psychological and physiological measures of stress. The same authors suggested that ecological approaches should employ a synchronization timing signal to all devices, since no available ambulatory solution currently exists for this purpose.

Finally, regarding the use of technology, 19 studies used electronic diaries as a technique for psychological stress data assessment. Tough, we found that some of the reviewed studies (23) still used paper and pencil format diaries. However, these may be more prone to a potential risk of retrospective completion of entries and completing entries in advance (Beckham et al., 2005). To overcome these limitations, Boody and Smith (2008) recommended the use of electronic diaries, since most ambulatory studies using electronic devices have conceived methods of self-reminder, prompting participants' to respond and releasing them of the need to worry for the appropriate times for response (Trull & Ebner-Priemer, 2013). Additionally, Bolger et al. (2003) suggested that most recent technologies allow to integrate diary reports with physiological measures. Thus, regarding physiological data, new modern methods are emerging, allowing the measurement of physiological stress indices as participants undergo their daily life. As an example, in a reviewed study conducted by Kimhy et al. (2010) aiming to measure concurrent stress and arousal in individuals with psychosis during daily functioning in natural environment, an ESM with electronic diaries and a wearable Life-shirt system to assess stress and psychosis were used. The methodology allows continuous and simultaneous assessments and provides the opportunity to understand dynamic variations in stress, arousal, and psychosis with an accurate, high time resolution measurement. This new technology was initially used in the medicine area, but nowadays this equipment is even more elaborated, non-invasive and easy to use, suitable for applications in other areas, such as psychology (Fahrenberg et al., 2007).

An important aspect to consider when assessing stress physiological data is the influence of confounders' variables such as physical activity and posture levels. In order to overcome this limitation, modern technological recording devices should be used. As an example, a study conducted by Pieper, Brosschot, van der Leeden and Thayer (2007) with 73 teachers aiming to understand cardiac effects during worry episodes and stressful events, used an ambulatory HR and HRV device including a accelerometer, aiming to identify and remove episodes with high physical activity that can bias stress physiological data. Despite this need, only seven studies were found recording physical activity with technology. The limited number of studies, may be explained by the fact that sophisticated

analysis software and equipment are required to analyze this data, which can be a limitation for research teams (Wilhelm & Grossman, 2010). To address this limitation a variety of low-cost devices and software possibilities can be found (http://www.ambulatory-assessment.org).

This review should be considered in light of some limitations, such as the lack of statistical appliance or software to analyze data, and conclusions are exclusively based on published studies. Regardless of its challenges, the present review provides strong support for the use of ecological approaches contemplating both psycho-physiological measures for stress assessment investigation, due to their capacity to capture experiences (e.g., stress) in a way that traditional designs cannot. These methodologies permit to obtain more accurate and detailed data, as participants are usually able to provide greater detail about their experiences, reducing errors and retrospective bias, without interfering in daily life flow (Vannier & O´Sullivan, 2008). Moreover, data has strong ecological validity, combining daily tasks with self-report information and physiological data (Hoppmann & Riediger, 2009). Furthermore, in agreement with Youshiuchi et al. (2008) ecological approaches lead to more profitable findings about the relationships between psychosocial factors and stress-related diseases when using wearable devices to assess physiological and behavioral data in natural settings.

5. Conclusion

Current findings suggested that literature in ecological approaches is vast and involves controversial theoretical and methodological issues. Our findings suggest that AA terminology is the most commonly used terminology to denominate ecological approaches of psychophysiological assessment, and should be used in the future as a standard assessment terminology in this area. Additionally, findings suggest that there is a multidisciplinary research approach to this area, in an attempt to fully understand the impact of stress on psychological and physical health.

Acknowledging the fact that the design of an ecological study is a challenging task, future studies designs including assessment schedules or intervals should always be theoretically and/or empirically guided. Furthermore, accurate and reliable measurements of stress should be supported by both psychological and physiological data, preferably synchronized and including control technologies for possible confounder variables affecting physiological data. Hence, findings suggest that ecological approaches combining

psychophysiological measures of stress, offer a promising avenue for future prevention and/or rehabilitation stress research, by offering a unique opportunity to obtain a detailed examination of stress causes and impact while maintaining natural context conditions.

This chapter presented a systematic review aiming to understand how to develop an ecological protocol. Hence, findings from this review underpin the methodology used in Study 4.

The first empirical study (presented hereafter – Study 2) was conducted with police recruits and PO in their first year when on duty, using a SEM analysis. This study aims to understand the experience of stress, coping and engagement among PO at the start of their career during academy training and one year after as PO working in their first year on duty. Considering that we intend to test innovative research methods to assess PO occupational health, Study 3 and 4, present novel methodologies among this population. These studies were conducted with a special team of PO, particularly Study 3 used a diary methodology and Study 4 used a novel ecological approach. Limitations and future studies directions were also provided and we encourage researchers to contribute to improve investigation in this area, by describing these emerging approaches.

CHAPTER III

STUDY 2: DO STRESS AND COPING INFLUENCE POLICE OFFICERS ENGAGEMENT LEVELS DURINGA AND AFTER ACADEMY?

1. Introduction[2]

Stress is a universal recognized phenomenon and a topic of research interest over several years (Maracine, 2010). As it was explained in the chapter I, one of the most used definitions of stress is the one proposed by Lazarus and Folkman (1984). Likewise, these authors model has been extensively supported, and its theoretical foundations are broadly accepted by the academic community (e.g., Cooper et al., 2001; Folkman & Lazarus, 1985; Kaiseler, Polman, & Nicholls, 2009; Young, Partington, Wetherell, Gibson, & Partington, 2014). Accordingly, when aiming to understand stress, it is important to consider the idiosyncratic meaning that a person gives to a stressful event. This individual perception firstly starts when the individual gives the meaning to an event (primary appraisal). Then, when an event is appraised as being a threat to the individual´s wellbeing, a complex evaluative process starts, whereas the individual addresses judgments of the resources available to them, such as coping strategies and the degree of perceived control in meeting the demands of the situation (Zakowski, Hall, Klein, & Baum, 2001).

As stated by Skinner (1996) control is a very important predictor of psychological functioning. In order to better understand this construct, the author draw on the notion of objective and perceived control. Objective control means the actual control present in the situation and the individual. On the other hand, perceived control refers to the beliefs of an individual about how much control is he/she has and is probably a more powerful predictor of functioning than objective control. Perceived control in this way influences the level of perceived stress and coping strategies (Compas, Banez, Malcarne, & Worsham, 1991). So, when people face stressful situations, coping strategies are used in order to deal with the events. Coping is defined as ones efforts to manage the demands of a situation, developed in order to help the individuals maintain psychological adaptation during stressful periods. Lazarus and Folkman (1984) definition and categorization of coping (PF coping and EF coping) will be the theoretical framework used in this study.

As previously addressed on this thesis, policing is considered a very stressful occupation, starting from the entry in the academy training. During this period these professionals undergo an extensive, demanding and exhaustive physical and psychological training (Violanti, 1992; Wilson & Grammich, 2009). The academy training period, aims to provide a natural setting to prepare officers to real world situations. Therefore, the training

[2] This chapter is presented in the scientific article format in submission to an International Journal of Psychology with Peer Review (Rodrigues, Kaiseler, Sinval, Queirós, & Marôco, 2016).

program includes physical training, performing under stress, use of defensive tactics, weapons, and the use of force. Indeed, police academies are characterized by some of the rituals as boot camp in the military, such as stress, an emphasis on chain of command, and group punishments and discipline, where police recruits are exposed to extensive rules and regulations (Chappell & Lanza-Kaduce, 2010). Accordingly, police academy instructors create controlled stressful situations, in order to better prepare future officers to cope with stressful encounters (Violanti, 1992).

Acknowledging the high levels of stress experienced by PO during their lifespan, bring us to the question of how this population copes with stress. However, ambiguous results have been found regarding the types of coping mostly used by PO, limiting trustworthy conclusions in this topic. Moreover, police research on occupational health is scarce and has mainly focused in the relationship between psychological distress as opposed to the study of wellbeing and optimal functioning (Toch, 2002). Recent lines of investigation have encouraged the study of engagement as an important outcome variable in occupational health research, considering that high levels of work engagement contribute to healthier workers and organizations (Ouweneel, Le Blanc, Schaufeli, & van Wijhe, 2012). According to this line of though, contemporary organizations need workers who are psychologically connected to their work, enthusiastic, able to invest themselves fully in their tasks, proactive and devoted, in other words, engaged workers. Engaged workers are energetic, dedicated, proactive and committed to high quality standards (Bakker & Leiter, 2010).

Schaufeli et al. (2002) considered that engagement is not a momentary state of mind, rather, it is "a more persistent and pervasive affective-cognitive state that is not focused on any particular object, event, individual, or behavior" (p. 74). Accordingly, Sheldon, Ryan, and Reis (1996) stated that daily fluctuations in work engagement are viewed as error variance, because they are only deviations from what is to be predicted, namely, the baseline level of workers engagement.

As stated previously, some working and personal resources seem to be related to engagement. Accordingly, there seems to be some empirical evidence suggesting that the use of certain type of coping strategies predict engagement across different professions such as teachers (e.g., Parker & Martin, 2009), students (e.g., Gan, Yang, Zhou, & Zhang, 2007), nurses, electricity supply personnel and PO (e.g., Rothmann et al., 2011; Kaiseler et al., 2014). However, more research is needed to fully understand this relationship. For this purpose, the present study aims to examine the relationship between stress, coping and

engagement among PO in two particular moments of their careers, during the academic period and then one year later. The current research methodology also aims to overcome preceding research shortcomings highlighted in the following lines.

Firstly, previous studies investigating PO stress, mainly concentrated in describing the nature of stressors faced by this population (e.g., Kop et al., 1999), without considering the appraisal process. Following Lazarus and Folkman (1984) theoretical framework, it is important to understand how police personnel perceives and give meaning to stressful situations in terms of stress intensity and perceived control over a stressor (stress appraisal), when aiming to fully understand the stress and coping process. In agreement with this idea, Dewe et al. (2010) suggested that to ignore the way individuals appraise and give meaning to events is to overlook the processes that are beyond coping decisions.

Secondly, there is a lack of occupational health research among police recruits and among Portuguese police in particular (Recansens et al., 2009). As suggested by Mathur (1999) this fact may be partially due to the difficult access to police institutions for data collection procedures. Considering the importance of the academy period for the formation of a future PO, more research is needed using longitudinal designs aiming to understand how individual features and police culture interact and influence these professionals earlier in their training period and latter, in the field reality (Kaiseler et al., 2014).

Thirdly, traditional studies regarding occupational stress were mainly focused on the impact of external factors on stress process. However, the reality is much more complex, since stress emerges from the complexity of the personal, social, economic and working variables (Dewe et al., 2010). Accordingly, Ferreira and Assmar (2008) reinforced the idea that different stressors operate in an interactive and dynamic way to cause stress and they do not work independently. Hence, recent lines of investigation have appealed for the use of more complex and multivariate statistical techniques, such as multiple regression analysis and SEM in order to understand occupational stress.

Fourthly, according to Hart et al. (1995) there is a lack of investigation about PO strengths, optimal functioning and wellbeing, as opposed to the common study of negative aspects of work (e.g., stress, burnout).

In order to overcome previous limitations on occupational health research among PO and following previous recommendations in this area, SEM was used to examine the hypothesized relationships between stress, coping and engagement. Hence, based on the literature three research hypotheses were developed:

H1: Stress appraisal and coping predicts engagement among police recruits.

H2: Stress appraisal and coping predicts engagement among PO.

H3: Engagement among police recruits predicts later engagement among PO.

2. Method

2.1. Participants

Participants were Portuguese PO (*N*= 356) who agreed to voluntarily participate in this study. Participants were inquired at two moments. At the pre-test, during attendance to the Police academy, the mean age was 24.1 years (*SD*=2.5) and at the post-test 1 year after graduation the mean age was 25.3 years (*SD*=2.4). The study was approved by the University, Police Academy and National Direction of PSP and participants provided written informed consent prior to participating.

2.2.Measures

2.2.1. Stress appraisal

To examine stress appraisal, participants reported their primary appraisal of a reported stressor by indicating stress intensity, that is how much stress the event caused, and their secondary appraisal by indicating how much control they perceived they had over the stressor. Responses were recorded on a 5-point Likert-type scale with response anchors 1 – "Not at all stressful" and 5 - "Extremely stressful", or 1- "No control" and 5 – "Full control". This approach was similar to that used in previous research in the area of stress appraisal and coping (e.g., Kaiseler et al., 2014).

2.2.2. Coping

Following completion of stress appraisal, in both moments participants completed the BriefCOPE (Carver, 1997) translated and adapted to Portuguese by Pais-Ribeiro and Rodrigues (2004) in order to examine coping. The BriefCOPE comprises 28 questions on a 4-point Likert-type scale ("I haven't been doing this at all", "I've been doing this a little bit", "I've been doing this a medium amount", and "I've been doing this a lot"), where two items each form the following 14 sub-scales: Active Coping (AC), Planning (PL), Positive

Reframing (PR), Acceptance (A), Humour (H), Religion (R), Emotional Support (ES), Instrumental Support (IS), Self-Distraction (SD), Denial (Den), Venting (Vent), Substance Use (Subs), Behavioural Disengagement (BD), and Self-Blame (SB).

For this study, a confirmatory factor analysis (CFA) for the BriefCOPE in the police academy recruits (BriefCOPE pre) and for the BriefCOPE in PO (BriefCOPE post) was conducted. Twelve items, representing six dimensions were eliminated in order to obtain an acceptable model fit. Hence, eight of the fourteen original dimensions of BriefCOPE showed good factorial validity both for police recruits ($\chi2(76)=241.149$, $p<0.001$, N=356; $\chi2/df=3.173$; CFI=0.914; GFI=0.920; RMSEA=0.078; $P(rmsea\leq0.05)<0.001$) and PO ($\chi2(76)=176.220$, $p<0.001$, N=356; $\chi2/df=2.319$; CFI=0.949; GFI=0.941; RMSEA=0.061; $P(rmsea\leq0.05)=0.062$, IC90]0,049; 0,073[). These eight dimensions were used in further modelling according to Carver's (1997) suggestion to use the different dimensions separately.

2.2.3. Engagement

Engagement was assessed in both two moments using the 9-item Utrecht Work Engagement Scale (UWES) (Schaufeli & Baker, 2003; Portuguese version: Picado, Marques Pinto, & Lopes da Silva, 2008) with two versions: one for students (UWES-S-9), that was completed by police recruits and one for workers (UWES-9), that was completed by PO in the following year while on duty. This self-report scale was scored on a 7-point Likert-type scale (0 – Never; 6 – Always). Both of these scales, include three subscales: Vigour (three items), Dedication (three items), and Absorption (three items).

In order to assess confirmatory factor analysis for the UWES-S-9 a second latent factor was proposed and the observed the fit was good ($\chi2(22)=87.716$, $p<0.001$, N=356; $\chi2/df=3.987$; CFI=0.973; GFI=0.949; RMSEA=0.092; $P(rmsea\leq0.05)<0.001$). For the UWES-9 a second latent factor was also proposed and the observed the fit was very good ($\chi2(21)=56.746$, $p<0.001$, N=356; $\chi2/df=2.702$; CFI=0.984; GFI=0.965; RMSEA=0.069; $P(rmsea\leq0.05)=0.067$, IC90]0,048; 0,091[).

2.3. Procedure

After granting ethics approval, the researches sent digital letters to academy police recruits by e-mail, providing specific information about the study.

Data was collected at two different moments in time, separated by a yearlong. In the first moment participants were police recruits enrolled in the Police Academy, undergoing their last month of training. In the second moment, participants were already PO working on their first year of duty in the city of Lisbon.

The participants completed a consent form, and a web-based survey available on the academy Moodle web platform. In the following year, participants were once again contacted by the researchers through email, with a link inviting them to the second part of the study. Voluntary participants completed again a consent form, and the second web based survey.

2.4. Data Analysis

Preliminary analyses were conducted to explore the data. Data normality was checked using the Kolmogorov-Smirnov (K-S) test. To assess data reliability, standard Cronbach's alpha coefficient (α) was calculated for each dimension proposed in the BriefCOPE pre and post, UWES-S-9 and UWES-9. To analyse the factorial validity of the proposed structures of the scales used, four CFA were conducted for the BriefCOPE pre and post, for the UWES-S-9, and for the UWES-9 respectively (results presented above). The CFA analysis was done as described in Marôco (2014). To test our causal model, SEM was used. A two-step approach was conducted according to the procedures described in Marôco (2014). Maximum likelihood estimation was applied in the covariance matrix of the observed variables using IBM SPSS AMOS (v.22, SPSS Inc, Chicago, IL) software. The goodness of fit of the measure model (step 1) and of the causal model (step 2) was evaluated with the quality indexes recommended by Marôco (2014): χ^2/df; CFI; GFI; and RMSEA. A good fit of the models was assumed when RMSEA values were below .08 and CFI and GFI values were above .9.

3. Results

3.1. Descriptive statistics

Table 2 provides the means and standard deviations, for the BriefCOPE pre and post, the UWES subscales, stress intensity, and stressor control. The K-S test showed an absence of normality in the distribution of all variables (Table 2). Additionally, standard Cronbach's alpha coefficient (α) are also presented in Table 2. Some subscales of BriefCOPE, particularly those from BriefCOPE pre show low level of internal consistency (Table 2). These results are similar to those found in previous coping research (e.g., Kaiseler, et al., 2009, 2012). As suggested by Billings and Moos (1981) estimates of internal consistency have limited applicability when assessing psychometric properties of coping measures. As proposed by Kaiseler et al. (2014) this could be explained by the fact that one coping strategy may be appropriate to relieve stress and as such would not require additional responses from either the same category or other categories of coping.

Table 2

Means (M), Standard deviations (SD), internal consistency reliabilities (α) and Kolmogoronov-Sminorv test (K-S) for the dimensions of BriefCOPE, the Utrecht Work Engagement subscales, stress intensity, and stressor control among Police recruits and PO in their first year of duty (N=356).

		Police Recruits				PO (year 1)			
		M	*SD*	α	K-S	*M*	*SD*	α	K-S
BriefCOPE	Active Coping	1.90	.81	.87	.201*	2.72	.69	.68	.151*
	Emotional Support	2.93	.61	.48	.232*	2.09	.71	.78	.224*
	Religion	3.09	.65	.62	.210*	1.44	.61	.90	.359*
	Positive Reframing	2.90	.69	.76	.231*	2.61	.72	.81	.186*
	Self-blame	1.59	.66	.59	.231*	1.61	.56	.51	.205*
	Acceptance	2.32	.64	.50	.167*	2.43	.74	.72	.204*
	Denial	1.99	.61	.46	.185*	1.40	.53	.56	.340*
	Behavioral Disengagement	2.37	.64	.43	.235*	1.21	.44	.72	.497*
UWES	Vigour	4.28	1.03	.79	.135*	5.45	1.11	.85	.170*
	Dedication	4.34	.95	.82	.129*	5.97	.96	.90	.249*
	Absorption	4.59	.96	.82	.174*	5.84	.96	.70	.252*
	UWES Total			.94				.91	
Stress appraisal	Stress intensity	2.41	1.06		.232*	2.71	1.15		.196*
	Stress control	3.38	1.12		.212*	2.83	1.24		.194*

*$p < .001$.

3.2. Hypotheses testing

H1: Stress appraisal and coping predicts engagement among police recruits

The measurement model to test *H1* revealed a good fit (χ^2/df=2.163*; CFI*=0.932*; GFI*=0.894*; RMSEA*=0.057; P(rmsea≤0.05)=0.031; *MECVI*=2.306). The statistical analysis of the paths between the factors revealed that all the paths between Engagement, the BriefCOPE dimensions and the stress appraisal items were not statistically significant among police recruits.

Figure 3 presents the standardized factor weights and the individual reliability of each of the model items.

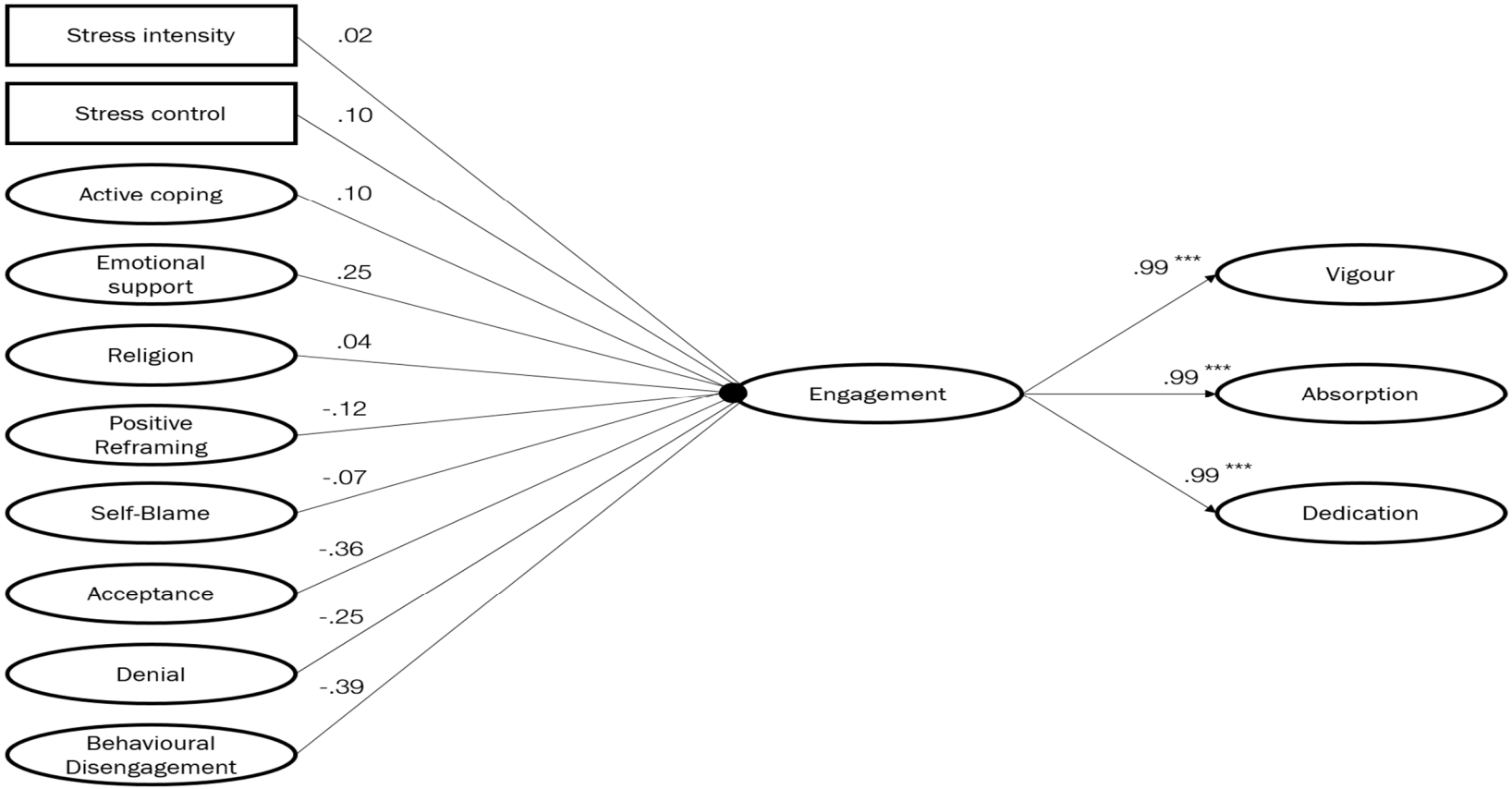

Figure 3. Proposed model for *H1*.

H2: Stress appraisal and coping predicts engagement among PO

The measurement model (of the latent factors in this study) revealed a very good fit (χ^2/df=1.756; *CFI*=0.954; *GFI*=0.914; *RMSEA*=0.046; P(rmsea≤0.05)=0.818; *MECVI*=2.001). The analysis of the regression weights revealed statistically significant paths between behavioural disengagement and engagement (*B*=-.33, *p*=<.05); self-blame and engagement (*B*=-.26, *p*<.05); stress control and engagement (*B*=.12, *p*<.05). The path between stress intensity and engagement (*B*=-.14, *p*=<.05) was marginally significant. Therefore, the results showed significant relationships between some coping strategies and engagement and stress intensity and engagement among PO. Particularly, coping strategies such as behavioral disengagement and self-blame are significantly negative predictors of engagement. Moreover, stress intensity was also a negative predictor of engagement. On the other hand, stress control was a positive predictor of engagement.

Figure 4 shows the standardized factor weights and the individual reliability of each of the model items.

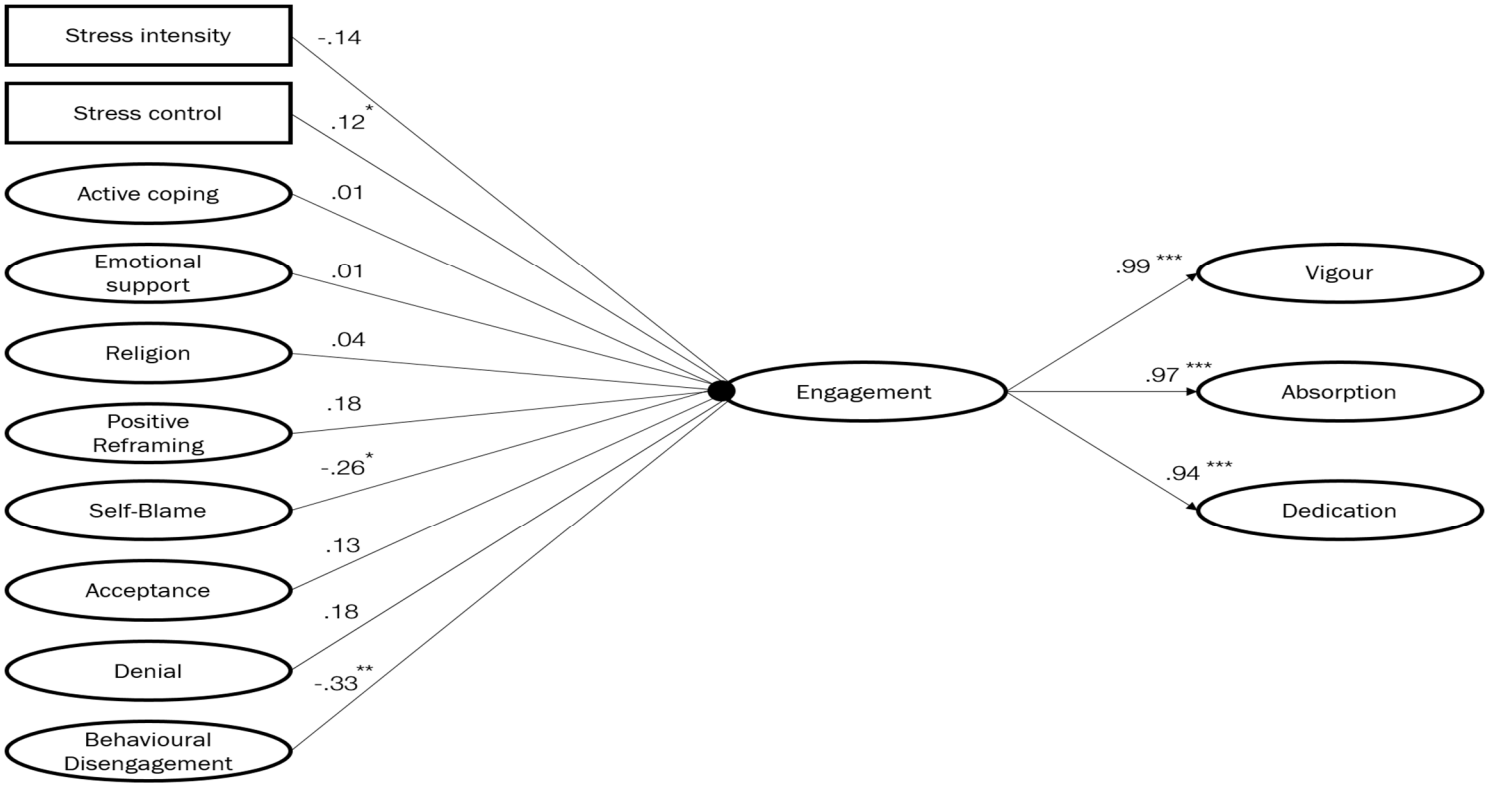

Figure 4. Proposed model for *H2*.

H3: Engagement among police recruits predicts later engagement among PO

The measurement model of the latent factors in this study revealed a good fit (χ^2/df=2.449*;* *CFI*=0.962*;* *GFI*=0.910*;* *RMSEA*=0.064; P(rmsea≤0.05)=0.006; *MECVI*=1.137). The path between engagement among police recruits and engagement among PO was statistically significant (*B*=.44, *p*<.05). Accordingly, these results supported the formulated hypothesis suggesting that engagement among police recruits predicts engagement among PO.

Figure 5 shows the standardized factor weights.

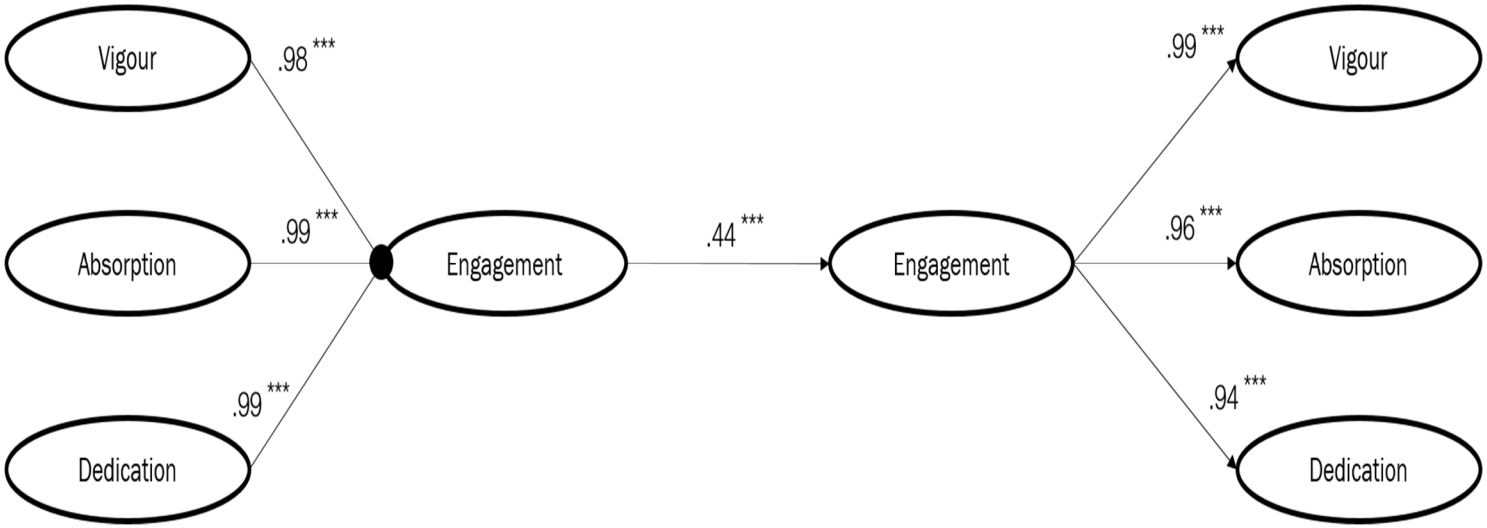

Figure 5. Proposed model for *H3***.**

4. Discussion

The aim of the present study was to understand the relationship between stress appraisal (stress intensity and perceived control over a stressor), coping and engagement among police recruits undergoing academy training and one year after as PO in their first year on duty.

In opposition to our *H1: Stress appraisal and coping predicts engagement among police recruits,* results suggested that stress appraisal and coping were not significant predictors of engagement among police recruits. Although the literature suggests that important drivers of engagement are personal resources and job resources (e.g., Bakker et al., 2011), findings from this study suggest that personal resources (e.g., coping) do not predict engagement levels among police recruits during academy training. These findings may be associated with the fact that police recruits in the current study perceived a reduced level of control over stressors experienced during academy training, what may had affected their coping strategies or individual efforts to enhance engagement. Accordingly, Brown (1996) has previously stated that policing is often characterized as high demand and low control because of the authoritarian and bureaucratic structure, which fails to recognize the autonomy and decision ability of individual officers, particularly police recruits. However, further research is warranted analyzing the relationship between perceived control, coping and engagement to confirm this assumption. Additionally, these results could also suggest that job resources could be an important point to address when aiming to promote engagement levels among police recruits undergoing academy settings. In agreement with this assumption, a study by Alzyoud, Othman, and Mohad Isa (2015) found that job resources were strong predictors of engagement levels in a higher educational setting. However, since job resources were not accessed in the current paper further conclusions cannot be drawn. Alternatively, a possible explanation for these findings can be the lack of sensitivity of the BriefCOPE scale to assess coping among student population (e.g., Lee & Liu, 2001). In the present study, six dimensions of the BriefCOPE were removed (namely substance use; venting emotions; instrumental support; planning; self-distraction and humor) due to their low factorial validity. In agreement with this, Carver (1997) recommended that researchers should use the BriefCOPE flexibly and creatively, such as by proposing the possibility of only selecting a sub-set of the sub-scales. This could be suggestive of the need to use a new version of the BriefCOPE adapted to educational contexts and students needs similarly to the UWES-S (Schaufeli & Bakker, 2003).

Our findings supported *H2: Stress appraisal and coping predicts engagement among PO*. Results showed statistically significant paths between stress control and engagement; behavioral disengagement and engagement; self-blame and engagement and a marginally significant path between stress intensity and engagement. Accordingly, stress control was positively associated with work engagement which means that PO with higher levels of engagement reported higher levels of control over reported stressors. These findings are consistent with previous literature (Lazarus & Folkman, 1984) suggesting that the experience of high sense of control over a situation, is associated with a more positive appraisal of events (e.g., challenge) (Lazarus & Folkman, 1984). Additionally, statistical paths were found regarding stress intensity and engagement. Particularly, stress intensity was a significant negative predictor of engagement. This finding supports previous literature (Bakker, 2009) suggesting that engaged and motivated workers are less likely to experience stress. According to Schiffrin and Nelson (2010) one way to increase work engagement is to reduce the stress levels. Considering that coping strategies play an important role when dealing with stress, the use of effective coping strategies may consequently increase work engagement (Rothmann et al., 2011). Regarding coping strategies and engagement, results showed that particularly behavioral disengagement (EF coping) and self-blame (EF coping) were negatively related to work engagement. The negative association found between behavioral disengagement and engagement can be possibly explained by the assumption that this strategy mainly aims to reduce and manage the intensity of the negative and distressing emotions that a stressful situation has caused (Carver et al., 1989). Acknowledging that engaged workers actively deal with any stressors faced, therefore by avoiding the problem, rather than solving it, may be of little help for them. Additionally, self-blame was also negatively associated with engagement among PO similarly to Kaiseler et al. (2014) findings with police recruits. Considering that this EF coping strategy indicates a tendency to respond to stressful situations, by criticizing or blaming oneself, for not being able to cope with stressful situations, suggesting dissatisfaction with the present coping behavior. Once again, these strategies are unlikely to solve the source of stress and could indeed increase stress levels in some circumstances (Baker & Berenbaum, 2007; Lazarus & Folkman, 1984) instead of engaging employees. As opposed, conclusions based on previous findings (e.g., Hurrel, 1995) suggested that when PO attempt to cope with stress by actively dealing directly with the stressful event, rather than only managing the emotional distress associated with the situation, they were more likely to experience positive outcomes. Thus, in order to fully understand the coping

process and its relationship with positive outcomes (e.g., engagement), it seems that coping effectiveness measurement should be considered in future studies (Lazarus & Folkman, 1984).

In what concerns to *H3: Engagement levels among police recruits predicts later engagement levels among PO,* the results confirm this hypothesis. Acknowledging the fact that work engagement is likely to remain relatively stable over time (e.g., Schaufeli, Bakker, & Salanova, 2006), these findings suggest that the development of applied interventions aiming to enhance PO engagement levels, should be initiated during police recruits academy training. According to Bakker (2009) engaged employees experience positive emotions more often, have better health outcomes, are able to generate their own job and personal resources, and transfer their engagement to others. Since our findings suggest that coping is not a stronger predictor of engagement in the academy period, future researchers should contemplate whereas job resources could be a stronger predictor of work engagement in this particular period in order to start engaging recruits for their future work life as PO.

The present study is not without limitations. Data was self-reported and retrospective, which increases the chance of common method bias (Leino, Selin, Summala, & Virtanen, 2011). Since data was only from police recruits in the academy and one year later as PO, it is recommended that future studies should investigate PO longitudinally and during longer years of experience in order to fully understand the relationship between stress appraisal, coping and engagement levels. Moreover, data was only from PO which limits the generalizability of our findings. Still, future studies with different samples and contexts could clarify on whether the obtained results could be generalized to other working environments or if are exclusive to this sample or this context. Stress data did not contemplate the stressors faced by PO, considering that this was not the aim of this study, however future research on occupational health area among PO might complement this information collecting and analyzing data on both the stressors and the stress appraisal reported by PO in their daily life. The instrument used for assessing coping strategies in police recruits showed several limitations and constrains. In accordance with Marôco, Campos, Bonafé, Vinagre, and Pais-Ribeiro (2014) it is recommended that future studies should consider using coping instruments more appropriate to student populations. Furthermore, considering the complexity and the dynamic nature of stress and coping process, future research should investigate these variables by using complementary and

alternative methods (e.g., daily diaries; narratives), that have the potential not only to reduce retrospective and biased information but also to collect daily measures.

Despite the limitations found, it is important to highlight the fact that the current study was the first to investigate police recruits and one year later PO coping and engagement levels. Hence, findings provide a novel and original contribution to the field. Furthermore, the use of SEM allowed to examine the relations between the different factors without measurement error. Therefore, the error is estimated and removed, leaving only the common variance, SEM tests at an appropriate level the construct-level hypotheses (Ullman & Bentler, 2003). Finally, this study is pioneer in the understanding of how these variables are related, giving important hints for police administrators willing to develop a healthy and engaged PO force.

5. Conclusions

In conclusion the present study found that police recruits coping strategies have a very low impact on engagement levels during the academy period. However, when on duty PO with higher levels of control over stressors and perceiving events as less stressful, showed higher levels of engagement. Additionally, it seems that some types of EF coping (e.g., behavioral disengagement, self-blame) are negative predictors of engagement among PO. These findings, highlight the need to develop effective coping interventions to reduce stress levels and increase engagement. Finally, findings add support for the notion that engagement levels are likely to remain relatively stable over time. Given that emerging evidence suggests that high engagement levels have a positive influence on health, wellbeing and work-related attitudes, more attention should be dedicated to ways of developing engagement levels throughout policing career.

CHAPTER IV

STUDY 3: STRESS AND COPING AMONG POLICE PATROL OFFICERS: A DAILY DIARY STUDY

1. Introduction[3]

As previously mentioned, PO are constantly exposed to stress (operational and organizational stressors) and use a variety of coping strategies in order to better deal with this stress. However, despite the limitations presented in the study above, research in the area of stress and coping among police personnel has presented other conceptual and methodological challenges that can restrict conclusions in the area (Hickman et al., 2011; Mikkelsen & Burke, 2004).

First, when analyzing the study of stress among PO over the years, it seems that most research in this area has concentrated on the impact of stress among this population (e.g., Violanti & Aron, 1995) and limited attention was drawn to stress and coping as a process (Evans et al., 1993; Lau, Hem, Berg, Eckeberg, & Torgensen, 2006). Accordingly, although the transactional approach of stress and coping is the most frequently mentioned, it has not been much used in the work stress research mainly due to difficulties in generalization of the findings to most employees (Harris, 1991).

Second, the majority of studies in the area relied only on cross-sectional designs using self-report measures, only contemplating a snapshot of a changing process, and merely providing an indication of perceived stress with memory bias and distortions (Anderson et al., 2002; Tennen et al., 2000).

Third, regarding coping concept among this population, as suggested by Beehr and McGrath (1996) inconclusive findings in this area may be due to a number of conceptualizations and measures of coping used across previous research.

Fourth, considering that some types of coping are more effective when dealing with stress than others, the study of coping effectiveness is imperative for the fully understanding of coping concept. However, coping effectiveness is a controversial issue (Lazarus, 2000) and very few studies contemplated this measure. Towards this purpose it seems crucial to analyze PO coping effectiveness otherwise, limited conclusions can be made on coping process for this population (Lazarus & Folkman, 1984).

Regarding the limitations presented above, one possible solution to overcome these challenges is the use of qualitative and longitudinal methods that allow to capture the dynamic nature of stress and coping process in ecological settings (Mazolla et al., 2011). Accordingly, diary designs have shown several benefits over cross-sectional research. Daily diaries give a deeply understanding of working behavior, since they go beyond

[3] This chapter is presented in the scientific article format submitted to an International Journal of Psychology with Peer Review (Rodrigues, Kaiseler, Queirós, & Basto-Pereira, 2015).

traditional static models of human behavior, allowing for the comprehension of changing processes over time, such as stress and coping in occupational settings (Ohly, Sonnentag, Niessen, & Zapf, 2010). As an example Clarkson and Hodgkinson (2007) conducted a diary-format study with 15 clerical workers, employed in a higher education organization, aiming to demonstrate the efficacy of diaries in capturing the way people experience stress and to promote individual reflection and self-assessment, during five consecutive working days. The authors concluded that diaries can add real insight into the way a person experiences stress, considering diaries as a versatile, easy-to-use and a powerful tool in work-related stress diagnosis and intervention.

Recent studies in the area of organizational psychology have given strong support for the use of diary-based approaches (e.g., Levy et al., 2009) to assess stress and coping instead of other methods such as interviews or questionnaires. Alaszewski (2006) noted that diaries give not only descriptive information about behaviors and events, but also provide an insight into how each individual perceives and gives meaning to that situations (e.g., stress appraisal), allowing the individual to have a personal vision into their own rationalizations of actions and events. Additionally, this method allows to collect data on the specific stressors and corresponding coping responses on a day-to-day basis, contemplating context influences and increasing the reliability and validity of self-reports (DeLongis et al., 1992). Moreover, it allows for the possibility to draw conclusions more trustworthy, considering the reduced time lag between the measurements and the idiographic nature of this process (Cooper et al., 2001). In other words, as mentioned by Bolger et al. (2003) diary methods present researchers the chance of capturing ‘‘life as it is lived’’.

The present study proposes a novel research methodology following previous literature recommendations across police science, stress and coping research (e.g., Anderson et al., 2002; Folkman & Moskowitz, 2004; Lazarus & Folkman, 1984) and based on the assumption that this technique offers promising potentialities to assess daily stress and coping in work environments (Tennen et al., 2000). It is important to note that this study does not intend to replace previous methodological traditions accomplishments, but otherwise aims to provide a closer look to the benefits of diary methods as a complementary method with promising results, particularly among police personnel. Additionally, once again the transactional perspective of stress and coping proposed by Lazarus and Folkman (1984) was the theoretical framework used. Thus, PO used daily diaries over a period of 11 consecutive days in order to (i) investigate the frequency and

the appraisal of daily stressors (ii) examine their preferred coping strategies and, (iii) determine their effectiveness. Findings will contribute to the development of research methods to assess stress and coping among police personnel and will provide valuable knowledge for stress prevention and effective coping interventions tailored for this specific population.

2. Method

2.1. Participants

Fourteen Portuguese male patrol PO from a national police station voluntarily participated in this study. Participants in this study performed emergency police duties, since they were part of a rapid intervention team that is called to intervene in critical situations in the second biggest urban city in Portugal. The age range was 30-45 years (M=35, SD=5.3). After granting participation, the instructions for the diary procedure were given face-to-face by the first author. The study was approved by the Ethics Committee of the University of Porto and National Direction of PSP.

2.2. Materials

A simple and portable paper and pencil format (A5 sized, 11 pages) was adopted. Online questionnaires were sent to collect demographic and socio-educational information.

Participants were asked to note the date of completion and full researcher contact details were given to all participants, who were encouraged to use these whenever they need it.

The diary booklet consisted of four sessions: i) an open-ended stressor boxes (based on Nicholls, Holt, Polman, Remco, & Bloomfield, 2006) where participants indicated the most stressful situation during their working day; ii) a stress intensity Lickert-type scale to rate their primary appraisal, by indicating how much stress the event caused. Responses were recorded on a 5-point Likert-type scale with response anchors 1 – "Not at all stressful" and 5 - "Extremely stressful" (Kaiseler et al., 2014); iii) an open-ended coping responses section, where participants wrote what they did to manage the indicated stressor and iv) a perceived coping effectiveness scale to rate how effective their coping strategy

was managing the stressor on a 5-point Lickert-type scale with response anchors 1- " Ineffective" and 5 – "Very effective" (Nicholls et al., 2006).

2.3. Procedure

The project was presented in a public session to the Police Commanders. Following this stage, instructions for the diary procedure were given and PO were asked to complete the appropriately dated diary booklet at the end of each shift during 11 working days. Participants were instructed not to complete the diary on the days off work. PO were also instructed about the confidentiality of their responses and it was explained that the diary was used only for research purposes. After completing the diary, participants returned it to the researchers.

2.4. Data analysis

A qualitative and quantitative between-person variation analysis, based on an event-based approach was conducted. The analysis procedure will be explained below taking in consideration the different types of data: stressors and stress appraisal, coping and coping effectiveness.

2.4.1. Stressors and stress appraisal

The written open-ended responses were transcribed verbatim and subjected to an inductive content analysis procedure as suggested by Maykut and Morehouse (1994). The data was coded into stressors categories by the first author and then verified by the other authors (e.g., Nicholls et al., 2006). Then, stressors categories generated for stressor responses were categorized into more general dimensions labeled as Operational or Organizational Stressors as recommended in the literature (Violanti & Aron, 1995). For instance, "Some citizens tried to attack us" was classified as "Aggression Attempts" that was categorized as "Operational Stressors".

The frequency, and stress appraisal was calculated considering the intensity and mean intensity of each stressor. This approach is similar to previous research in the area of stress appraisal (e.g., Kaiseler et al., 2009).

2.4.2. Coping and coping effectiveness

Data from the open-ended coping responses section were also transcribed verbatim and subjected to an inductive content analysis procedure collaboratively by the lead and the second author. Following this stage, similar coping strategies were categorized into first-order themes, then a descriptive label was given and a rule of inclusion was defined for each theme. Therefore, the frequencies for each theme were recorded. Similarly, first-order themes were grouped under more abstract labels as second-order themes (e.g., "Increased concentration on task" was assigned the rule of inclusion "refers to PO trying to get focused on the task to cope" and was coded in the second order theme of "Active coping". Second-order themes were then deductively classified according to the coping function that they were apparently intended to serve using the dimensions PF and/or EF as recommended in the literature (Lazarus & Folkman, 1984).

Coping effectiveness was evaluated in relationship to each coping strategy, considering the overall satisfaction with the strategy used (Lazarus & Folkman, 1984). In order to understand the effectiveness of both PF and EF coping strategies, the sample was divided into two independent groups with the same size using the median point of the ranking orders (PF; EF). Then, an independent variable was created with two levels for representing the two different coping dimensions in a single independent variable.

3. Results

From the 11 daily sheets received, a total of 146 answers were given by the PO, of which 46 referred to non-stressful events. Eight missing answers were accounted. Additionally, a total of 112 stressors and 112 coping responses were reported. Results found were analyzed separately based on three main categories: stressors (including stress appraisal), coping and coping effectiveness.

3.1. Stressors and stress appraisal

Stressors reported were displayed into two general dimensions: operational and organizational stressors (see Table 3). The three most cited stressors were "public disorder" (28% of total stressors responses) (e.g., "The citizens did not respect our orders.") "inadequate resources" (10%) (e.g., "I could not solve a situation because I did not have the material resources I need for that purpose.") and "vehicles chase" (9%) (e.g.,

"We had to chase a suspect motorcycle driver carrying a child."). Regarding stress appraisals, only stressors cited more than five times were considered. Thus, the three most intense stressors were "gun situations" (M=4.8) (e.g., "We had to shoot a gun to protect ourselves from the suspects threats."), followed by "inadequate resources" (M=4.6), and "public disorder" (M=3.8).

Table 3

Classification of stress appraisal, frequency of stressors and the correspondence mean.

General dimension	Stressors	Illustrative data	Frequency	Stress appraisal
Operational stressors			**88**	
	Public disorder	"The citizens did not respect our orders"	32	3.8
	Vehicles chase	"We had to chase a suspect motorcycle driver carrying a child"	10	3.4
	Neighborhood interventions	"We had to get into a problematic neighborhood"	9	3.7
	Drug traffic	"We conducted an operation to combat drug trafficking"	7	3.3
	Gun situation	"We had to shoot a gun to protect ourselves from the suspects threats"	6	4.8
	Suspects approach	"We had to address suspect men, who seemed outraged about the situation"	5	3.4
	Detentions	"We had to handcuff an exalted man, that was causing problems"	5	2.6
	Suspects escape	"A driver did not stop at a red light and escaped from the police"	4	3.5
	Urgency driving	"We had to drive fast to answer an emergency call"	3	3.3
	Aggression attempts	"Some citizens tried to attack us"	2	5.0
	Use of force	"A suspect resisted the arrestment, so we had to use force to stop him"	2	4.5
	Land subsidence and leaking gas	"We had a land subsidence and leaking gas situation to solve"	1	4.0
	Building demolition	"We were called for a building demolition situation"	1	3.0
	Vehicles disaster	"We were called to respond a vehicles disaster situation"	1	2.0

Organizational stressors			**24**	
	Inadequate resources	"I could not solve a situation because I did not have the material resources I need for that purpose".	11	4.6
	Conflicts with superiors	"I have a disagreement with my superior"	4	2.8
	Conflicts with colleagues	"I have an argument with a colleague"	4	2.8
	Work overload	"The work was too much"	2	4.0
	Overtime hours	"I leave the police station long after the shift has finished"	2	5.0
	Making compensatory day off	"I have to make a compensatory day off"	1	3.0

Note: Bold indicates the total frequency of general dimensions of stress

3.2. Coping

First order themes contemplated 13 coping strategies; second order themes included seven coping responses and two coping general dimensions (PF, EF) (see Table 4). Regarding general dimensions, EF coping was the most reported (67% of total coping responses), followed by PF coping (33%). “Peer support” (30%) (e.g., “I talked with my colleagues.”) was the most reported coping strategy, followed by “distraction” (24%) (e.g., “I tried to think in something else.”) and “argued” (21%) (e.g., “I argued for my rights.”) respectively.

Table 4

Classification and frequency of coping responses.

General dimension	2nd order theme	1st order theme	Illustrative data	Frequency
PF				**37**
	Active coping	Argued	"I argued for my rights"	24
		Increased concentration on task	"I tried to get focused on what I was doing"	2
		Problem solving	"I solved the situation with the resources that I had available at that moment"	2
	Instrumental support	Talking with people involved	"I talked with the people involved in that situation"	5
	Planning	Taking an action plan	"I took actions in order to coordinate the work with my colleagues"	4
EF				**75**
	Emotion support	Peer support	"I talked with my colleagues"	34
	Positive reframing	Minimizing	"I tried to minimize the problem, by thinking that tomorrow will be a better day"	1
		Positive thinking	"I tried to think positive"	3
		Rationalizing	"I tried to think clearly, convincing myself that everything was ok"	3
		Keeping calm	"I tried to keep calm"	2
	Self-distraction	Distraction	"I tried to think in something else"	27
		Smoking	"I smoked a cigarrete to relax"	4
	Humor	Laugh	"After the situation I laughed with my colleagues"	1

Note: Bold indicates the total frequency of each general dimension

3.3. Coping effectiveness

Results showed that when analyzing a day-to-day variation in coping effectiveness over the course of the 11 work consecutive days, it appears that PF coping seems to be perceived as consistently more effective when dealing with overall stressors compared with EF coping (see Figure 6). Additionally, results suggest that coping effectiveness mean is higher for both PF and EF when facing operational compared with the organizational stressors. Particularly, when dealing with organizational stressors, PF coping seems to be perceived as more effective than EF coping (see Figure 7). Overall, all coping strategies deemed moderately effective (see Table 5).

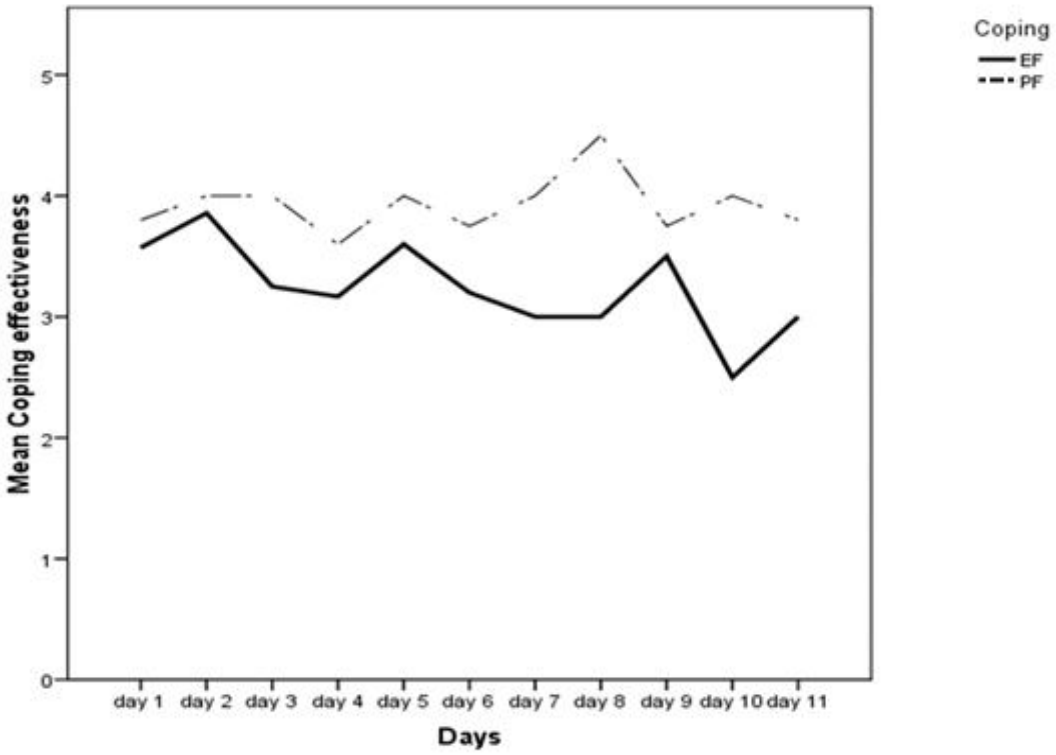

Figure 6. Coping effectiveness variation displayed by dimension of coping during an 11-day period.

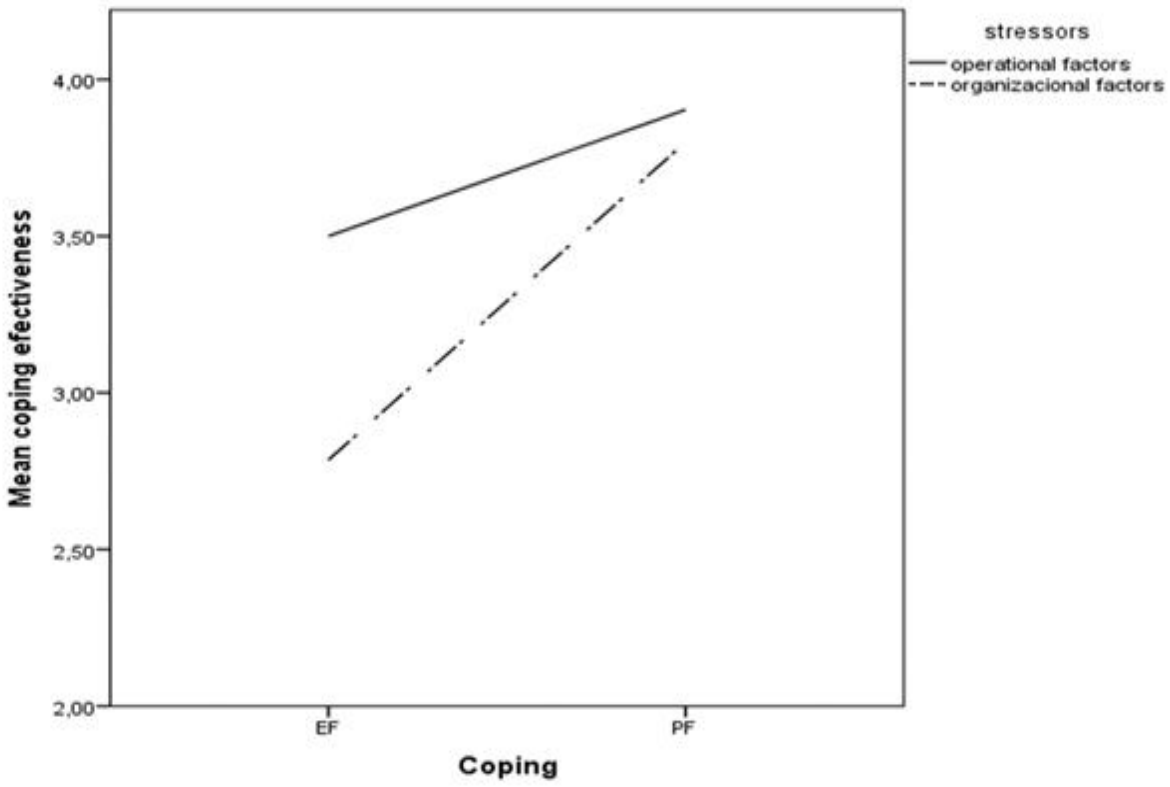

Figure 7. Coping effectiveness by dimension of coping (EF and PF) for different stressors (organizational and operational).

Table 5

Means (M) and Standard Deviations (SD) of coping effectiveness in PF and EF coping and in both coping dimensions.

Coping	PF		EF		Both coping dimensions	
Coping effectiveness	*M*	*SD*	*M*	*SD*	*M*	*SD*
	3.69	0.62	3.42	1.03	3.51	0.91

4. Discussion

The purpose of this study was to examine patrol PO stress, coping strategies used and their perceived effectiveness.

Regarding PO stress appraisal, findings from the present study suggest that operational stressors were the most commonly reported stressors by PO working in real world conditions. The present findings are not similar to those reported by Suresh et al. (2013) using a cross-sectional design. Particularly, the authors found that organizational stressors were the most commonly reported stressors among PO. A possible explanation for the different findings across studies, might be due to the nature of the current PO job. It is important to highlight that the participants of the current study are part of a rapid intervention team that mainly perform operational duties. Moreover, in the study conducted by Suresh et al. (2013) the nature of their duties was unclear and since PO duties can vary substantially in nature and great differences exist between police forces and respective duties, this fact could restrict comparisons between studies. Hence, as suggested by Maran et al. (2015) when analyzing stress among PO, variables such as role and type of work should be considered in order to reach more trustworthy conclusions. Accordingly, as opposed to current study results, PO with more administrative roles, are more prone to rate organizational tasks as being more stressful, as they are part of their daily routines. Another possible explanation could be related to the use of different methodologies. As opposed to cross-sectional designs, the current study assessed stressors on a daily basis, using an idiographic approach in an ecological setting (Tennen et al., 2000). Since this is to our knowledge the first study using daily diaries to investigate stress and coping among PO, different findings can be due to the different research methods used, rather than differences in sources of stress. It is believed that the current research methods might be more sensitive to assess stress and coping among police patrols compared with retrospective questionnaires. Since this study is pioneering in this area, with this methodology and using this population, future studies are required to confirm this argument.

Regarding the frequency and stress appraisal for each stressor, findings suggest that not always the most frequently reported stressors are the ones perceived by PO as being more intense or stressful. As an example although the stressor “gun situations” was not frequently reported by PO, it seemed to be appraised as severely more intense (M=4.8) compared to more frequently reported stressors such as “public disorders”, “inadequate

resources" or "vehicles chase". These findings support Violanti and Aron (1995) suggestion that shooting episodes are normally rated as highly stressful by PO, due to the psychological negative impact of these situations. Additionally, although organizational stressors were not the most commonly reported stressors overall, it seems that certain types of stressors within this category are particularly perceived as more stressful than others. As an example, a specific type of organizational stressors, such as "inadequate resources" was appraised as being highly stressful (*M*=4.6). Hence, the fact that some type of stressors are more frequently reported than others, does not always mean that they are perceived as more intensely stressful. On the other hand, less frequently reported stressors could be highly stressful (e.g., "aggression attempts") and can have a negative impact in an officer wellbeing and for this reason should not be neglected. These findings are in accordance with Anderson et al. (2002) suggestion that the frequency of a stressor is not necessarily correlated with the impact of that stressor. Hence, highlighting the need to contemplate stress appraisal assessment on a daily basis when aiming to understand sources of stress among PO.

The way PO perceived stress could also be influenced by external environmental processes that were not contemplated in this study. Accordingly, van Gelderen, Heuven, van Veldhoven, Zeelenberg, and Croon (2007) conducted a 5-day diary study, with 65 Dutch military PO aiming to examine the relationship between psychological strain, emotional dissonance and emotional job demands. The authors found that psychological stress at the start of a work shift had a positive effect on emotional dissonance and psychological strain at the end of the shift. This was explained by the Conservation of Resource (COR) approach (1988) that states that those PO with higher psychological strain at the start of a work shift were more vulnerable to feel more stress at the end of it. Hence, based on these findings, we recommend future research to contemplate the use of daily diaries both at the beginning and at the end of the shift. Moreover, variables such as the amount of energy, time for adequate sleep should be addressed in order to understand its impact on daily stress levels.

When analyzing the most frequently reported coping strategies used, it seems that EF were the mostly reported, particularly "peer support". Previous research among PO (e.g., Quick, Murphy, Hurrell, & Orman, 1992) has highlighted the importance of peer support in alleviating stress faced on a daily basis by this population. Accordingly, in a meta-analysis conducted by Webster (2013) aiming to quantitatively synthesize the available empirical literature on perceived stress among PO, it was found that increased

levels of social support were consistently related to decreased levels of perceived stress. As suggested by MacCarty et al. (2007) the possible justification for these findings might be that PO may consider their colleagues the only people capable of understanding police stress which makes peer support a particular desirable feature of police culture (Brown et al., 1989). Thus, based on the importance of social support, future applied stress management programs should emphasize the importance of reinforcing relationships between coworkers in police institutions (Morash, Haarr, & Kwak, 2006; Stinchcomb, 2006), provide peer support (e.g., Critical Incident Stress Management - CISM; Everly, Flannery, & Mitchell, 2000), group sessions and organize debriefings.

When aiming to understand the most effective coping strategies perceived by PO, results suggest that although EF coping was more frequently reported than PF coping, the last one seems to be consistently rated as more effective. Particularly, PO perceived PF coping as being more effective than EF coping when dealing with both operational and organizational stressors. These results support previous findings linking PF coping and positive outcomes among police recruits (e.g., Kaiseler et al., 2014) and PO (e.g., Rothmann et al., 2011). Additionally, considering that PF is more effective when used to cope with organizational stressors, it seems that the current results may provide tentative support for the goodness-of-fit hypothesis. Since this hypothesis suggests that the effectiveness of PF vs EF coping strategy is moderated by control appraisals of the stressful situation (Zakowski et al., 2001). Although control, was not assessed in the current study, the literature suggests that officers have less control over critical incidents (e.g., operational stressors) than they do over other forms of organizational stress (e.g., Clark-Miller & Brady, 2013). Future research in this area is required contemplating the inclusion of stressors controllability in order to fully test the goodness-of-fit hypotheses and confirm this assumption.

Findings suggest that PO in the current study may not be using the most effective coping strategies. Although EF coping was the mostly reported (67%) type of coping, PF coping seems to be rated as the most effective when dealing with stressors. In line with this idea, Kaufmann and Beehr (1989) conducted a study with 121 American PO aiming to understand buffering effects of social support (EF coping) in the stressor-strain relationships. The authors found some evidence of "reverse buffering", which suggests that social support interacted with job stressors to make stress more intense rather than alleviate it. Although this is not a common finding, some explanations were advanced. A possible reason suggested by LaRocco, House, and French (1980) was denominated by the

"negative buffering" effect. This happens when the support from colleagues is negative, for example, when supportive colleagues convince the person that job conditions are as bad or as even worse than believed. As found in the current study, this could be suggestive that this population may not use EF strategies (e.g., social support) effectively (e.g., Balmer, Pooler, & Cohen, 2013). However, further research is needed to confirm this assumption and fully understand the "reverse buffering" effect. For this purpose, a wider range of variables such as the content of communication of supportive colleagues, sources of stressors and support should be analyzed.

In agreement with current results emphasizing that PF coping was rated as more effective than EF coping, Evans et al. (1993) suggested that police culture and training should emphasize the use of a more PF coping rather that EF one. Nevertheless, as proposed by Balmer et al. (2013) EF coping is not necessarily detrimental to officers' well-being. Alternatively, the authors suggest that PO should be trained to better regulate their emotional responses to stress, in order to better deal internally (e.g., with colleagues) and externally (e.g., with civilians) with the professional requirements. As an example of this, PO are required to express anger when correcting a criminal, while at the successive moment they should be able to show empathy for a crime victim and it is important to highlight that police public image is created based on these interactions.

Findings from the current study provide support for Anshel et al. (2013) suggestion that a possible cause for PO stress problems may be their poor coping abilities. The current method was crucial to highlight this problem and it is recommended that future research in this area continues to use longitudinal designs and ecological research methods to assess stress and coping among PO. Furthermore, as highlighted by Ellison (2004), the work of patrol officers is characterized by stressful situations, where it is difficult to intervene. However, it is possible to interfere in their ability to cope with stressors, by developing stress management programs tailored to suit the specific needs of this population. As an example, when stressors are operational, police organizations can support patrol PO, by providing courses on physical efficiency (e.g., safety techniques, total body conditioning) and well-being (e.g., autogenic training, yoga). For this purpose, applied practitioners aiming to design effective coping interventions programs for PO should contemplate, not only stress and coping strategies used but also stress appraisal and coping effectiveness measures. Supporting patrol PO, by increasing their ability to effectively cope with stress, would consequently mean an improvement on the standard of service offered to the general public (Maran, Varetto, Zedda, & Franscini, 2014).

The current study, while exploratory, can be considered promising, since it overcame some of the shortcomings found in previous cross-sectional designs. However, some methodological limitations were found in the current study that have been discussed in the previous section. This section summarizes some of these research shortcomings and recommends future researchers with new improvements in this area.

Firstly, participants' demographic and socio-educational aspects were not considered in the current study, due to lack of responses obtained to online questionnaires. Acknowledging the potential importance of this information, future studies should consider using different data collection methods to increase response rates.

Secondly, this study was conducted with a small sample and during a short time period of time, what may restrict conclusions and the generalizability of the findings. Further research is required with larger samples, using longitudinal designs.

Finally, it is important to acknowledge that data collected from daily diaries was brief and failed to provide an insightful narrative of events and coping what restricted within person analyses in the current study. This can be due to the nature of the daily diaries questions that restricted the use of open-ended questions, due to their required longer time of completion and less successful participation rates among PO (Maran et al., 2014). As discussed previously, we recommend future studies to include a two-moment assessment, at the beginning of the day and at the end of it (van Gelderen et al., 2007). Additionally, it is recommended that future research analyzing stress should consider the use of Ecological approaches and whenever possible physiological measures should also be combined with self-reports (Rodrigues, Kaiseler, & Queirós, 2015).

5. Conclusion

In conclusion, the present study suggests that: i) PO experience a variety of stressors and it appears that operational stressors are more commonly reported than organizational ones. Particularly, out of the operational stressors, "gun situations" seem to be appraised as the most stressful one. When analyzing coping, ii) PO tend to use more EF particularly "peer support", than PF coping. Regarding coping effectiveness, iii) PF coping seems to be perceived as more effective than EF when dealing with both operational and organizational categories of stressors. Considering that the coping strategies used by PO in this study deemed moderately effective, it seems important to dedicate further attention to the design of effective coping strategies for this population.

Future research aiming to assess stress and coping among police personnel should contemplate the importance of longitudinal ecological methodologies among this population. Additionally, applied practitioners aiming to design effective coping interventions for police personnel should contemplate stress appraisal and coping effectiveness measures.

CHAPTER V

STUDY 4: PSYCHOPHYSIOLOGICAL ASSESSMENT OF STRESS AND COPING AMONG POLICE OFFICERS – AN AMBULATORY ASSESSMENT STUDY

1. Introduction[4]

PO exposure to different stressors can occur at any time during a shift, which can be risky and threatening to PO wellbeing and to the overall community safeguard (Grawitch, Barber, & Kruger, 2010). Furthermore, as stated by some authors (e.g., Anshel et al., 2013) PO are not coping effectively with stress, which has been a topic of great concern among occupational health researchers.

PO working in the field are exposed to unpredictable and potentially dangerous or traumatic events (e.g., exposure to assaults, shooting episodes) (Anderson et al., 2002). Such acute incidents are likely to trigger a body mechanism known as the "fight or flight" response, which is regulated by the brain, particularly by the ANS. This system is divided in two major components: the Parasympathetic Nervous System (PSNS), that is responsible for the regulation of basic body functions while one's rest (e.g., digestion, salivation, lacrimation) and the Sympathetic Nervous System (SNS) that regulates many of the homeostasis mechanisms, controlling the response of the organism to a perceived attack by preparing the body to "fight or flight" (Jansen, Nguyen, Karpitskiy, Mettenleiter, & Loewy, 1995).

Researchers have proposed HRV as a feasible and reliable way to assess stress physiological responses (Malik, Bigger, & Camm, 1996). More specifically, HRV provides information about two different domains of the cardiac signal – the time-domain and the spectral-domain. According to Malik et al. (1996), some feasible time-domain parameters for stress assessment are the average time between consecutive normal-to-normal (NN) heart beat time intervals. As for spectral-domain parameters, both Low Frequency (LF) and High Frequency (HF) provide information, about SNS and PSNS activity. The LF/HF ratio has been frequently used as an indicator of the overall balance between the sympathetic and parasympathetic systems. Higher values reflect domination of the sympathetic system, while lower ones refer to a higher activity from the parasympathetic system. Therefore, stress seems to be related with an increase in LF/HF ratio (Kaur, Bhalla, Bajaj, Sanya, & Babbar, 2013). According to the literature in this area, normal values of this parameter in healthy people are 2.8 ± 2.6 (e.g., Nunan, Sandercock, & Brodie, 2010).

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[4] This chapter is presented in the scientific article format in submission to an International Journal of Psychology with Peer Review (Rodrigues, Kaiseler, Pimentel, Rodrigues, Aguiar, Queirós, & Cunha, 2016).

Lazarus and Folkman (1984) stated that acute stress situations can negatively affect several cognitive and emotional processes which in the particular case of PO, can cause a considerable risk due to the possibility to impair their judgment and performance. As an example, Oudejans (2008) noted that PO shooting performance decreased under pressure. Additionally, although isolated acute stress responses do not necessarily cause chronic disease, risks are increased when stressors, or the stress response persists over large periods of time (Smyth, Zawadzki, & Gerin, 2013). Hence, as a consequence of this demanding occupation, the continuous activation of the stress response system has been associated with several physiological complications (e.g., hypertension, coronary heart disease) and psychological/emotional problems such as severe nervous conditions and neuroses (e.g., depression, anxiety).

Considering that stress is a complex process, there seems to be a clear need to investigate this variable, using physiological parameters, by combining interdisciplinary methodologies conducted under ecological conditions (Rodrigues, Kaiseler, & Queirós, 2015). Trull and Ebner-Priemer (2013) proposed AA as a new research tool that encompasses a wide range of assessment methods combining self-report, observational, and physiological/behavioral measurements in natural environments.

Two studies were found in police stress literature using a direct measure of an officer HR in the course of their regular duties. The first study was conducted by Anderson et al. (2002) among a sample of 121 PO, aiming to identify common stressors and the magnitude of stress reactivity in PO during daily working tasks. The authors conducted ride-along observations with PO equipped with ECG monitors and HR was recorded during the entire shifts. Results suggested that PO experienced both physical and psycho-social stress during the working day. They also suffered from anticipatory stress at the start of each shift. The highest levels of stress occurred just before and during critical incidents and they did not fully recover from that stress before leaving their shift. These findings reinforce the importance of considering stress reactivity patterns in order to understand the impact of workplace stress on health among PO.

The second study was conducted by Hickman et al. (2011) and investigated only one PO. This pilot study intended to describe an innovative approach to study police stress, using direct, real-time and spatially anchored measurements of an officer´s response to stressors, obtained from HR measurement during shift work. Results showed that the continuous measurement of the HR over a course of a shift was possible and these data could be placed in space-time context for purposes of exploring potential stress “hot

spots". However, despite the benefits presented by this research, a major limitation observed was the fact that no self-report data was considered. Hence, limiting conclusions on whether the physiological measures were due to psychological stress or physical effort. As concluded by the authors, studies aiming to understand police stress should combine physiological stress assessments with correspondent psychological reports on stress events, by using multiple data sources. However, ambulatory studies in real life investigating both physiological and psychological reactivity to stress are still scarce (Zanstra & Johnston, 2011), making this an unexplored and defiant area to invest.

Based on recent research recommendations that have successfully investigated psychophysiological stress among firefighters and bus drivers under ecological conditions using an AA protocol (e.g., Vital Responder (VR); Gomes et al., 2012; Rodrigues, Kaiseler, Aguiar, Cunha, & Barros, 2015), this interdisciplinary method seems to be an accurate and reliable measure to understand stress and coping in real world professions.

The proposed AA protocol consists on a combination of physiological and psychological measures of stress and coping, combining a geo-referenced event system with ECG data, using user-friendly, and non-intrusive technology, adapted to PO needs and requirements. Thus, the current study aims to investigate stress reactivity, psychological appraisal and coping among PO working under real world conditions. Once again, stress and coping will be analyzed based on Lazarus and Folkman transactional framework. It is important to bear in mind that, up to date, no previous studies were found with this population using a similar approach. Therefore, this study will make a novel and original contribution to the advance of knowledge in psychophysiological assessment among PO. Findings will particularly benefit a thorough understanding of PO stress experience while working on duty and also informing practical interventions and new diagnostic methods.

2. Method

2.1. Participants

Eleven male patrol Portuguese PO from PSP in Porto, Portugal voluntarily accepted to participate in this study. Four participants withdrew from the study due to professional commitments (e.g., workplace transferring; sick leave). Hence, seven participants aged between 31 and 45 years (M = 34.57, SD= 4.32) participated in this study. However, only ECG recordings from six participants were considered for analysis,

due to the high noise present in one of the participant's ECG signal. PO in this study performed mainly operational duties (e.g., drug traffic; public disorder) since they were part of a rapid intervention team that were called to intervene in critical situations. The exclusion criteria for the study were participants having a history of cardiovascular disease and/or taking prescription drugs known to affect cardiovascular function. Participants who volunteer to this study were instructed to perform no changes in their daily routine, such as sport activities, caffeine, nicotine and food consumption. The study was approved by the Ethics Committee of the University of Porto and National Direction of PSP.

2.2. AA Measures

All the AA measures presented below were collected using an electronic diary.

2.2.1. Stress symptoms

Participants completed eight questions in a designed smartphone – out of the eight, four questions were related to physical stress symptoms and the other four were related to cognitive aspects (based on Cohen & Williamson, 1988). Participants were then asked to rate each item on a free scale ranging from 0 – "Not felt at all" to 4- "Extremely felt".

2.2.2. Events

Participants fulfill in an event question, from a stressor checklist in the electronic diary, every time they went through a stressful situation. The stressor checklist was developed based on a pilot study previously conducted with daily diaries among the same participants (see Chapter IV).

2.2.3. Stress appraisal

For each event, PO were requested to record the stress intensity (based on Kaiseler et al., 2014) on the electronic diary. Participants had to self-evaluate how stressful was the event for them in a 5-point Lickert-type scale ranging from 1- "Not at all stressful" to 5 - "Extremely stressful". Additionally, participants reported the perceived control felt over

the reported event by using a 5-point Lickert-type scale ranging from 1- “No control” to 5- “Full control” (Kaiseler et al., 2014).

2.2.4. Coping

Participants fulfill in an open-ended question regarding the coping strategy they use to deal with the reported event (based on Nicholls et al., 2006).

2.2.5. Physiological stress

Following the literature standards, different components of the cardiac signals spectrum were extracted for this study, considering their relevance for stress data. More specifically, LF Power (Rodrigues, Kaiseler, Aguiar, et al., 2015) and the ratio between LF Power and HF power (LF/HF) (Malik et al., 1996).

2.3. Materials

2.3.1. Demographic and medical data

Online questionnaires were sent to collect demographic, socio-educational and medical information.

2.3.2. AA data

A “Kit” was developed by computer engineers for this study. The kit included: i) an electronic diary held on a smartphone, with a software application - called SCOPE App, including the events, stress appraisal (e.g., stress intensity and perceived control), stress symptoms and coping measures (see Figure 8); ii) a wearable t-shirt that acts like an ECG monitor - VitalJacket® (VJ; Cunha, 2012) (see Figure 9). The VJ is a wearable bio-monitoring platform in the form of a t-shirt that provides real time ECG at a sampling rate of 500 Hz, through one lead and a three axis ACC. The ACC is used to monitor the level of activity and posture. The VJ enables a continuous recording of ECG data without interfering with the user’s daily activities.

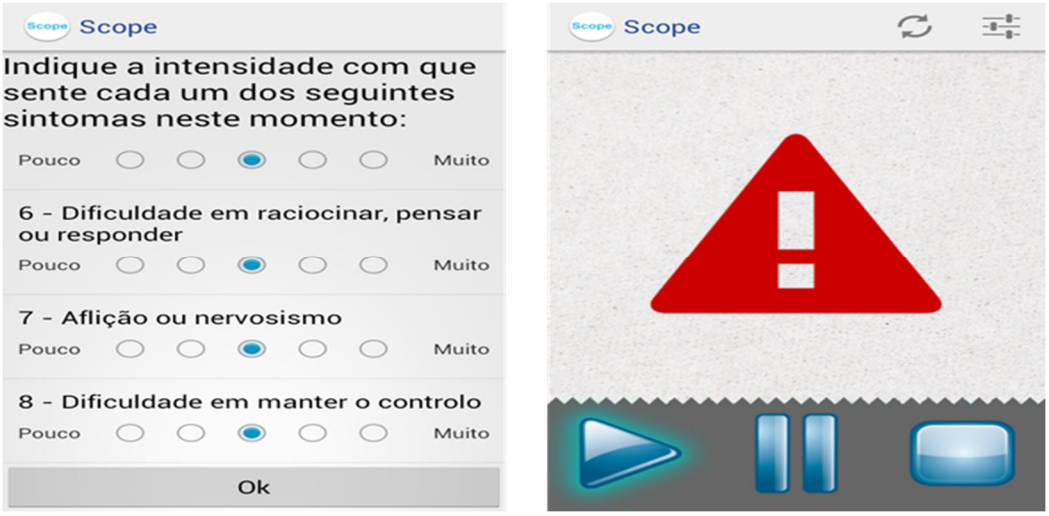

Figure 8. SCOPE App layout displayed on the electronic diary. Users are asked to "rate the intensity with which each symptom was felt" ranging from low to high. Sub questions were: "6 – Difficulty in reasoning, thinking or answering"; "7 – Affliction or nervousness"; "8 – Difficulty in maintain control".

Figure 9. VitalJacket® equipment.

2.4. Procedure

Following ethical approval, a presentation session was organized explaining the aim and the protocol of the study. PO were instructed about the confidentiality of their responses and it was explained that the results were only used for research purposes. After granting participation, the instructions for the study were provided face-to-face by the first researcher, including a detailed explanation and demonstration of the procedures.

Prior to data collection, a daily diary study was conducted with the PO in order to collect information about their daily stressors to inform the design of the mobile application (Chapter IV). Thereafter, a stressor checklist was constructed based on these results as shown in the SCOPE App (Figure 8).

A pilot study was also conducted with two PO in order to ensure that the designed methodology contained an appropriate level of detail, capable of obtaining the information required to the particular research aims. In this pilot study, several tests were made to ensure the reliability of the method and the user friendliness properties. Based on feedback received from the participants technological and methodological adjustments were made to the application in agreement with the study research question.

Data was collected during PO one day shift using the full "kit" and on a day off. On the days off, participants were required to only use the VJ, in order to collect baseline physiological data.

At the beginning of each shift the participants dress up the VJ and the respective ECG electrodes were placed following given instructions (see Figure 10). Then, participants were required to switch on the electronic diary, containing the SCOPE App and filled in the initial stress questionnaire. Following this procedure, the officer was ready to carry out the equipment for the full working day period. After the experience of a stressful situation, participants were instructed to fill in the event question on the smartphone, including a description of the event, ratings of stress appraisal and coping. These events were saved in the system and could also be available for PO description later at the end of the work shift.

At the end of the shift, the researcher met the participant at the police station, and checked if all the data in the VJ was synchronized with the self-reported information. Then data was exported to the server to be processed. The processed ECG data, together with the Global Positioning System (GPS) information and the Google Earth platform, was used to identify moments of potential stress in the map, identified as events, displaying the

information for the full workday of that participant (Figure 11). For each of the displayed events, PO visualized the exact location, thus, facilitating memory retrieval of the experienced situations. For the cases any self-report data was missing, (e.g., situations when the participant could not remember the event) a brief end-of-shift interview was conducted to facilitate the officer's memory recall and complete missing information. Therefore, the participant was asked to recall the situation identified by the events, and to provide a brief description of the event. This process was simultaneously completed in the computer and stored and synchronized with the physiologic data on the cloud server. All the protocol is illustrated in Figure 12.

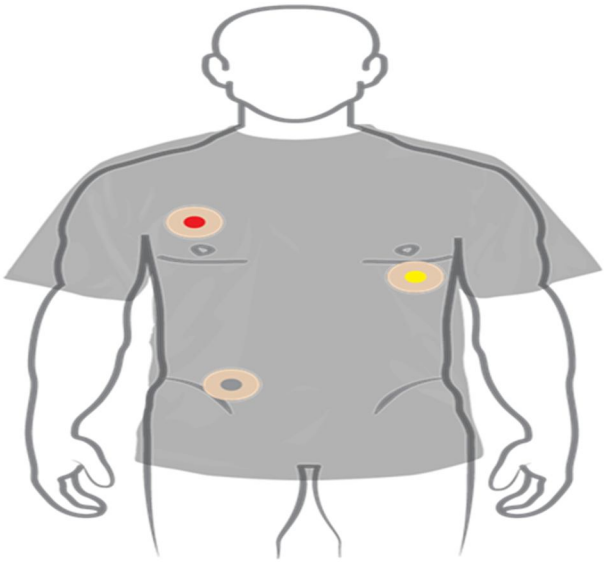

Figure 10. Placement of ECG electrodes in VJ.

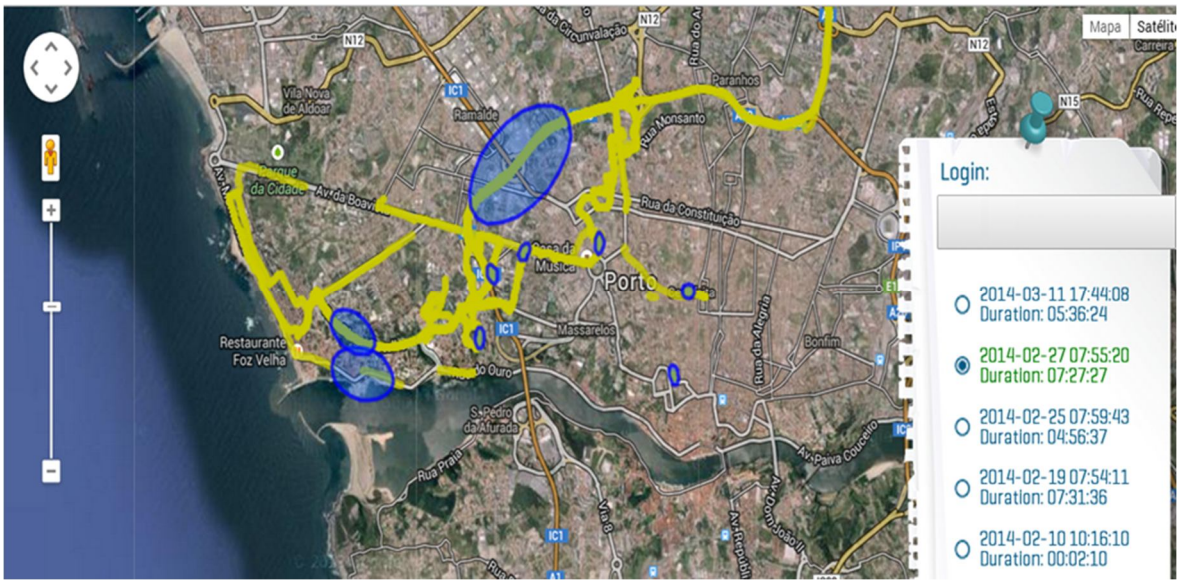

Figure 11. Visualization of events in Google Earth. This image represents one PO shift.

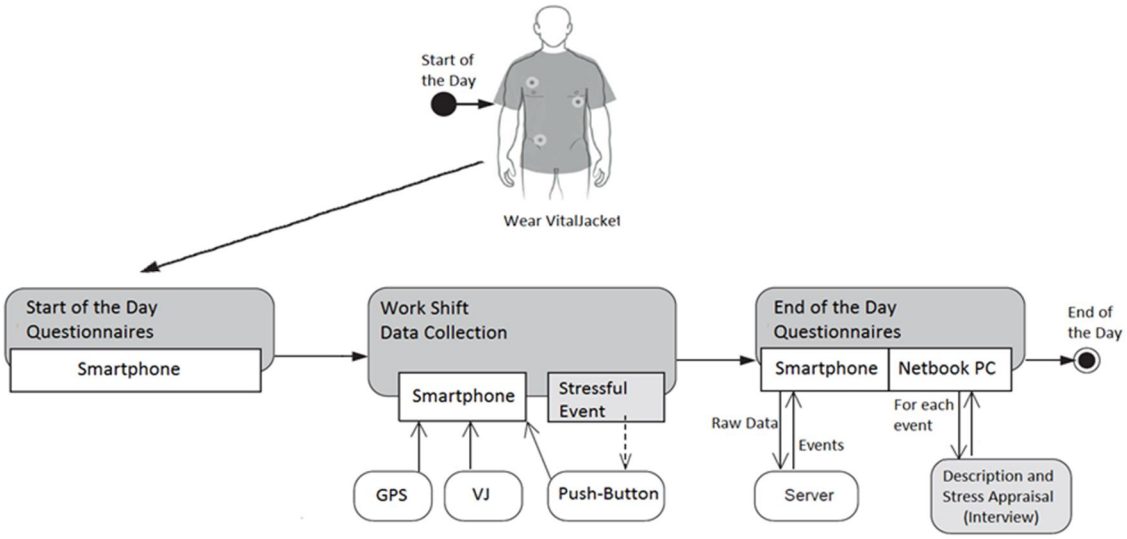

Figure 12. Diagram of the followed protocol during monitoring sessions.

2.5. Data analysis

Two different types of data were collected – continuous physiological ECG recordings and psychological data, particularly information about daily events, stress appraisal, stress symptoms and coping preferences.

A geo-referenced event system was developed for the analyses of potential stressful events during PO shifts, based on the computation of physiological parameters. Psychological data from electronic diaries and end-of-shift interviews was subjected to a qualitative and quantitative between-person variation analysis, centered on an event-based approach. The data analysis procedures will be carefully explained below taking into consideration the different types of data: events, stress appraisal, coping and stress symptoms. Physiological stress data was further analyzed recurring to an ECG motionless analysis.

2.5.1. Geo-referenced event system

Data was analyzed recurring to a geo-referenced event system previously validated in bus drivers (Rodrigues, Kaiseler, Aguiar, et al., 2015). The geo-referenced event system analyzed physiological data and detected potential stressful events based on the cardiac signal retrieved from the VJ. Data was collected and transmitted to the cloud server using the aforementioned Kit's smartphone. The ECG data was then divided in blocks of 100 seconds and processed using the HRV Toolkit from Physionet (Goldberger et al., 2000), to extract time-domain and frequency-domain metrics of the HR. The system then analyzed these metrics and selected the places (using GPS) where a potentially stressful event occurred. These events were selected from all the moments the PO reported an event on the SCOPE App, combined with the blocks having the highest HRV's LF spectral power, but separated at least 5 minutes between each other. These events were mapped and presented to the PO with an end-of-shift interview, helping memory retrieval as described in Figure 11.

Responses from electronic diaries and the end-of-shift interviews were transcribed verbatim and subjected to an inductive content analysis procedure as suggested by Maykut and Morehouse (1994). The data was coded into events (potential stressors) and coping categories by the first author and then verified by the second author. Then, event categories generated for PO responses were categorized into more general dimensions labeled as

Operational or Organizational type. Stress appraisal regarding the reported events was calculated considering the mean intensity and mean control of each event.

Coping strategies were deductively classified according to the coping dimensions: PF and/or EF as recommended in the literature (Lazarus & Folkman, 1984). The absence of coping was also categorized as a "No Coping" dimension. Only the conscious use of a coping strategy developed in order to reduce the stressor or improve personal´s resources to deal with it was considered a coping strategy (Lazarus & Folkman, 1991).

Data from stress symptoms questions was analyzed using a non-parametric hypothesis test – the Wilcoxon Signed Rank Test - conducted using SPSS to analyze if there were any statistically differences between physical and cognitive stress symptoms at the beginning and at the end of the shift.

2.5.2. ECG motionless signal analysis

After the geo-referenced event system analysis, an extra procedure for ECG signal analysis was developed in order to complement data. Hence, an ECG motionless analysis based on LF/HF parameters was also conducted in order to understand the continuous HR activation of PO during shifts, and compare it with days off. This analysis also allowed to discard autonomic changes induced by movement in the ECG signal. For that purpose, independent 5 minute windows (no overlap) where the participants were still (e.g., seated), were also analyzed, by extraction of HRV parameters. These windows were successful identified by recurring to the data generated by the ACC, which was synchronized with the cardiac signal. Paired Sample T-Tests using SPSS were also conducted in order to verify if there were significant differences between the different sets of block sizes and between LF/HF ratio during shifts and days off. Data was also checked for normality.

3. Results

Psychological data, particularly information about daily events, stress appraisal, stress symptoms and coping preferences will be presented in the geo-referenced event system section. Results from the continuous physiological stress analyses will be presented according to the geo-referenced event system and the ECG motionless signal analysis.

3.1. Geo-referenced event system

The geo-referenced event system analyzed HR metrics and selected the places where a potentially stressful event occurred during a PO shift. Complementary data from end-of-shift interviews is presented according to events, stress appraisal, coping and stress symptoms.

3.1.1. Events

Only one potential stressful event was reported on site by one officer during the shift ("suspect escape"). A total of 12 events were reported by PO at the end-of-shift interviews. From all the events reported, "Neighborhood interventions" were the most frequently reported one (cited three times, 25% of total event responses) followed by "public disorder" (cited two times, 17% of total event responses) (see Table 6).

3.1.2. Stress appraisal

Regarding stress intensity, the overall mean of all reported events was 2.1 (*SD*=.99) by PO. Regarding perceived control, the overall mean was 4.2 (*SD*=.42). The most stressful reported event was a "suspect approach" situation, directly reported by the PO (see Table 6).

3.1.3. Coping

A total of 11 coping responses were reported by the PO. Particularly, "Trying to stay calm" was the most reported coping strategy (cited three times, 27% of total coping responses). PO reported both PF ("Doing my job"; "Talking with the suspect"; "Solve the situation") and EF coping ("Trying to stay calm") dimensions. The absence of coping responses was cited five times (see Table 6).

3.1.4. Stress symptoms

Out of the seven participants, only five completed both moments at the beginning and at the end of the shift. Results from the Wilcoxon Signed Rank Test show no

statistically significant change regarding physical and cognitive stress symptoms between the beginning and end of the shift ($Z = -1.60$, $p > .05$ and $Z = .37$, $p > .05$, respectively).

Table 6

Classification of PO reported data for daily events, stress appraisal and coping.

PO	Data report	Event type	Events	Stress appraisal		Coping dimension	Coping strategies
				Stress intensity/ Perceived Control			
P1	End-of-shift interview	Operational	Neighborhood intervention	2	4	PF	Doing my job
P2	End-of-shift interview	Operational	Suspect approach	1	5	PF	Talking with the suspect
P3	Reported on site	Operational	Suspect scape	4	4	EF	Trying to stay calm
	End-of-shift interview	Operational	Public disorder	2	4	No coping	Nothing
	End-of-shift interview	Operational	Neighborhood intervention	2	4	No coping	Nothing
P4	End-of-shift interview	Operational	Driving fast	1	4	No coping	Nothing
	End-of-shift interview	Operational	Neighborhood intervention	2	5	No coping	Nothing
	End-of-shift interview	Operational	Public disorder	3	4	EF and PF	Trying to stay calm and solve the situation
P5	End-of-shift interview	Operational	Drug traffic	1	4	No coping	Nothing
	End-of-shift interview	Operational	Gun situation	3	4	EF	Trying to stay calm
P6	_____	_____	No events reported	_____	_____	_____	_____

3.2. ECG motionless signal analysis

A total of 47h01 of annotated ECG recordings during working hours and 30h10 of data during days off were collected and analyzed, resulting in a total of 77h11 of clinical grade ECG signal.

Results from Shapiro-Wilk test showed a normal distribution. No statistic significant differences between the different sets of block sizes ($p>.05$). However, statistical differences were found between LF/HF values between shifts and days off ($p<0.05$), suggesting that this parameter is higher during shifts (M=4.52, SD=1.71) when compared to days off (M=3.72, SD=1.39) (see Table 7).

Table 7

Average LF/HF and Standard Deviations (SD) during the motionless moments during shifts and days off. The same number of 5 minute segments (N) was extracted for each participant. Corresponding total minutes (min.) *are also presented.*

Participants	N (min.)	LF/HF (*SD)* during shift	LF/HF (*SD)* during a day off
P1	2 (10)	4.8 (0.2)	3.5 (0.6)
P2	39 (195)	2.1 (1.2)	2.2 (1.7)
P3	26 (130)	3.0 (0.9)	2.3 (0.7)
P4	29 (145)	6.6 (2.7)	5.8 (2.3)
P5	33 (165)	6.3 (2.5)	3.6 (1.0)
P6	45 (225)	4.9 (1.6)	4.7 (1.9)

4. Discussion

The present exploratory study aimed to investigate stress reactivity, psychological appraisal and coping among PO working under real world conditions. Overall results suggested that PO experience high levels of continuous physiological stress. However, daily acute events were not appraised as being particular stressful.

All the events reported by the officers during their daily shifts were operational-type. As opposed, previous crossectional designs considered organizational stressors as being more common (e.g. Suresh et al., 2013). A possible explanation for these findings might be due to the nature of the current PO job. It is important to highlight that the participants in the current study are part of a rapid intervention team that mainly perform emergency duties. Other possible explanation could be related with the use of different methodologies. Thus, future studies comparing stress categories among PO using ecological methods are warranted to confirm these results.

Regarding the coping strategies used by PO in the current study, it was found that the particular EF coping strategy "Trying to stay calm" was the most frequently reported one (27% of the total responses). These findings suggest that the ability to stay calm when facing operational stressors may be valuable for this population. Additionally, the findings suggest that, depending on the event experienced, PO used both types of coping strategies. Literature on coping among PO is controversial, and it seems difficult to conclude which are the most effective coping strategies used to deal with stress. According to the previous literature in the area (e.g., Hart et al., 1995) the tendency is that PF coping seems to be more effective when dealing with stress among PO. However, coping effectiveness was not assessed in this study, so limited conclusions could be drawn in order to understand which are the most effective strategies used by PO. It is also important to note the high number of "No coping" responses (46% of the total responses) found in the current study. The observed findings can be explained by the fact that very few events were reported by PO as being high in stressfulness. Accordingly, Anshel (2000) proposed a coping model for PO, and the author stated that events that are not perceived as being stressful do not require coping.

Considering the low level of stress intensity reported by PO in the current study, it can be questioned if these events were in fact perceived as stressful by PO. In support of this argument, it was also found that only one event ("Suspect escape") was reported on site by a PO as being highly stressful. Moreover, the end-of-shift interviews

suggested that the majority of the situations presented by the geo-referenced event system (based on LF changes), were tagged as natural/regular events, considering that subjective stress intensity reported was very low. Furthermore, PO showed high levels of control over reported events. These findings are consistent with previous literature suggesting that the experience of high sense of control over a situation, is associated with a more positive appraisal of events (Lazarus & Folkman, 1984).

However, when conducting the ECG signal analysis procedure, based on LF/HF average between shifts and day offs, statistical significant differences were found, suggesting that working shifts cause higher physiological stress, which was expectable. Moreover, results showed a high LF/HF ratio for the majority of the participants, either on duty or on the day off, when compared to healthy subjects (Malik et al., 1996). This could be suggestive that PO face a chronic state of stress and are not recovering well from working periods. Furthermore, this continuous high physiological activation can lead to an overload, and eventually exhaustion, of body biological systems (Taelman, Vandeput, Spaepen, & Huffel, 2008).

The current findings also suggest a possible mismatch between PO self-report stress levels and their physiological responses, considering that participants show high physiological reactivity without being aware of it. One possible explanation for these findings could be related with the fact that the reported events are regularly experienced by PO during working days. Thus, they do not perceive these events as stressful, instead these might be perceived as normal events in their work. An alternative explanation for these findings could be related with 'superhuman coping skills' image associated with PO, as well as with the stereotype that when a PO expresses psychosocial stress, this could be viewed as a weakness. In agreement with this argument the literature (Anshel, 2000; Biggam, Power, Macdonald, Carcary, & Moodie, 1997) suggests that PO are individuals who are viewed as independent, competent, and trained to take care of dangerous situations, and to protect the population. Therefore, the presence of the researcher, that was a graduate in Psychology, may acted as a possible confounding variable biasing the officer´s responses. In other words, despite assurances of anonymity, participants may have felt compelled to respond in a certain way. In agreement with this possible explanation, Waters and Ussery (2007) called attention for the existing lack of confidence between officers and clinicians relationship, due to the fact that looking for mental health professionals could be viewed as a weakness. Finally,

we can also question the PO ability to recognize and verbalize negative thoughts and emotions while on duty (e.g. Evans et al., 1993).

It is very important to reflect on these results, particularly because these findings suggest that PO are facing high physiological stress reactivity that can lead to chronic stress. Moreover, as stated by Dragomir, Gentile, Nolan, and D´Antono (2014) very little attention has been dedicated to long-term stability of physiological stress responses. Additionally, these authors found that reactivity to and recovery from psychological stressors, across cardiovascular and autonomic systems, represent stable individual traits in healthy individuals. Hence, further research using longitudinal designs is required in order to understand stress physiological responses across time.

Furthermore, unlike everyday stressors that can be managed with stress management therapy, untreated chronic stress can result in serious health conditions such as anxiety, insomnia and high blood pressure among other disorders (Baum & Polsusnzy, 1999). Moreover, chronic stress can affect the ability to perform well (Queirós et al., 2013). These findings highlight the need to dedicate further attention to PO occupational health. Hence, the use of physiological parameters synchronized with self-report data under ecological conditions appears to be an essential method in detecting stress among this population.

5. Limitations and improvements for future studies

Considering this is an international pioneering method in the area of occupational health among PO, and since nothing like it was ever held in Portugal, some limitations were found.

Firstly, this study was conducted with a small sample, with specific roles, and for a short period of time. Consequently, the exploratory nature of the current research restricts the generalizability of the findings and the applicability of this method to a wider population. Hence, further research in this area is required, using larger samples, for larger periods of time and contemplating longitudinal designs.

Secondly, data collected by the geo-referenced event system analysis following similar research among bus drivers (Rodrigues, Kaiseler, Aguiar, et al., 2015) might have been biased by the influence of confounders that could have interfered with time and spectral-domain values (like LF power). This noise in the ECG signal, reduced the accuracy of the heart beat detectors, and therefore could have influenced the accuracy of

HRV results and consequently detected stressful events. In order to overcome these limitations, future studies should consider other HR parameters to analyze stress (such as HF; LF/HF; pNN20) and include ACC data.

Thirdly, due to the variety of between-person differences in the physiological responses to stress, it is difficult to build a simple stress algorithm that works on a large population. Moreover, defining such a physiological algorithm requires the collection of ground truth data in natural environments (Plarre et al., 2011).

Finally, some failures were detected on the GPS signal, which could be due to Electromagnetic activity in the patrol cars that cause some gaps in the data. This limitation is similar to that reported in the study by Anderson et al. (2002) described above. Unfortunately, to our knowledge, the literature does not yet address all of these problems, neither provides a scientifically valid, and continuous measurement of stress that works in natural environment, calling for more investigation in this area.

6. Conclusion

This study has two main key implications. Firstly, based on the ambulatory cardiovascular analysis, it suggested that PO experience high levels of physiological stress potentially indicating the presence of a chronic stress state when compared to healthy populations. However, when questioned about the type and intensity of stressors experienced during shifts, PO did not report any significant events as stressful. As it seems, PO may not be aware of their stress levels, therefore they are unlikely to ask for help. Regarding the coping strategies used to deal with daily events, EF was the most reported, which according to previous research (e.g., Hart et al., 1995) could be considered as an ineffective coping strategy. Based on Schultz and Schultz (2010) suggestion, stress in the workplace becomes a health problem if not managed well. Hence, further attention should be dedicated to PO occupational health. Therefore, by collecting not only information about what causes stress, but also concerning its real impact on psychological and physical health, this study reinforced the importance of AA research for the design of prevention and intervention plans and programs adapted to PO real needs. Thus, monitoring stress during real events might be the key for controlling stress related problems and might be a suitable information to consider for PO assigned tasks.

The second key implication of the present study is its potential impact for working as a reference model for police stress investigation. Acknowledging the limitations and challenges found in this study, very important insights and potential future benefits can be addressed in order to reach methodological innovation in this area. To our knowledge, the current methodology is internationally pioneering with this population, representing a breakthrough in research, since it overcomes previous research limitations in the area of occupational health among PO and provides a promising avenue for prospect research in the area.

CONCLUSION

My interest in the study of this topic, particularly among police recruits and officers emerged from my prior professional practice, while working as a psychologist and as an army officer for the Portuguese Army. During this two-year period I have contacted with professionals suffering from stress, particularly those that engaged in military missions for long periods. Fortunately, during my Ph.D. studies I had the opportunity to closer investigate this theme not with army personnel, but with police personnel. The opportunity to be in the field, talk with the officers and understand their needs and requirements gave me a better understanding of the profession and its respective demands. On the side, a detailed familiarization with the national and international literature on police science, allowed me to develop knowledge in the area, and use a variety of research methodologies to investigate stress, coping and engagement among PSP while always reflecting critically about the findings. In this way, the current chapter, will present a discussion of the current Ph.D. findings and will draw conclusions based on the systematic review and the three empirical studies conducted, as well reflect on the limitations of the studies and finally provide future recommendations and practical implications to the police science area of research.

Summarizing, our main goal in the current Ph.D. programme was to understand PO stress, coping and engagement levels. For that purpose, in Study 2 we aimed to understand the relationship between stress, coping and engagement in a large sample of PO in two particular moments of their careers (academy training and while on the first year of duty). In this study it was hypothesized that stress appraisal and coping would predict engagement levels among police recruits and PO. Additionally, it was hypothesized that engagement levels among police recruits would predict later engagement levels among officers. Then, in Study 3, our focus was to understand daily stressors, coping and coping effectiveness of PO during 11 consecutive working days. For this purpose a daily diary methodology was used, aiming to understand these variables while also decreasing retrospective bias, considering that data was collected on a daily basis at the end of each shift. Finally, Study 4 aimed to understand stress and coping in a more complementary perspective, by using a novel and original ecological protocol, that contemplated both psychological and physiological measurements of stress. Considering that this type of methodologies are fairly new in the psychology area (Rodrigues, Kaiseler, & Queirós, 2015), we started by conducting a systematic review on ecological assessments of stress (Study 1), that provided important hints for the design of the AA methodology used in Study 4.

For the analysis of PO stress, the theoretical framework underpinning this research was the transactional model of stress and coping proposed by Lazarus and Folkman (1984). Hence, individual appraisal was considered as suggested by the authors. For that purpose information about how officers perceived stress in terms of intensity and perceived control was contemplated.

Starting by the analysis of PO stressors in particular, findings from Study 3 and Study 4 suggested that operational stressors were the most commonly experienced stressor type among PO under study. It should be noted that these findings tend to contradict previous literature in the area suggesting that organizational stressors are the most typical stressors reported by PO (e.g., Suresh et al., 2013). One possible explanation for our findings could be related to the participant's role as patrol PO performing more operational tasks when compared to those in previous research. Accordingly, participants in Study 3 and 4 were patrol officers taking part of a special force unit, responding to the most critical situations in the second biggest city in Portugal. Whereas in the study conducted by Suresh et al. (2013) the authors suggest that patrol PO were also investigated, however the nature of their duties is unclear. A future recommendation in this sense, would be for researchers in the area of occupational health among PO to clearly describe the nature of PO duties, so findings can be better understood and contextualized. Other possible explanation for these findings, could be related to the use of different methodologies. Previous research in this area used mainly cross-sectional designs based on retrospective reports. However in this Ph.D. thesis different methodologies were used including day-to-day data collection methods and physiological parameters of stress were also contemplated. Data collected on a daily basis facilitates memory retrieval, hence PO could better recall the situations that happened on a particular shift. Considering that the participants studied were part of a rapid intervention team, it is expectable that the majority of experienced events were mainly operational type.

In order to reinforce the idea that the use of different methodologies could lead to different findings, we should reflect on the fact that the same PO in this Ph.D. thesis were assessed with two different methodologies respectively in Study 3 and 4. Specifically, in Study 3 a diary methodology was used among 14 patrol officers. Whereas in Study 4 out of the 14 PO that participated in Study 3, seven volunteered to participate in this study and data was collected using an AA methodology. As a result, in Study 3, several stressors (e.g., public disorder; vehicles chase) were reported by the

officers, using a diary methodology. However, in Study 4 the same officers, using an AA methodology reported very few stressors restricting conclusions on what were the most reported stressors. It is important to bear in mind that in Study 3 data was collected during 11 consecutive shifts and in Study 4 only one shift was assessed, therefore the length of the study may had also influenced the quality of their reports. Hence, we encourage further research in this area, to use different research methodologies in order to make additional contributions to the literature, particularly through the use of ecological approaches.

Despite the investigation of PO stressors, we also aimed to understand stress appraisal, based on Lazarus and Folkman (1984) recommendation, considering this as a way to obtain complementary information on stress assessment. Hence, regarding stress appraisal information, Study 2 suggests that when PO experience a high sense of control over a situation, they are more likely to perceive events as being positive (e.g., challenging) rather than negative or stressful, reporting higher levels of engagement. Moreover, stress intensity was a negative predictor of engagement. This finding supports previous studies suggesting that engaged PO are less prone to feel stress (e.g., Bakker, 2009). Furthermore, Study 3 results suggested that not always the most frequently reported stressors were the ones perceived by PO as being more stressful, as it was exemplified with the "gun situations". Although this was not a very frequently reported stressor, it seemed to be appraised as severely more intense, when compared to more frequently reported stressors. On the other hand, less frequently reported stressors (e.g., "aggression attempts") were highly stressful and can have a negative impact in an officer wellbeing and for this reason should not be neglected. Additionally, in Study 4 PO reported several potential stressors during their daily routines however, when they were asked about their respective stress intensity and perceived control, results suggested that those events were not appraised by PO as being stressful. These results add support to the need to analyze stress appraisal information when aiming to understand stress.

It was also concluded that complementary data, such as information from physiological parameters, could be necessary to understand stress as it was shown in Study 4. If this study had only contemplated stress appraisal based on self-report measures, probably it would reach the premature conclusion that PO do not report/experience stress. However, when analyzing individual ECG data, results suggested the presence of a high physiological activation, either on duty as well as on

the days off, when compared to healthy subjects (e.g., Nunan et al., 2010). This could be suggestive of the presence of chronic stress and that PO are not recovering well from working periods. Hence, using only self-report measures to assess stress among this population may be leading to inconclusive findings. In sum, these results highlight the need to not only contemplate self-report measures (e.g., the frequency and stress appraisal), but also to include stress physiological measurements, when aiming to understand stress among PO. As previously discussed this mismatch between PO self-report measures of stress and their physiological responses, can be explained by the "superhuman coping skills" stereotype associated with PO that has been extensively described in the literature. Alternatively, one may question the capacity of PO to recognize their thoughts and emotions while on duty, since the literature considered that PO have difficulties acknowledging the presence of negative emotions (Evans et al., 1993; Violanti et al., 1985). Moreover, the presence of the researcher, that was a Psychologist, at the end-of-day interviews, could also have interfered with participants responses, which is also in accordance with previous literature (e.g., Waters & Ussery, 2007) suggesting that PO may inhibit their responses in a presence of a clinician. Accordingly, the act to admit stress in the presence of a clinician could be perceived as a weakness. In opposition to these findings, in Study 3, the same PO filled in diary sheets at the end of the shift, which is a more private and isolated environment, facilitating individual reflection, without external interference and in this particular case several stressors were reported by PO. However, further research analyzing PO awareness of stressors and appraisal is required to confirm this assumption.

Study 1 also provides important theoretical contributions for the design of ecological approaches regarding the assessment of stress. For example, by showing that literature about ecological approaches is vast and involves controversial theoretical issues. Our findings suggested that AA terminology is the most commonly used terminology to denominate ecological approaches including psychophysiological assessments, and should be used in the future as a standard assessment terminology in this area. Moreover, it was found that stress could be defined in several different ways and this could interfere with the way stress is assessed, leading to different findings and conclusions. Finally, this systematic review provided different recommendations for future AA research including the use of synchronized measures of self-report and physiological data.

Coping assessment in the current studies, also followed the theoretical framework by Lazarus and Folkman (1984). Results from Study 2 showed that some EF coping strategies (e.g., behavioral disengagement; self-blame) were found to be negatively related with work engagement levels among PO. This is in accordance with previous literature suggesting that coping strategies used by PO can predict their engagement levels (e.g., Rothman et al., 2011). Furthermore, in Study 3 we aimed to understand not only what were the most coping strategies used by PO, but also its effectiveness. It was found that EF coping was more commonly used by PO, particularly peer support. These findings can be explained by the strong police culture friendship and solidarity climate among colleagues (Waddington, 1999). As previously mentioned in this Ph.D. thesis, the current literature is not conclusive about which are the most effective coping strategies used by PO, calling for more investigation in this area. In order to have a more consistent understanding of this topic, coping effectiveness measurement was included in Study 3. Results suggest that the coping strategies used by PO in this study were only moderately effective, and particularly PF was rated by PO as the most effective when dealing stressors. Thus, although EF coping was mostly reported, PF coping seems to be rated as most effective when dealing with stressors. These findings were only possible due to the measure of coping effectiveness in this study, otherwise following previous trends in the literature (e.g., Alexander & Walker, 1994) one could prematurely conclude that EF coping were the most effective type of strategies. In sum, our findings across studies suggest that in order to fully understand coping, researchers should use Lazarus and Folkman theoretical framework in order to provide a greater consistency in the measurements and terminology used to classify these variables and consequently improve conclusions and generalization of findings.

Regarding the engagement concept, the construct was only included in Study 2 to understand its relationship with stress appraisal and coping among police recruits and PO. Additionally, we were interested in investigate whether engagement levels in recruits predicted later engagement in PO in their first year on duty. Results suggested that engagement was not predicted by stress appraisal and coping among police recruits, however when PO started working, it seems that these variables predict engagement. This seems to be related to the lack of control police recruits have during the academy training. Hence, individual efforts seems to have a very low impact in enhancing engagement. However, further research is warranted to understand the predictors of engagement during the academy period, particular the role of job resources.

Furthermore, the results showed that engagement among police recruits predicted engagement among PO, which is consistent with theoretical perspectives that view engagement not as a momentary and specific state but, rather, as a more persistent and stable state (Schaufeli et al., 2006). Hence, highlighting the need to design applied interventions to increase engagement levels among academy training.

Regarding the methodological contributions of this Ph.D. thesis, it is important to reinforce the originality and novelty presented in the research methods used in the different empirical studies. As an example, to our knowledge this was the first national and internationally study investigating stress and coping among PO using this type of AA approach. We first started using a longitudinal design and data was analyzed using a complex and multivariate technique such as SEM in order to examine the relations between stress appraisal, coping and engagement (Study 2). One of the main advantages of SEM is the ability to correct for measurement error. This is particularly relevant to psychology and social sciences that are not generally interested in manifest, tangible variables, but unobservable, or latent, variables (e.g., stress, coping or engagement). Moreover, this is a flexibly and powerful research technique that allow researchers to understand the interaction between theory and practice, with the ability to test a model (Chin, 1998). An important methodological conclusion from this study was the need to develop a BriefCOPE scale, used for the assessment of coping among police recruits. This constraint leads to a reflection about the usefulness of using only self-report questionnaires to collect data. Hence, the next two empirical studies (Study 3 and 4) used novel methodologies in order to overcome previously reported limitations in the area of stress and coping research. Following previous literature recommendations (e.g., Folkman & Moskowitz, 2004) Study 3 used paper diaries during several consecutive shifts and Study 4 used electronic diaries during one shift. As suggested by Ohly et al. (2010) this longitudinal and qualitative methodology allowed the assessment of stress and coping as a dynamic process. Moreover, it allowed not only for a description of behaviors and events, but also provided insightful information about how events were perceived by the individual (stress appraisal). This allowed the possibility to draw more trustworthy conclusions, considering the reduced time lag between measurements and the idiographic nature of this process (Cooper et al., 2001). Furthermore, in Study 4 an innovative AA methodology was designed in order to obtain a more detailed information in real time combining psychophysiological stress measures. Hence,

physiological assessment was also considered and, as discussed before, was the key to understand the impact of stress on PO health.

Limitations and future research

Despite the fact that this Ph.D. thesis has presented key findings in the area of occupational health among police recruits and PO, some challenges and limitations were found, that raise important questions regarding these methodologies and the generalization of these results to the police population. Particularly in Study 2, data was self-reported and collected retrospectively, which increased the chance of common method bias (Leino et al., 2011) and the instrument used for the assessment of coping strategies in police recruits showed several limitations and constrains. In order to overcome these limitations, Study 3 and 4 employed different methodologies to collect data by addressing some of the limitations faced in Study 2. Specifically, to overcome the influence of memory bias, data was collected on a daily basis (Study 3 and 4), to improve ecological validity, real world settings were used (Study 4) and for the fully understanding of stress process, physiological parameters were complemented with self-reports (Study 4).

However, despite our effort to overcome previous limitations, careful should be drawn when generalizing these findings to other police forces in Portugal or even to international police forces, particularly due to the reduced sample size, the short duration of the data collection procedure and the specific nature of participants work roles. Accordingly, Study 4 was conducted with only seven out of the 14 participants in Study 3 and Study 4 only contemplated one shift. Instead, it is recommended that researchers in this area replicate the current research designs with a larger sample and for a longer period in a particular population under study and learn whether similarities apply. Study 4 in particular presented other limitations besides the ones cited above, which includes the negative influence of confounders (e.g., body movement; noisy data), typical of ecological approaches. However, it is important to bear in mind that AA is a new area of research, and the current Ph.D. work is pioneer in this area of study. Hence, acknowledging the commonly cross-sectional research conducted previously in this area, our goal was to investigate the usefulness of novel methodologies while considering the population needs and requirements.

Despite the limitations found, the collected information was extremely useful to understand the stress and coping transactional process among this population. Considering that we found evidences of stress in the physiological assessment which were not suggested in the self-reports filled in by PO, our findings present themselves as a novel contribution in the field of occupational health, giving a new and objective dimension for the analysis of stress and coping research. It is expectable that the findings here presented encourage other researchers in this area of expertise to use and improve similar methodologies to investigate the variables under studied among a particular police force.

Applied implications

Given that policing is considered an extremely stressful occupation, it seems crucial to design practical interventions suitable to this population needs and that help them dealing with stress. Hence, findings from this Ph.D. thesis also provide important practical implications particularly, for police administrators, clinicians and officers themselves. Despite the fact that police administrators are not clinicians, they have a key role in helping officers, since they are the ones who closely work with trainees, by educating and motivating them for the line of duty. As an example, Papazoglou and Andersen (2014) suggested that they may help them to combat the stigma of mental health treatment in this population, by the normalization of help-seeking behavior. Results from Study 2 suggested that when becoming PO on duty, personal resources (e.g., coping strategies) are an important predictor of engagement. When analyzing the relationship between coping, stress and engagement, one possible solution to reduce stress, and therefore enhance engagement levels, is to enhance PO coping strategies, by developing effective coping interventions. However, according to our findings during academy training, personal resources seems to have limited effect on the enhancement of engagement levels among police recruits. As suggested by Alzyoud et al. (2015) job resources could be an important factor in predicting engagement in high stressful educational contexts such as the police academy. Hence, it is worth reflecting that stress has been a common problem over the years in police organizations, which suggests that this problem should not only be addressed at a micro level (e.g., focusing on the individual) but also at a macro level (e.g., organization). Accordingly, Hart et al. (1995) stated that “police organizations are the main source of psychological distress among

police officers" (p. 150). Several authors (e.g., Morash et al., 2006) have also suggested that the law enforcement organization should be a target for change as a means of stress reduction. It is highlighted that increasing research work is being conducted in this area in Portugal (e.g., Kaiseler et al., 2013; Silva & Queirós, 2013).

Thus, in order to reduce stress and consequently improve PO engagement levels, police organizations should take active steps to protect and motivate their employees. As an example, as stated by Suresh et al. (2013) public criticism, particularly disseminated by the media, has been a serious and increasingly common source of stress among PO. In order to overcome this problem, police organizations should implement efficient strategies (e.g. educational interventions) to raise the public profile of police professionals.

In line with the importance of the police organizations in preventing stress among employees and bearing in mind the results from Study 4 regarding the high stress physiological activation of PO, researchers as Ménard and Arter (2013) referred that police institutions should provide continuous health education information (e.g., monthly newsletter, wellness classes), by providing free or reduced cost services (e.g., gym memberships, counseling) to officers. Additionally, Torres and Maggard (2003) presented various practical solutions to address police stress, particularly, by providing employee assistance programs, including services to officers and families; elaborating orientation programs for the new officer's transition into the police culture; developing pre-academy programs that emphasize physical conditioning and by teaching coping mechanisms related to the demands of the profession (e.g., crime, death, boredom). Some of these innovative educational methods incorporate international and multicultural perspectives (e.g., Kratcoski & Das, 2007), which can be very interesting allowing for the contact with different realities. Papazoglou and Andersen (2014) also reinforced the importance of a more educational perspective, known as Psychoeducation, by recommending officers to read books or scientific articles and attend mental health seminars and conferences.

Despite all of the practical recommendations provided above and considering the importance of developing best practices on police occupational health in Portugal, it also seems crucial to conduct European comparative research, in order to develop a more qualified and efficient police training system (MacDonald et al., 1987). This should not only include best operational practices, but also healthier officers. However, as stated previously, the difficult access to this population (Mathur, 1999) and the

diversity of police forces and respective duties across European police forces (Vertovec, 2007), difficult comparisons between countries. Furthermore, the different languages and cultural barriers are also a challenge for the use of standardized research methods. In order to overcome these challenges, researchers could consider the use of more qualitative research methods, the inclusion of technology and the use of interdisciplinary approaches developed by regular communication and knowledge sharing, through European research networks. Accordingly, this Ph.D. work proposed innovative and interdisciplinary methods in the area of PO occupational health assessment that could be tested in other police forces in Europe.

Based on our findings, we conclude that policing is a very stressful occupation, with a negative short and long term impact on officers' health. Hence, as an example of a novel direction for intervention targets, we propose the use of Ecological Momentary Interventions (EMIs). EMIs, are applied interventions, incorporating mobile technology, that provide a specialized help to people during their everyday lives and in natural settings. Evidence from other studies conducted in foreign countries (e.g., Heron & Smyth, 2010) suggested that EMIs have been well accepted by patients, and are successful for treating a variety of physical and psychological symptoms. Hence, future research should integrate the assessment and intervention capabilities of mobile technology in order to generate dynamically and individually tailored EMIs for PO. Acknowledging the limitations and benefits of these new research methods, our findings suggest that this is a worthy area to invest, by offering a unique opportunity to obtain a detailed examination of stress causes and its impact on PO health.

Concluding, the development of this Ph.D. thesis leaded to a deep reflection about the importance of developing an ethical sensibility and a sense of social and scientific responsibility. Therefore, our intention is to disseminate the achieved results with the national and international scientific community, police institutions in Europe while also make a significant contribution to a better society.

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