



Development of the Behavioural-Biomedical Law Enforcement Stress Discordance Model (B²LESD): An epidemiological criminology framework

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ABSTRACT

The stressors associated with the law enforcement profession have become a focal point of discussion as the reporting of police misconduct has been increasing. Simultaneously researchers are exploring the relationship between police stress, as manifested through physical behavior, and health outcomes. While the current definitions and theories shed some light on the pathways of police stress leading to police misconduct, the emergence of more critical, interdisciplinary theories is essential and needed so as to better understand its underlying causes scientifically and practically. Relevant studies conducted from year 2008 to present were searched and collected, through a number of databases, to investigate the relationship between stress and police misconduct. The results of the final sample of ten studies were utilized to refine a conceptual model that serves as a guiding framework to more accurately provide a conceptual picture of police stress-exposure and the role of the bio-psycho-social and environmental contributors that impact the police work environment, thereby influencing the stress experienced by police officers that lead to police misconduct. We use the Epidemiological Criminology framework to understand the biobehavioural impact of stressful exposure on health and wellness of law enforcement officers. This framework intends to help the law enforcement, research, policy, and practice community to understand more effectively the bio-psycho-social and environmental health effects within the context of the behavioural and biomedical disparities of police officers, who are likely to experience high levels of stress while on duty—leading to the development of stress-reduction interventions for police officers.

Key Words Epidemiological criminology; police stress; police health; police deviance; police misconduct.

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INTRODUCTION

The law enforcement profession is considered one of the most stressful occupations in the United States (US), with 77% to 83% of police officers reporting that they experienced occupational stressors in the past month (Violanti et al., 2016). Even more, stress as an occupational hazard in policing has an effect throughout the life course of police officers (Reingle-Gonzalez, Bishopp, & Jetelina, 2016; Ramey, Downing, Franke, Perkhounkova, & Alasagheirin, 2012; Kaufmann, Rutkow, Spira, & Mojtabai, 2013). Police officers (46.9%) are more prone to work a non-day shift when compared to other workers (9%) in the US (Hartley, Burchfiel, Fekedulegn, Andrew, & Violanti, 2011a). These shift differences have been associated with exposure to more stressful events (Ma et al., 2015). In

regard to specific occupational stress exposures, Violanti et al. (2016) examined the occupational stressors among police officers using the Buffalo Cardio-Metabolic Occupational Police Stress (BCOPS) Study (2004–2009) and found that the most frequent identified police stressor was ‘responding to family disputes’ (83%), and the most highly rated stressor was ‘exposure to battered children’ (27%). With respect to gender, male police officers reported a higher prevalence of stress associated with interruption in their time off duty and working second jobs compared to female police officers. On the other hand, female police officers reported experiencing a higher prevalence of stress related to poor supervisory management relative to male police officers.

The stressors associated with the law enforcement profession have become a focal point of discussion as the

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reporting of police misconduct has been increasing. Using the general strain theory, Arter (2007) found that police officers who reported experiencing higher levels of stress also reported engaging in more deviant or aberrant behaviours, such as verbal assaults toward citizens, excessive force, and acts of nonfeasance, malfeasance, or misfeasance (i.e., behavioural disparities), in contrast to other occupations. When police officers were reassigned from duties that were identified as highly stressful, the reported deviant behaviours were decreased. This is important because the 2010 National Police Misconduct Statistics and Reporting Project (NPMSRP) indicated that approximately 6,613 law enforcement officers met the criteria for NPMSRP's police misconduct. Excessive use of force was the most prominent type of reported allegation, involving 1,575 complaints (23.8%). Incidents of sexual misconduct (9.3%) ranked as the second most reported complaint, followed by theft/fraud allegations (7.2%) (Packman, 2011). Also, since the formation of the Civil Rights Division (the Division) of the U.S. Department of Justice's (DOJ) pattern-or-practice cases, which investigates police misconduct based on the macro level (e.g., policies, systemic practices) rather than on the micro level (e.g., individual police misconduct), the Division has opened 69 formal investigations and entered into 40 total reform agreements to foster change to police departments (United States Department of Justice, 2017).

Simultaneously, researchers are exploring the relationship between police stress, as manifested through physical behaviour, and health. These police stressors are being explored due to reports of such factors as: increased absenteeism (Violanti et al., 2014), presenteeism (Leineweber et al., 2011), and short-term and long-term disability (Violanti et al., 2013a) contributing to higher estimated costs due to at-work productivity loss (Fox et al., 2012). Most recently, police operational stress injuries, defined as "any persistent psychological difficulty resulting from operational duties performed while serving" (Oliphant, 2016, p. 15) has become an important focus of screening among police officers (Carleton et al., 2017). One such operational stress injury is post-traumatic stress disorder (PTSD), which is a trauma and stress-related disorder that is experienced by many police officers (American Psychiatric Association, 2013; Foley & Massey, 2018). For instance, it has been reported that, for every six months of service, a police officer can experience an average of three traumatic events that translate into symptoms of PTSD (Patterson, 2001), which impacts their ability to carry out effectively their duties based on PTSD symptomatology (e.g., heightened reactions, aggressive behaviours) (Foley & Massey, 2018). The fact that police officers are exposed to traumatic events does not necessarily mean that they will experience PTSD-related symptoms. Many police officers are resilient and, despite the trauma-related exposure, they have the capacity to recover/adapt. In addition, some officers may experience PTSD-related or trauma-related symptoms; however, they have the capacity to recover. Bonanno (2004) uses the term "potential traumatic event", and contends that it is not the event that traumatizes a person but rather the person's perception of the event that determines their trauma-response. In fact, a person exposed to a traumatic event could find meaning in the event, view it as a learning experience, and move on. Of course, there appears to be a percentage of officers who get affected by trauma exposure

over time. A police officer diagnosed with PTSD may also have higher comorbid psychological symptoms of anxiety and depression (i.e., biomedical disparities), as well as higher cardiovascular disease risk factors such as obesity, metabolic syndrome, and high cholesterol, relative to working adults in their occupations in the US (Hartley et al., 2011b; Javidi & Yadollahie, 2012).

As a result of the prevalence of police misconduct and stress-related health issues among police officers, the stress associated with police work has been explored to determine its relationship with health and wellness and the manifestation of deviant predisposition that leads to police misconduct (Juarez, 2004; Agnew, 2001; Manzoni, 2009; Gershon, Lin, & Li, 2002; Kop & Euwena, 2001; Arter, 2007). The main crust of this study is the pathways of stressful exposures (i.e., personal, organizational/operational, and psychological/physical) on the biological, psychological, sociological, and environmental well-being of police officers. Focusing on system and structure and organizational and operational stressors are important for prevention. Importantly, the complexity of this level of analysis further requires the analysis of three critical theoretical factors related to law enforcement and public health: micro (individual), meso (organizational/operational), and macro (structural). Each level of analysis must be considered in order to adequately determine how the bio-psycho-social and environmental conditions affect the health and deviant behaviours of police officers, thereby leading to misconduct.

Law Enforcement and Stress Process

The stress process, as conceptualized by Pearlin, Menaghan, Lieberman, & Mullan (1981), identified three core components: stressors, moderators (social and psychological resources), and outcomes (psychological distress), with each serving as its own weaving of gossamer thread of emotions. According to Pearlin (2005), stressors refer to:

"problems, hardships, or threats that challenge the capacities of people; moderators refer to the social and personal resources that people can mobilize to contain, regulate, or ameliorate the effects of the stressors; and outcomes refer to the effects of the stressors that are observed after the moderating resources are taken into account" (p. 3).

When considering the stress process of law enforcement personnel, stress can be operationalized as the combined relationship of stressors and the police officer's response to the stressors. Stressors, which are the sources of stress, are the events and/or the triggers that present a threat or a challenge to police officers. Police officers may experience acute stress, resulting from an unexpected emergency such as mass shooting. They may also experience chronic stress, which is the stress that results from the day-to-day occupational expectations. It has been found that both the acute stress and chronic stress experienced by police officers increase the risk for psychological and physical health problems (Hartley et al., 2011b; Hartley, Sarkisian, Violanti, Andrew, & Burchfiel, 2013).

Even more, stress responses are the ways that a police officer reacts to the stressors; psychologically (e.g., PTSD symptoms), physiologically (e.g., flattened cortisol levels),

and behaviourally (e.g., police misconduct). Keep in mind that not all psychological symptoms are PTSD symptoms-related; they might be due to other mental health concerns or heightened overall stress (not a clinical disorder), burn-out, compassion fatigue, moral injury, and limited distress tolerance, for example. Also, we don't wish to imply that all police misconduct is related to psychopathology or PTSD symptoms. In addition, many officers are capable of making right decisions despite exposure to stressors. At least they are substantially better able to make right decisions (e.g., shoot/no shoot) compared to civilians; for example, although higher than suggested by official data, police officers accounted for about 8% of all homicides with adult male victims between 2012 and 2018 (Edwards, Esposito, & Lee, 2018). Nonetheless, when police officers are confronted with a stressor (i.e., personal, organizational/operational, and psychological/physical), they resort to a wide range of coping strategies to help alleviate the stress such as: religion, denial, substance use, emotional support, venting, humor, acceptance, and self-blame. (Acquadro Maran, Varetto, Zedda, & Ieraci, 2015; Lazarus & Folkman, 1984).

Law Enforcement, Stress, and Biomedical/Behavioural Health Disparities

Epidemiological research indicates that police officers have elevated mortality risk factors relative to the general population (Hartley et al., 2011a; Hartley et al., 2012; Joseph et al., 2009). For example, Violanti et al. (2013b) reported that the years of potential life lost for police officers was 21 times greater than the general population, mainly due to occupational stress, environmental work hazards, shift work, and obesity. Compared to other employed populations, police officers experienced higher rates of depression (12.0% vs. 6.8%), obesity (40.5% vs. 32.1%), metabolic syndrome (26.7% vs. 18.7%), and higher mean serum total cholesterol levels (200.8 mg/dL vs. 193.2 mg/dL) (Hartley et al., 2011a). Reduction in sleep quality and duration and physical activity has also been shown to be associated with perceived occupational stress among police officers (Charles et al., 2011; Ramey et al., 2012). In a 24-hour period, police officers (33%) are approximately four times more likely to sleep less than six hours when compared to the general employed population (8%) (Hartley et al., 2011a), which is associated with a four-fold greater number of metabolic syndrome health issues, thereby contributing to their risk for bio-psycho-social and environmental effects (Violanti et al., 2009a; Fekedulegn et al., 2013; Ramey et al., 2012).

Even further, acute exposure to a stressor can produce elevated cortisol levels lasting for approximately one hour after the initial response to the stressor (Khalifa, Bella, Roy, Peretz, & Lupien, 2003). During chronic stress exposure, the body's ability to self-regulate the secretion of cortisol becomes compromised, causing an allostatic overload, which is the body's inability to appropriately regulate the stress response (McEwen, 2008; Lippi, et al., 2009; Violanti, 2009b; Meyer, Novak, Hamel, & Rosenberg, 2014). Violanti et al., (2017a) found that as police officers' stress index increased, there was a flattening of their cortisol slopes over time. This is an important finding since Adam et al. (2017) conducted a systematic review and meta-analysis of cortisol and physical and mental health outcomes, and their results indicated a

significant association between flattened cortisol slopes and poorer physical and mental health across all studies.

Most recently, the biological basis of personality has been scientifically investigated using personality neuroscience to examine the individual differences in behaviour, motivation, emotion, and cognition. Personality neuroscience employs methods of personality psychology to link biological variables to trait through assessment of brain structures. It has been found that the Big Five personality traits (Extroversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience) have some effect on various brain systems that influence health (Young, 2010). This is important because personality types have also been identified to be important factors in determining how stress is regulated differentially (Cooper, 2005). Those personality types that are associated with healthier traits seem to mediate the deleterious effects of stressors (Afshar et al., 2015). In regard to law enforcement personnel, police officers with personality types, such as egocentricity and stimulation-seeking tendencies, were significantly associated with insubordination, neglect of duty, and excessive citizen complaints (Weiss, Rostow, Davis, & DeCoster-Martin, 2004; Weiss, Zehner, Davis, Rostow, & DeCoster-Martin, 2005). Researchers have found that police officers with traits of narcissistic personality disorder, or who had personality traits such as neuroticism, psychoticism, and extroversion, were significantly associated with psychological stress, thereby placing them at high risk for the development of a psychological disorder leading to misconduct (Kaur, Chodagiri, & Reddi; 2013; Weiss, Vivian, Weiss, Davis, & Rostow; 2013). Hence, the daily stressors that police officers experience during the course of their long working hours put them at significantly higher risk than the general population for physiological, psychological, and physical health effects (Fekedulegn et al., 2013; Zimmerman, 2012; Violanti et al., 2013b), which has also led to police misconduct (Weiss et al., 2013; Bishopp, Worrall, & Piquero, 2016).

Law Enforcement, Stress, and Police Misconduct

Police misconduct has been defined in many ways and the term has been used to describe many different behaviours and actions. However, the U.S. Supreme Court defined police misconduct as the "misuse of power, possessed by virtue of state law and made possible only because the wrongdoer is clothed with the authority of the state" (United States v. Classic et al., 1941). With the reported increase in this "misuse of power", there has been some recent interest in the relationship between stress and police misconduct. For example, researchers are currently working with a sample of members of the Buffalo Police Department on a three-year, \$814,000 study being funded by the U.S. Department of Justice's National Institute of Justice to examine the effects of mild-to-severe PTSD on attention and cognitive control in police. It is the researcher's contention that police officers who experience high levels of PTSD symptoms have more difficulty in selectively attending to on-the-job police situations and in making the right decision—which may lead to police misconduct (Hill, 2018).

Also, the stress associated with the unpredictability of police work causes police officers to perceive most, if not all, citizens as "symbolic assailants"—defined by Skolnic (1994) as the intuitive techniques developed by police officers to identify potential perpetrators of the law using indicators

such as a person's appearance, language, gestures, attitude clothing, hairstyle, body language, or tattoos. Johnson, Todd, and Subramanian (2005) described it this way: "the highly unpredictable and potentially dangerous persons who cannot be dependably identified in advance condition officers to treat each individual with suspicion and caution" (p.4). It is proposed that this is caused by the aggressive cognitive scripts that are developed by police officers due to their exposure to acute high-intensity stressors (Groves & Anderson, 2016; DeWall, Anderson, & Bushman, 2011). These aggressive cognitive scripts are developed through repeated observations of prior aggressive behaviours or internalized values, but can also include stereotypes that are learned through the socialization process (DeWall et al., 2011; Cox & Devine, 2015). The aggressive cognitive scripts can also be developed through environmental and contextual cues that activate stress-induced, out-group threat appraisals. This is manifested by means of such pervasive stereotypes of Black men being associated with criminality or violence. Hence, the appraisal of Black men as violent, combined with the aggressive cognitive scripts, may increase the risk of police misconduct with a Black male suspect compared to a White male suspect (Miller, Maner, & Becher, 2010).

Moreover, most researchers either define or theorize police misconduct based on several micro-meso-macro-level characteristics associated with law enforcement.

1. Micro-level characteristics such as police officers' race, age, length of service, and rank (Kane & White, 2012; Kane & White, 2009; Donner & Jennings, 2014; Wolfe & Piquero, 2011).
2. Meso-level characteristics such as the structural disadvantage of the community where police officers work, defined as percentages of persons in a given community with severe material hardships, and population mobility, defined as percentages of persons in a given community who reside at their current address less than five years (Kane, 2002).
3. Macro-level characteristics such as law enforcement policies and work culture (Wolfe & Piquero, 2011; Skogan & Frdyl, 2004; Brooks, 2005; Westmarland, 2005).

While others employ theoretical models to help understand and explain actions and behaviours, mainly from a micro-level perspective, as found in Thomas Hobbes' theoretical framework on deterrence theory (1651, trans.2017), which argues that, when faced with opportunities to break the law, we consider the long-term consequences of our actions and that may prevent us from engaging in criminal behaviour. Another is Gottfredson & Hirschi's (1990) self-control theory, which posits that a person's lack of individual self-control is the main factor behind criminal behaviour. Agnew's (1992) strain theory proposes that individuals experience negative emotional states, such as anger, depression, and fear, due to exposure to various forms of strain. Criminal behaviour develops as individuals attempt to cope with these negative emotional states through criminal activity. Tittle's (1995) control balance theory is based on the premise that a control ratio, which is the ratio of the controls that an individual exercises to what controls the individual experiences, is the main cause of criminal behaviour. Akers (1998)

social learning theory suggests that an individual's socialization produces both conforming and criminal behaviour. Druckman's (1998) social exchange theory hypothesizes that people weigh the potential benefits and risks of social relationships, which links perceived organizational treatment of employees to criminal behaviour.

While the above definitions and theories shed some light on police misconduct, the emergence of more critical, interdisciplinary theories is essential and needed to better understand such misconduct's underlying causes scientifically and practically. The purpose of this paper is to develop a conceptual model that provides a picture of police stress exposure, and the role of the bio-psycho-social and environmental contributors that can impact the police work environment, which may influence the stress experienced by police officers that lead to police misconduct. Results from this model development will increase our understanding of the biomedical and behavioural disparities that impact stressful exposure on health and well-being of law enforcement officers. The emergence of a more robust, interdisciplinary theory and framework will yield greater understanding by law enforcement, research, policy, and practice communities. The point across the behavioural continuum that tips the balance of healthy reasoning to a behaviour of police/criminal misconduct requires a comprehensive analysis of the bio-psycho-social and environmental health effects confronting police, thereby leading to appropriate prevention and intervention strategies.

METHODS

The current review utilized to develop Behavioural-Biomedical Law Enforcement Stress Discordance Model (B²LESD) summarizes the more representative studies investigating the relationship between stress and police misconduct. Relevant studies conducted from year 2008 to present were searched and collected through a number of databases, including the PubMed, the EBSCOhost Online Research, the Social Sciences Citation Index, the MEDLINE, the PsycINFO, and SOci. The search parameters focused on using keywords such as 'police misconduct and stress', 'police misconduct and general strain', 'police misconduct stress, and health', and 'police misconduct general strain, and health'. After relevant research articles were identified, further efforts were made to scan through the references of these articles to locate other relevant research articles for the review. Among all the studies that were identified, those with standard quality and representation in terms of design, method, and sampling were included in the review.

Although a substantial number of empirical studies investigated police misconduct and its relationship with stress, general strain and health were identified through the aforementioned databases, most of the studies did not fulfill the purpose for review. Empirical research articles adopted for this review were defined as quantitative or qualitative studies that included in their methods and findings at least the application of one inferential or correlation statistic to investigate the association between police misconduct and its relationship with stress, strain, and health. One exception was made which allowed for a comprehensive literature review of recent empirical research on police stress and psychological and physiological health outcomes in police officers due

to the depth of the content. The final sample for this review consists of eight quantitative studies, one qualitative study, and one comprehensive literature review, across the years from 2008 to 2018.

RESULTS

Preliminary Findings

Table I provides a summary of the characteristics of the ten studies that met the inclusion criteria.

The aim of the study conducted by Bishopp and colleagues (2018) was to examine the relationship among police stress, anger, depression, and burnout using the Police Work Experience Survey. This was a cross-sectional study utilizing data from 1,400 police officers employed at three large urban police departments in Texas. The researchers found that organizational stress was positively associated with depression and burnout. Organizational and environmental stress was positively associated with anger, although organizational stress had a stronger influence on expressions of

TABLE I Summary of key findings

Study	Sample Characteristics	Materials	Study Design	Findings
Bishopp, Piquero, Worrall, & Piquero,(2018)	1,400 sworn police officers from three of the largest urban centers in Texas: Agency A is located in south central Texas; Agency B is in northeastern Texas; and Agency C is found in the state's Western region.	3-item anger scale; 5-item depression scale; 4-item burnout scale; 10-item organizational strain scale; and 6-item environmental strain scale	Cross-sectional data analyses utilizing the Police Work Experience Survey (PWES).	Organizational stress was positively associated with depression and burnout. Organizational and environmental stress were positively associated with anger, with organizational stress being a stronger influence on anger. Minority officers reported less emotional-response to stress than white officers.
Reynold, Fitzgerald, & Hicks (2018)	Four former and 20 current police officers representing eight police departments in the United States; Police Department sizes ranging from approximately 30 officers in a department to more than 2,000 officers.	Officers were asked questions such as the following: 1. Can you think of an incident in which you felt that you were not treated fairly by the department? 2. How did that experience make you feel? 3. How did you respond to the experience?	Qualitative semi-structured interview process.	Police officers reported engaging in production deviance in response to organizational stress.
Zavala & Kurtz (2016)	1,104 police officers from Baltimore City Police Department.	1-item perpetrator; 1-item alcohol consumption; 4-item coercion; 2-item social-psychological deficits; 2-item social support	Cross-sectional data analyses utilizing the Police Stress and Domestic Violence in Police Families in Baltimore, Maryland, 1997-1999.	Child maltreatment and peer victimization related to IPV but mediated by anger. Street victimization and inherent policing coercion related to alcohol consumption.
Bishopp, Worrall, & Piquero (2016)	1,449 police officers from three large agencies in Texas: Agency A had 1,740 sworn officers serving a community of approximately 885,000; Agency B served 1.3 million constituents with 3,454 officers; and Agency C had 1,066 officers responsible for roughly 675,000 people.	3-item police misconduct; 3-item organizational strain; 3-item anger scale	Cross-sectional data analyses utilizing the Police Work Experience Survey (PWES).	Stress from fatigue and internal investigations was significantly related to driving misconduct. The relationship between organizational stress and yelling/cursing and unnecessary force was attenuated by anger.

TABLE I (cont'd)

Study	Sample Characteristics	Materials	Study Design	Findings
Kurtz, Zavala, & Melander (2015)	1,104 police officers from Baltimore City Police Department.	1-item police misconduct; 12-item physical/psychological stress; 2-item childhood strain exposures; 9-item critical incident strain	Cross-sectional data analyses utilizing the Police Stress and Domestic Violence in Police Families in Baltimore, Maryland, 1997–1999.	Exposure to childhood strain related to higher critical incident strain. Childhood strain and critical incident strain are associated with increased stress. Childhood strain and critical incident strain increases the odds of officer-on-officer violence.
Harris (2014)	938 officers who were employed by a large police department in the northeastern USA from January 1, 1987 through June 30, 2001.	Computerized records of academy scores and patrol zones retrieved from the personnel system; and computerized records of police misconduct data from the internal affairs (IA) unit.	Cross-sectional data analyses of police misconduct filed against officers, using both all complaints and only substantiated complaints, from data collected from police officers followed for a long period of their careers.	It takes approximately 3.7 years for onset of police misconduct. Police officers assigned to higher-crime patrol zones were more likely to onset of police misconduct than those who were assigned to lower-crime patrol zones.
Akinola & Mendes (2012)	81 active male police officers employed by a Massachusetts police department.	Saliva samples were obtained before and after stressful role play (Neuroendocrine responses) shoot/don't shoot video game simulation (decision-making).	Analyses of induced cortisol increases with an adapted Trier Social Stress Task and then police officers complete a shoot/don't shoot computerized-decision-making task.	Larger cortisol increases to the stress task was related to fewer errors in the decision-making task; relationship was stronger when the targets were armed and Black than when the targets were armed and White.
Wolfe & Piquero (2011)	Random sample of 504 police officers selected from all 3,810 Philadelphia Police Department (PPD) officers of the rank patrol officer, sergeant, or lieutenant as of January 2000.	3 measures of police misconduct; 6-item organizational justice; 2-item procedural justice; 3-item code of silence; 8-item noble cause beliefs; six hypothetical vignettes to measure perceptions of deviant peer associations	Cross-sectional data analyses utilizing the data originally collected by Greene and Piquero (2000) in a study of police integrity in Philadelphia funded by the National Institute of Justice.	Police officer perceptions of organizational justice was associated with lower likelihoods of police misconduct (e.g., having citizen complaints filed, IAD investigations instigated, or disciplinary charges).
Shane (2010)	Convenience sample of 461 sworn incumbent police officers, who were actively working in the patrol division, and from two police departments located in two different cities in the United States.	Two subscales measuring operational stressors (20 job content questions) and organizational stressors (20 job context questions); performance data gathered from police departments' records.	Cross-sectional data analyses utilizing the 40-item Police Stress Questionnaire.	Leadership and supervision, management, and internal affairs are negatively related to job performance. White officers, female officers, older, those who are not married, and those who have more children tend to have lower job performance.

TABLE I (cont'd)

Study	Sample Characteristics	Materials	Study Design	Findings
Violanti et al. (2017b)	66 empirical studies that examined the relationship between police stress and physical and psychological health outcomes (cross-sectional, prospective, retrospective, and experimental studies; meta-analyses or systematic reviews) from 15 countries around the world (Australia, Brazil, Canada, Finland, Germany, Israel, Italy, The Netherlands, New Zealand, Poland, Sweden, Switzerland, Turkey, United Kingdom, United States of America).	Articles that investigated associations between police stress and health-related outcomes.	Searches of relevant databases (years 1990-2016) including PubMed, Scopus, Embase, ProQuest, PsycINFO, PILOTS, and Google Scholar.	Number of studies showing police stress related to: <ul style="list-style-type: none"> • Burnout (3) • Chronic disease (1) • Cortisol (2) • Cortisol and PTSD (2) • CVD risk factors (6) • CVD risk factors and PTSD (1) • CVD risk factors and organizational stressors (5) • Depression (2) • Injuries (5) • Metabolic syndrome (1) • Metabolic syndrome and organizational stressors (4) • Neurological disorders (2) • Psychological strain (4) • Psychological strain and organizational stressors (1) • PTSD (2) • PTSD (5) • PTSD and organizational stressors (2) • Sleep disorders (16) • Sleep disorders and stressors (1) • Suicide ideation (1)

anger than environmental stress. When considering race, the officers who identified with a minority group reported less emotional-response to stress than non-minority officers. In another relevant study, Reynolds and colleagues (2018) conducted a qualitative study with 4 former and 20 current police officers representing eight police departments in the United States. The data analyses revealed that the events that police officers associated with organizational injustice were: disciplinary actions, citizen complaints, supervisory disagreements, and blocked career aspirations (i.e., promotions). The stress and anger associated with their perception of the events led them to engage in production deviance (e.g., wasting resources or intentionally altering discretionary activities such as proactive policing) and self-protective behaviours (withdrawing and “laying low”).

Zavala and Kurtz (2016) conducted a study of 1,104 police officers from the Baltimore City Police Department to examine the differences in coercion and social support theory on police officers' misconduct. Their cross-sectional analyses were done using data from the *Police Stress and Domestic Violence in Police Families in Baltimore, Maryland, 1997–1999* (Gershon, 2000). The focus of this study was to test whether social

support theory could explain intimate partner violence (IPV) and moderate-to-severe substance use among police officers. Evidence was found to support the proposition that a police officer's history of child maltreatment (e.g., child abuse) and peer victimization (e.g., assaulted by fellow police officer) were related to IPV, although the relationship was attenuated by anger. Also, history of street victimization (e.g., assaulted by suspects or civilians) and inherent policing coercion (e.g., making a violent arrest, responding to a bloody crime scene) were related to moderate or severe alcohol use.

Bishopp and colleagues (2016) utilized a similar sample and instrument as the study conducted by Bishopp and colleagues (2018), presented above, to investigate how the general strain theory could explain the relationship between organizational stress and police deviance among 1,389 police officers from three large police departments in Texas. Their analyses revealed that the stress from fatigue and internal investigations was significantly related to police misconduct relative to operating a police car. Even further, there was an association between organizational stress and verbal abuse by police officers and unnecessary force, although both types of relationships were attenuated by anger.

Another study that utilized the *Police Stress and Domestic Violence in Police Families in Baltimore, Maryland, 1997–1999* was conducted by Kurtz and colleagues (2015). They examined the influence of prior child abuse and exposure to interparental violence on police officers' participation in work-related traumatic events (e.g., shooting someone) psychological–physiological stress responses, and officer-on-officer assaults. This was a cross-sectional study utilizing a similar sample of police officers as the study conducted by Zavala and Kurtz (2016), presented above. The researchers found that a history of child abuse or exposure to interparental violence was related to higher incidents of participation in work-related traumatic events—all of which were associated with increased stress. The odds of officer-on-officer assaults were increased if police officers had a history of child abuse or exposure to interparental violence or participated in work-related traumatic events.

The aim of Harris' (2014) study was to examine the factors that contribute to, or mediate, the odds of engaging in an episode of police misconduct, among 938 police officers who were employed by a large police department in the Northeastern United States from January 1, 1987 through June 30, 2001. The computerized records of academy scores and patrol zones, as well as records of police misconduct data from the internal affairs unit, were analyzed. This cross-sectional study analyzed police misconduct filed against police officers, using both "all complaints" and "only substantiated complaints." It was determined that it takes approximately 3.7 years for the onset of police misconduct among these police officers. Most importantly, police officers assigned to higher-crime patrol zones were more likely to experience an onset of police misconduct than those who were assigned to lower-crime patrol zones.

The purpose of the Akinola and Mendes (2012) study was to examine the effects of neuroendocrine responses on police-related decision-making skills using a videogame simulation of a shoot/don't shoot task. First, cortisol levels were assessed among 81 active male police officers who were employed by a Massachusetts police department, using saliva samples. Next, the police officers participated in an adapted Trier Social Stress Task which included a high-stress role play involving Black males who reported physical and verbal maltreatment by a police officer based on his race. They then were exposed to images of Black and White men who were holding various guns and items that were not guns (e.g., cell phones) and instructed to quickly press a button on the computer to indicate how they would respond (shoot/don't shoot). The police officers earned points for correctly shooting armed individuals and lost points for shooting an unarmed individual or not making a decision within 850 milliseconds after viewing an image of a Black or White male. The results of the study revealed that as a police officer's cortisol level increases, there were fewer errors in their decision-making skills related to the stress task. The relationship between increased cortisol level and decision-making skills related to the stress task was stronger when the targets were armed and Black than when the targets were armed and White.

Wolfe & Piquero's (2011) study used survey data originally collected by Greene & Piquero (2000) in a study on police integrity in Philadelphia, funded by the National Institute of

Justice (NIJ). The role of organizational justice in police misconduct was examined among a random sample of 483 police officers who were patrol officers, sergeants, or lieutenants as of January 2000, and employed in the Philadelphia Police Department. They found that police officers' perceptions of organizational justice were associated with lower likelihoods of police misconduct (e.g., having citizen complaint filed, IAD investigations instigated, or disciplinary charges). In a later publication, Shane (2010) conducted a study, utilizing the 40-item Police Stress Questionnaire, to examine the impact of organizational stressors on police performance. The study consisted of a convenience sample of 461 sworn incumbent police officers, who were actively working in the patrol division, and from two police departments located in two different cities in the United States. The analyses revealed that leadership and supervision, management, and internal affairs are negatively related to job performance. With regard to the role of socio-demographics, White officers, female officers, older officers, those who were not married, and those who had more children, were more prone to have lower job performance.

Finally, Violanti and colleagues (2017b) conducted a comprehensive literature review to examine the relationship between police stress and physical and psychological health outcomes. Relevant studies conducted from year 1990 to 2016 were searched and collected through a number of databases, including PubMed, Scopus, Embase, ProQuest, PsycINFO, PLOTS, and Google Scholar. They then reviewed 66 empirical studies that were either cross-sectional, prospective, retrospective or experimental. Included in this review were meta-analyses or systematic reviews. The strength of this review is the heterogeneity of the studies across 15 countries from around the world (Australia, Brazil, Canada, Finland, Germany, Israel, Italy, The Netherlands, New Zealand, Poland, Sweden, Switzerland, Turkey, United Kingdom, United States of America). The results revealed that police stress at the micro, meso, and macro levels was related to several biomedical and behavioural health outcomes to include the following: burnout, chronic disease, cortisol levels, PTSD, CVD risk factors, depression, injuries, metabolic syndrome, neurological diseases, psychological strain, sleep disorders, and suicidal ideation.

Primary Findings

The literature review provides empirical evidence of both biomedical and behavioural outcomes associated with police stress and the processes involved that may lead to police misconduct. The results of the nine studies and one literature review offer a conceptual idea of the associations among police stress, health, deviance, and police misconduct. First of all, law enforcement is an occupation that exposes police officers to a plethora of stressors that lead to biomedical and behavioural disparities, while at the same time increases the risk that a police officer will engage in police misconduct. This pathway seems to be experienced through several channels, such as police officers' perceptions of organizational justice, fatigue, burnout, current exposure to traumatic events, and history of past traumas. One of the constant findings was the role that anger played in the relationship between police stress and misconduct. This is significant, because anger is related to several factors including heightened stress levels,

PTSD, depression, low tolerance to frustration, emotional dysregulation, perceived injustice, and burnout—all of which is related to police misconduct. Second, there was an identified time frame for the onset of misconduct (approximately 3.7 years) after being exposed to the stressors associated with policing. This allows us to know that misconduct is not an immediate response to stressors, but rather an end result in the domino effect caused by the sequence of events related to stress, health, and deviant behaviours. Finally, certain socio-demographics must be considered when developing any interventions for police misconduct based on stress. For instance, Ross (2015) puts forward that police misconduct was more prevalent in police departments located in larger metropolitan counties plagued with extreme economic inequities and a large proportion of African American residents with low median incomes. Even more, it was found that the demographics of an average victim of police misconduct were a 29-year-old male (88.1%) who was non-White (70.4%). The average police officer was a 34-year-old male (94.7%) who was white (70.4%) (Lee, Vaughn, & Lim, 2014). Even more, while only 13% of the total US population is African American, they account for 28% of the persons killed by police officers. At the same time, while White Americans make up 61% of the total US population, they account for 75% of the employed police officers (Menifield, Shin, & Strother, 2018). Hence, public health and criminal justice practitioners should consider these socio-demographic factors, as well as others, when planning prevention and intervention strategies.

Although a key limitation is the cross-sectional design of most of the study designs, this is a “call to action” to inspire researchers to explore the associations among police stress, health, and police misconduct, utilizing a longitudinal study

design to determine causality. Nonetheless, the research findings from the literature review are based on sound bio-psycho-social and environmental evidence of the relationship between stress-related disorder and deviance that lead to misconduct among police officers.

DISCUSSION

Framing the Conceptual Model

The purpose of this paper serves as a guiding framework that more accurately provides a conceptual picture of police stress-exposure and the role of the bio-psycho-social and environmental contributors that impact the police work environment, thereby influencing the stress experienced by police officers that lead to police misconduct. To address the broader theoretical relationships across the various dynamic studies, theories, concepts, and approaches, we utilize an epidemiological criminology (EpiCrim) framework (Akers & Lanier, 2009; Akers, Potter, & Hill, 2013; Waltermaurer & Akers, 2013) to develop the Behavioural-Biomedical Law Enforcement Stress Discordance Model (B²LES_D), graphically illustrated in Figure 1. This model posits that the pathways of police stress leading to police misconduct requires researchers to examine the health and deviant behaviour among police officers as both distinct and balanced, while simultaneously differentiating between biomedical and behavioural disparities (Akers & Whittaker, 2010). Utilizing an EpiCrim framework allows the results of each level of analyses to be used as a blueprint for providing primary, secondary, and tertiary prevention approaches and techniques that can be implemented to address the etiological-stress dimensions linked to poor health outcomes and misconduct among police officers (Akers, Potter, & Hill, 2013).

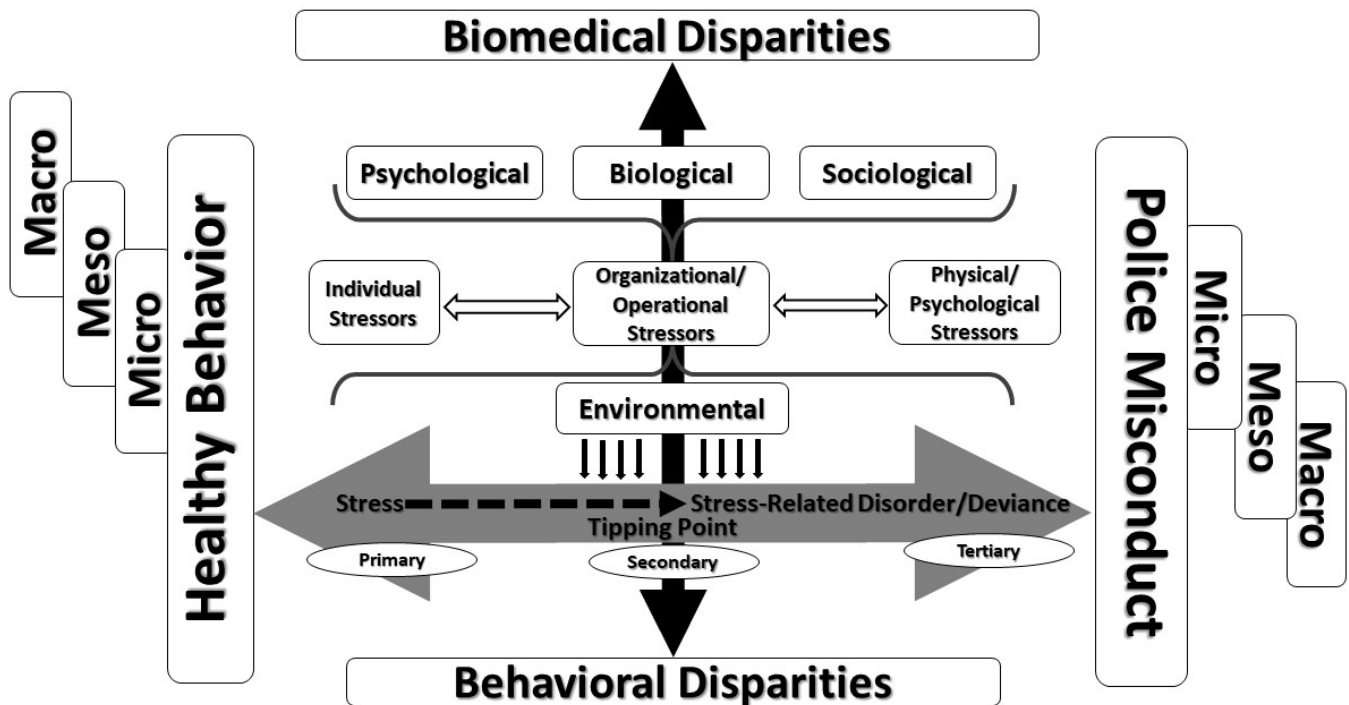


FIGURE 1 Behavioural-biomedical law enforcement stress discordance model (B²LES_D): An epidemiological criminology framework.

Due to the complexity of the model, we divide the full B²LESD model into three parts graphically to further explicate the concepts in the model portraying the police-stress process that leads to police misconduct. Part 1 (epidemiological criminology triad) breaks down further the description of the epidemiological criminology aspect shown in the full model (illustrated in Figure 2). Part 2 (bio-psycho-social-environmental explanation) dissects the part of the full model that shows how stressors (i.e., individual, organization/operation, physical/psychological) are related to biomedical and behavioural disparities, and associated with the psychological, biological, sociological, and environmental aspects of law enforcement (illustrated in Figure 3). Finally, Part 3 (treatment implications), discusses the proposed treatment process for law enforcement personnel with regard to stress related disorder/deviance, to reduce the prevalence of police misconduct (illustrated in Figure 4). Figures 2, 3, and 4 collectively show how the key factors illustrated in the full model (Figure 1) are connected to, or affected by, one another, as well as the connection from primary to tertiary prevention.

Epidemiological Criminology Triad

The Behavioural-Biomedical Law Enforcement Stress Discordance Model (B²LESD) is theorized around the critical elements from the ten studies reviewed. Some of the limitations in the research cited have been the lack of, in many ways, theories from epidemiology and criminology relative to their public health and criminal justice interaction, respectively. Quite literally, one of the only theories that integrate an

analysis that incorporates the sciences of epidemiology and criminology with the sciences of public health and criminal justice is the emerging theory, paradigm, and discipline of epidemiological criminology. However, the B²LESD examines the epistemology (or vector) of police-stress misconduct with the more conventional epidemiological triad of agent, host, and environment approach.

Figure 2, for example, illustrates that stress and police misconduct are considered in the environments in which they are defined, where they are experienced and manifested, and where police officers are assessed, diagnosed, and sanctioned—all done simultaneously for optimal results. In this process, the stress-agent (what) is the cause of the disorder and/or deviance in police officers that lead to misconduct (i.e., organizational, psychological, or individual stressors). The vector (how) is the transmittal that conveys the stressor as a pathogen from one police officer to another without actually causing the disorder itself, but may be a part of the infecting process. The host (who) is the police officer that is exposed to the stressors and harbours the stress-related disorder/deviance (SRD²), who may or may not become disordered or engage in deviant behaviour. The police officer may or may not know that they have SRD² and may not present with any visible signs and symptoms. It must be noted here that different police officers may have different exposure-reactions to the same stress-agent. The environment (where) is the favourable external surroundings or conditions where the police have contact, that causes or allows the stress-agent to transmit the SRD² (e.g., site of a mass shooting).

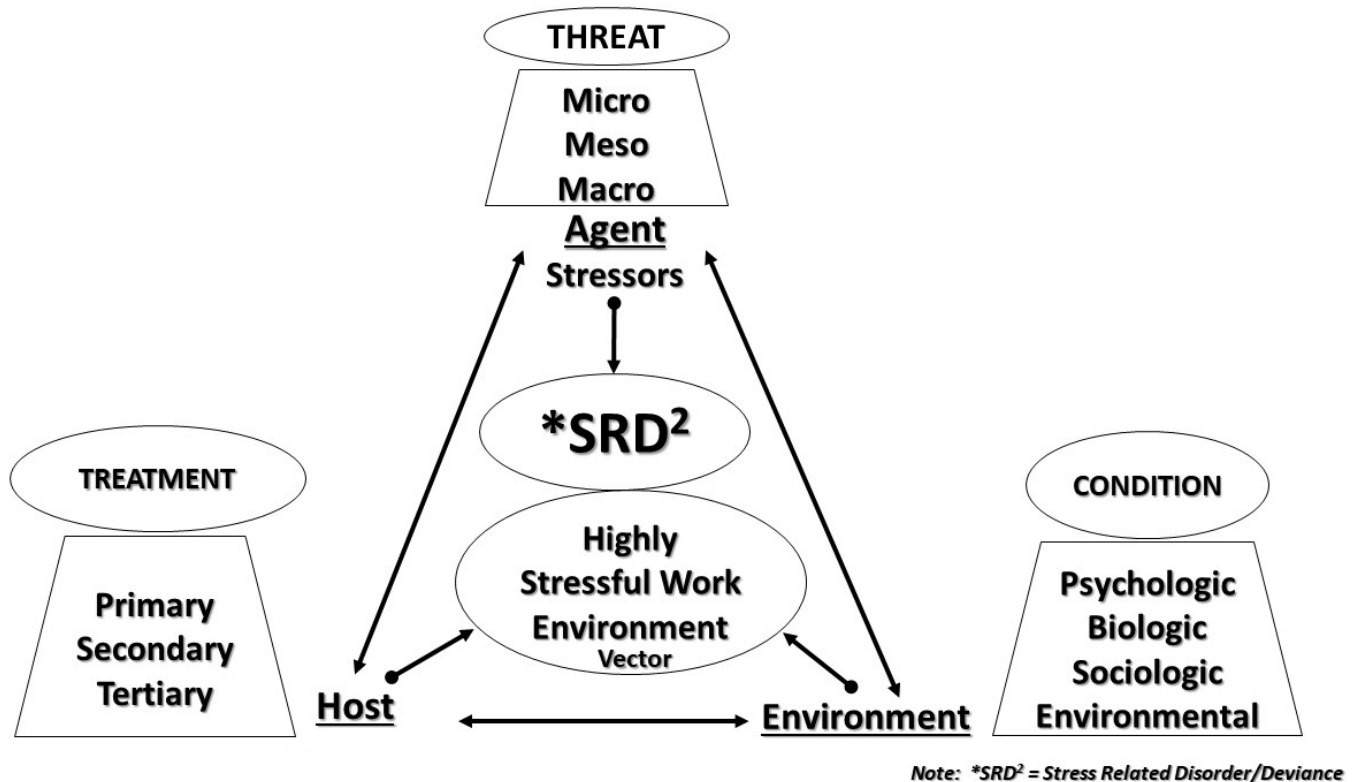


FIGURE 2 Epidemiology of police-stress misconduct.

Bio-Psycho-Social-Environmental Explanation

Even further, the analysis of the current literature review points to a bio-psycho-social-environmental explanation for the rates of police misconduct as police officers attempt to exist as ‘normal human beings’ while engaging in their policing expectations. This phenomenon is coined as “policing while existing”; depicted in the Behavioural-Biomedical Law Enforcement Stress Discordance Model (B²LES^D) and illustrated in Figure 3. The “policing while existing” phenomenon describes the cumulative bio-psycho-social-environmental cost of being employed in the law enforcement profession. First of all, the biological factors associated with the law enforcement profession are very important in epidemiological criminology. The biological markers associated with stress-related disorder/deviance (SRD²) (e.g., cortisol levels, BMI, personality neuroscience) help us to understand the prevalence and incidence of the disorder under investigation (Young, 2010; Perugula, Narang, & Lippman, 2017; Hartley et al., 2011b; Violanti et al., 2017a) from the perspective of biomedical disparities. Thus, an epidemiological criminology perspective also accounts for all of the behavioural changes that occur due to the police officer’s exposure to stressors at the individual, administrative/organizational, and psychological levels. For example, certain psychological

states (e.g., PTSD, depression) developed as a result of the stress-exposure can shift a police officer from being healthy to having stress-related disorder/deviance (SRD²), leading to police misconduct. In sum, it is important to understand the psychological state of police officers in order to appropriately administer the right intervention strategy. Otherwise, such lack of understanding would be analogous to giving an antibiotic or other medication to a patient while not caring to try and diagnose the underlying condition.

The sociological perspective affords us the opportunity to include the meso and macro level units of analysis. Police officers’ interaction with other police officers, community members, institutions, and organizations contribute to their cumulative health outcomes, leading to police misconduct. For example, the criminal justice system in which a police officer is indoctrinated has a long history of engaging in marginalizing behaviours towards immigrants and diverse minorities (Johnson, 1981), or others with few resources to challenge police officer behaviour. The early police officers had little to no formal training, and more often represented the political party in power than the legal system, while engaging in varied police misconducts (Conser & Russell, 2000). Most recently, law enforcement agencies have been attempting to address their fundamental mission while

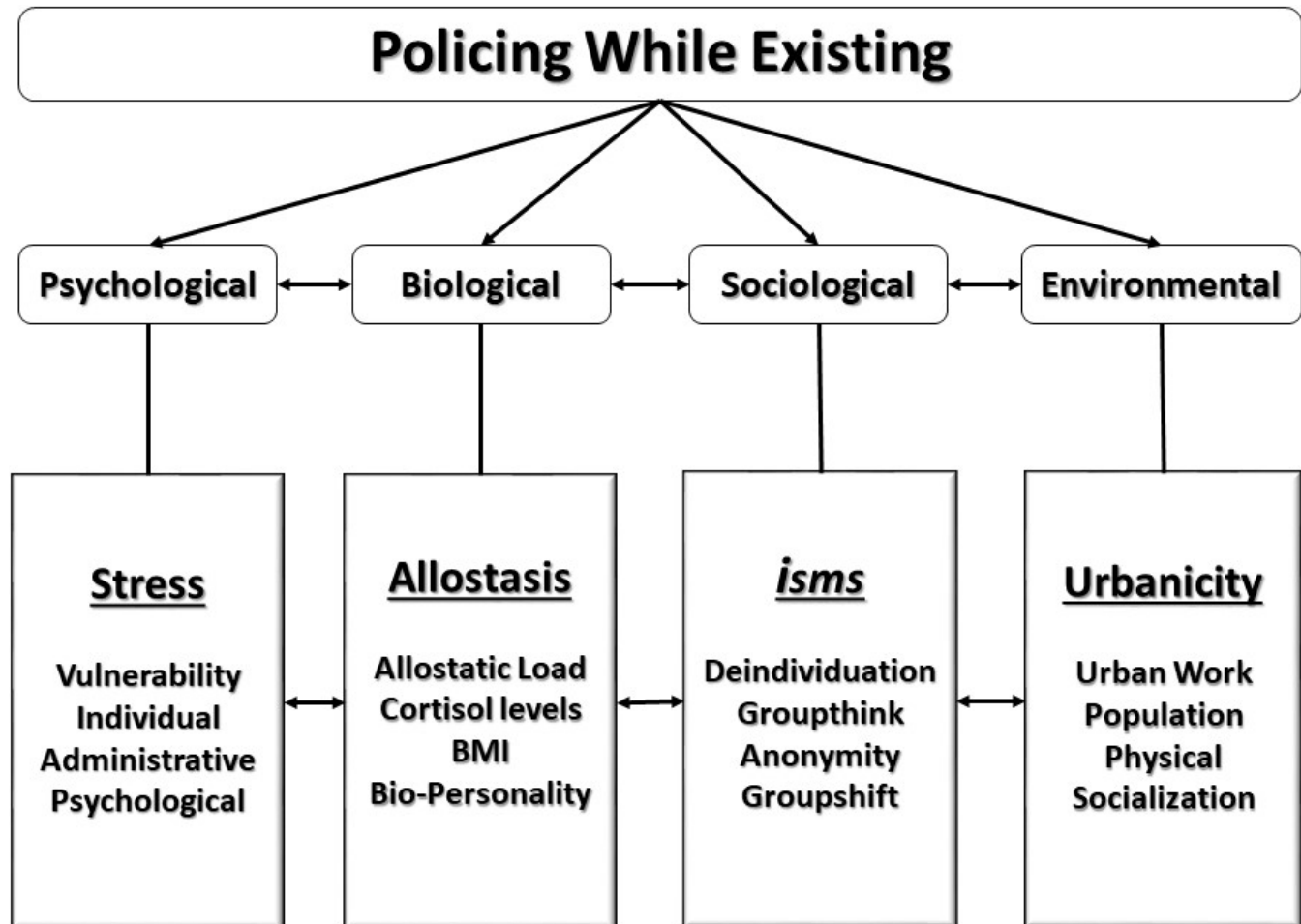


FIGURE 3 Policing while existing phenomenon.

concerning themselves with the issues inherent in the core strategies of policing (Weisburd & Braga, 2006). On the other hand, the police subculture is the primary peer group in which police officers develop new beliefs and values that may depart from acceptable behaviour. They may engage in a process of de-individualization, where police officers seemingly lose their sense of identity or individuality when placed in the police subculture. This results in the loss of what would be considered normal implementation of self-control or moral restraints, placing them at high risk for misconduct (Yousman, 2004). Even further, the police uniform plays a vital role in police officers losing their sense of anonymity and shifting their once-held individual standards of behaviour to adopt the police subculture beliefs, goals, and standards (Zimbardo, 1969).

The urban environmental perspective of police officers encompasses the social, physical, and the resource infrastructure. Keep in mind that the environment of police officers is determined and scrutinized by multiple political factors to include mayors, police commissioners, city council members, and community leaders. The environments that police officers are exposed to differ, based on the departmental policing style, population size versus size of police force, and the resources that are readily available. Furthermore, law enforcement personnel are currently being exposed to a rapidly changing environment, and these changes affect health and well-being through the pathways of increased pressure to learn new skills while adapting and competing for resources in order to manage work demands (Cox & Griffiths, 2005). This may result in stressful working environments that include longer hours, job insecurity, role conflict, insufficient rewards, harassment, and poor work-life balance, leading

to misconduct (Helleybuyck, Nguyen, Halphern, Fritze, & Kennedy, 2017).

Treatment Implications

The implications for developing the Behavioural-Biomedical Law Enforcement Stress Discordance Model (B²LES^D), from an epidemiological criminology perspective, are based on the premise that prevention is an important concept for both public health and criminal justice practitioners. It is also important to note that prevention is also important for health or mental health professionals (e.g., psychiatrists, psychologists, social workers), as well. At the micro and meso levels, mental health professionals' role is integral in changes such as preventative interventions and treatment, for example. Based on the results of this literature review, we can state with some confidence that there are many occupational factors associated with law enforcement that lead to increased risk for profound health issues and deviance among police officers. Hence, the law enforcement arena serves as a veritable petri dish for stress-related disorder/deviance (SRD²) requiring preventive actions. B²LES^D presents a multi-dimensional intervention process to interrupt the progression of stress-related disorders and deviance (SRD²) among police officers in order to prevent asymptomatic police officers from further risk.

The continuum of primary, secondary, and tertiary prevention is graphically presented in Figure 4 to illustrate the risk-process of movement from no stress-exposure to chronic stress-exposure. Primary prevention is required when police officers are not presenting with any symptoms of stress-related disorders and deviance (SRD²) although they may have been exposed to stressors. Secondary prevention

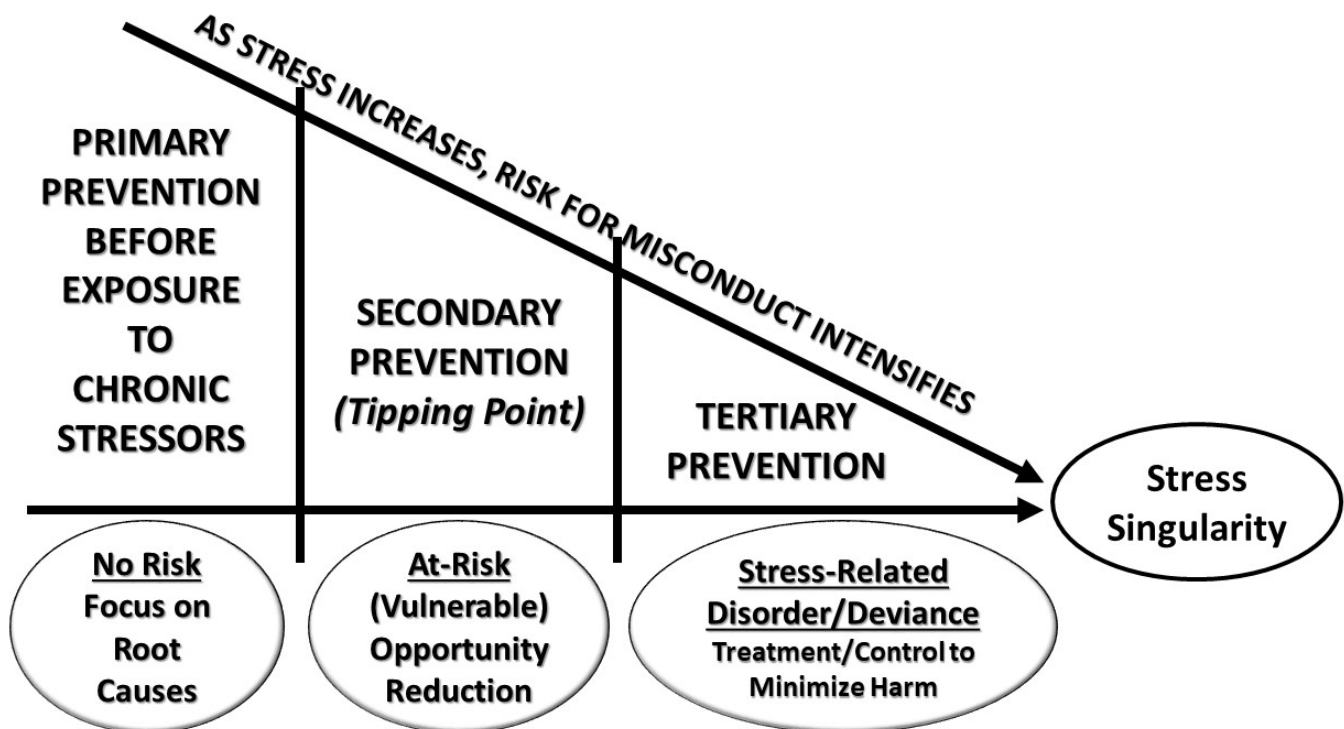


FIGURE 4 Police-stress misconduct prevention grid.

becomes necessary for police officers who have been exposed to chronic stressors and are showing symptoms of SRD² (e.g., poor and interrupted sleep, increased aggression). Tertiary prevention is warranted once SRD² is identified in a police officer, as a means of preventing further damage to the police officer and to the community. It also becomes necessary to prevent SRD² from spreading to other police officers.

It is also important to note that, as stress exposure increases, it becomes more focused, more intense, to such a degree that stress becomes theoretically infinite and eventually implodes into behaviours. These behaviours are led by outside external pressures that continuously push at the object/host, and, in our case, the police officer. This is what we call a “stress singularity”. In physics and engineering, a stress singularity is a force applied at a single point (point load) that, as refinement continues, the stress at the point load keeps increasing and increasing (Huston & Josephs, 2008; Joshi, 2008). The stress becomes theoretically infinite, and the matter and energy created converges on itself, thereby imploding. After an implosion, what follows is a massive explosion of force, and, in our context, police behaviour. Yet, to address this possible stress singularity, it will require treatment through medical and social rehabilitation and, in extreme cases, quarantine (Akers, Potter, & Hill, 2013).

CONCLUSIONS

Importantly, findings from the review of the literature point to the need for there to be an improvement in the bio-psycho-social and environmental health outcomes of law enforcement individuals employed in a highly stressed profession. The development of the Behavioural-Biomedical Law Enforcement Stress Discordance Model (B²LESD) is a developing framework for understanding the biobehavioural impact of stressful exposure on the health and wellness of law enforcement officers. It can serve as a tool to help the law enforcement, research, policy, and practice community to understand the stress-induced bio-psycho-social and environmental health effects confronting police, that seemingly lead to police misconduct (Akers et al., 2013; Shirom, 2003). In fact, Amaranto, Steinberg, Castellano, & Mitchell (2003) emphasized the importance of preventing and treating stress to prevent police officer misconduct. Understanding the bio-psycho-social-environmental perspectives in relation to the behavioural and biomedical disparities of police officers, who are likely to experience high levels of stress while on duty, can prove useful in the testing of stress-management theories and interventions geared towards reducing police misconduct. This reduction in stress may result in healthier police officers with high morale and greater job satisfaction. As a result, a mutually beneficial appreciation between police and communities may be developed, whereby reducing the prevalence of stress-related disorders and deviance (SRD²) that lead to police misconduct.

Recommendations

1. Use this suggested theoretical framework to create open dialogues of communication with professionals who are closely engaged with law enforcement personnel: public health and criminal justice practitioners, behavioural

and somatic health professionals/clinicians, policy makers, police researchers.

2. Law enforcement administrators should utilize this theoretical framework to engage in reforms within their agencies; especially those who are currently engaged in DOJ's Consent Decrees.
3. Include this proposed theoretical framework in police practice curricula to train police cadets or trainees on the phenomena of behavioural stress discordance among law enforcement that could lead to police misconduct. This could prove to be a way of exposing police officers to the relationship between trauma and stress-related disorders and police work. This could also normalize the experience of stress-related symptoms, which could, in turn, “break the silence” of this phenomena among police officers.
4. Develop a series of courses in colleges and universities on Epidemiological Criminology, utilizing this suggested theoretical framework to teach students from varied disciplines (e.g., public health, criminal justice, social work, psychology). The students will learn how to critically examine deviant and health behaviours in a consistent manner grounded in the same paradigms, regardless of discipline, while being able to develop solutions grounded in fully integrated theory and practice.

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CONFLICT OF INTEREST DISCLOSURES

The authors declare that there are no conflicts of interest.

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