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ARE YOU ALL RIGHT (AYA)? Association of cumulative traumatic events among Danish police officers with mental health, work environment and sickness absenteeism: Protocol of a 3-year prospective cohort study

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ARE YOU ALL RIGHT (AYA)? Association of cumulative traumatic events among Danish police officers with mental health, work environment and sickness absenteeism: Protocol of a 3-year prospective cohort study

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ABSTRACT

Introduction: Police officers are frequently exposed to potential traumatic events at work, which has been associated with increased risk of developing mental health problems, in particular Posttraumatic Stress Disorder (PTSD), and absenteeism. Individual and organizational factors may influence the detrimental effects of cumulative exposure to traumatic events. Occupational stress and lack of organizational support are associated with increased risk of PTSD among police officers. The AYA-project is a prospective cohort study investigating the cumulative effect of traumatic events at work on mental health problems and absenteeism among police officers. The study also investigates whether potential risk and protective factors modify the association between traumatic events at work and mental health problems and absenteeism. **Method and analysis:** The AYA-study includes the entire Danish police force. Prospective survey data are collected over a three-year period beginning in the spring of 2021. Electronic surveys are sent out at baseline with 1, 2- and 3-years follow-up. Further, short surveys are sent out every third month covering exposure to traumatic events and current mental health status. The survey data are paired with workplace register data on sickness absence. Register data on sickness absence cover the period from 2020-2025. **Ethics and dissemination:** This study was presented for evaluation at the National Ethics Committee in Denmark (Reference number 20202000-216), but according to Danish legislation, survey studies do not require further approval by official Danish scientific or ethical committees. Participation in the project is based on informed consent, and data are handled in accordance with the Danish data legislation (Journal no.: 20/41457). Results are published in scientific journals and be disseminated in international conferences.

ARTICLE SUMMARY

- AYA is the first large prospective cohort study on Danish police officers examining the impact of prolonged exposure to potential traumatic events in duty on mental health and sickness absenteeism.
- The study also addresses potentially modifying factors in the work environment and the individual employee on the development of mental health problems and sickness absence following exposure to traumatic events at work.
- The study sample represents a cohort of the entire permanent staff employed in the Danish National Police Force in the period of 2021-2023, approximately 11.000 individuals.
- The study uses prospective validated survey data with systematic follow-up through a 3-year period. Survey data are paired with workplace registers on sickness absence.
- The study is designed in consideration of the risk of bias related to observational studies, but as participation is voluntary there is risk of selection bias and attrition.

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INTRODUCTION

Police officers are frequently exposed to potential traumatic events as part of their work. Police-specific events may include violence, armed conflicts, as well as witnessing severe incidents such as child sexual abuse, mutilated dead bodies or seriously injured victims e.g. of traffic accidents [1, 2]. Police officers are on average exposed to three traumatic events every sixth months [1, 2]. In comparison, more than half of the adult population is only exposed to one traumatic event during their whole life [3]. One of the primary mental disorders connected with traumatic experiences is Posttraumatic stress disorder (PTSD). PTSD is defined as a prolonged or delayed reaction to a traumatic event, and the disorder is characterized by three main symptom categories: re-experiencing the traumatic event, avoidance of trauma-related stimuli after the trauma, and altered physiological arousal [4, 5]. A recent meta-analytic review reported an overall pooled point prevalence of 14.2 % for PTSD among police officers [6].

Previous research suggests that police officers may develop PTSD in a different pattern compared to people in the general population [7]. Due to professional selection and training, police officers possess a resilience to cope with traumatic events experienced at work. However, this professionalism also retains officers in a context where they will be re-exposed to traumatic events for long periods of time [8]. Research has indicated that the cumulative strain experienced by repeated exposure to traumatic events over time constitutes a specific mental strain with a possible different pattern of PTSD symptom development [7, 9]. McFarlane argues that a prolonged re-exposure to traumatic events among police officers leads to a gradual sensitization of the nervous system. This sensitization will eventually lower the threshold for reactions to psychological stressors, while the intensity of reactions gradually heightens at the same time [7]. PTSD in police officers also seems to develop with a delayed onset either months or years after the traumatic event [10, 11]. In these cases, the officer may

manage the experience of distress by adaptive means during the traumatic event, but the traumatic event constitutes a latent stressor that may become manifest at a future point in time due to subsequent environmental stress or traumatic re-exposure [11]. Thus, police officers may develop PTSD-symptoms gradually over even long periods of time, with a delayed manifestation of PTSD-psychopathology representing exacerbations of prior symptoms. Nevertheless, evidence from well-designed longitudinal studies are lacking.

In addition, police officers might not only react with PTSD symptoms to potential traumatic events. Research have indicated that the continued exposure to traumatic events at work can result in general mental health problems, including depressive and anxiety symptoms and may appear in combination with somatic health complaints, heightened sickness absence, problems with collegial cooperating and solving assignments, reduced productivity, and unemployment [12-15]. The exposure to traumatic events at work can also have more hidden consequences such as presenteeism, where the police officer continues to go to work although he/she is feeling unwell and has a reduced level of functioning [16, 17]. Emerging evidence indicates that presenteeism can have negative consequences on problem solving, which may become especially problematic in job functions with a high demand for safety behaviour [18]. However, longitudinal studies are also lacking in this area.

Therefore, the development of potential detrimental health effects of repeated trauma exposure in police work, information on PTSD, comorbidity symptoms and sickness absence, needs to be investigated in prolonged periods of time, if one is to capture the prolonged and less clear prodromal phases of a definitive manifestation of psychopathology. This understanding is pivotal to enhance the effectiveness of prevention strategies that rely on post-exposure support as well as treatment where early detection of pathology is of utmost importance.

The influence of work environment and individual factors

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Studies have indicated that severity and type of event, degree of exposure, prior traumatic experiences, work experience, family psychiatric history, personality characteristics, and coping style may influence the effect of exposure to traumatic events at work [19-23]. In specific, avoidant coping strategies have been reported as a significant risk factor for PTSD development [6]. At the organisational level, occupational stress, shift work, a lack of support (from colleagues and leaders), issues with colleagues and management, role ambiguity, and role conflict have been reported as risk factors for development of mental health problems among police officers [23-25]. In particular, occupational stress has recently been identified as the strongest risk factor for both suicidal ideation, depression, and PTSD [6]. Research also indicates that negative social support is an important factor in the development of PTSD [6, 26], and an existing prospective study found that the experience of deficient organisational support increased the risk of PTSD among police officers [27]. In which way these factors interact with exposure to traumatic events in the development of PTSD and other mental health problems remain unknown.

The present study

Several research gaps exist in the current understanding of the effects of exposure to work-related traumatic events on mental health among police officers. There is still only a limited focus on the effects of the cumulative exposure to traumatic events over time [7, 8], which limits our ability to identify early signs of mental health problem and thus the establishment of proper and effective preventive initiatives. Furthermore, existing research is mostly based on small populations in specific functions without long-term follow-up periods. This not only limits the generalisability of the results, but it also limits our understanding of how mental health problems might develop over time as well as our understanding of the interplay and temporal dynamics of exposure and health problems. Also, current research has mainly focused

on the independent effects of risk and protective factors at the individual or the organizational level respectively, though it is likely that health problems occur by the interaction of both individual and organisational factors [19]. Thus, our understanding of the complete and interacting effect of risk factors in the working environment and in the individual employee is sparse.

The present prospective cohort study situated in a Danish context aims to increase our understanding of how and when police officers develop mental health problems, in particular PTSD, following exposure to traumatic events. The study also aims to identify preventive factors and thereby enhance sickness prevention at the workplace. Access to sickness absence data allows us to analyse and compare mental health status and level of presenteeism, with the actual sickness rate at both individual and department level.

Objectives

The present project ARE YOU ALL RIGHT (AYA) addresses the following research questions:

1. What are the extent and character of traumatic events in the daily police work across different job functions?
2. What are the mental health consequences of repeated exposure to traumatic events at work over time?
3. What is the prospective association between traumatic events at work and presenteeism and sickness absence?
4. Which individual and work environment factors have a modifying effect on the development of mental health problems after exposure to potential traumatic events at work?

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6 presenteeism and sickness absence after exposure to potential traumatic events at work?
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10 **METHODS AND ANALYSIS**

11 **Study design and population**

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15 The AYA-project is a prospective cohort study investigating the associations between exposure
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17 to traumatic events, mental health consequences, work environment and sickness absence
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19 among a cohort of Danish police officers. Data is collected at baseline and at 1-, 2- and 3-years
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21 follow-up using electronic questionnaire surveys send out to participants' work mail. The
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23 baseline and follow-up surveys measure sociodemographic and lifestyle factors, mental and
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25 somatic health, trauma relevant factors at work and outside of work, factors of the psychosocial
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27 work environment, instrumental and social support, as well as factors of individual coping and
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29 resiliency. In addition, short questionnaire data is collected every third month covering
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31 exposure to police relevant potential traumatic events, symptoms of PTSD, level of general
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33 stress, presenteeism, and participation in formal support initiatives. Survey data are analysed
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35 and paired with individual data on sickness absence registered at each department within the
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37 Danish National Police. The study includes all officers in the permanent staff in the Danish
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39 Police, both men and women. Approximately 11.000 employees are invited to participate.
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47 **Patient and Public Involvement**

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49 Patients were not involved in the design of this observational study. However, the research
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51 questions and design were developed in discussions with stakeholders from the Danish
52
53 National Police, the police union, and psychologist employed within the Danish police force.
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55 Results, conclusions, and recommendations are published in a report to the Danish National
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57 Police, a public report to the Working Environment Research Fund, in international scientific
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journals and will also be disseminated on national and international conferences. Findings from the study will also be disseminated at meetings in the included police districts with the participating police officers.

Ethics

All data are collected using the police officers’ work mail, which we are allowed access to from The Danish National Police. In the Spring of 2021, all employees receive an information letter by e-mail which contains informed consent and a link to the baseline questionnaire. Clicking the link and returning the questionnaire is taken as written consent, but the participants can withdraw consent and participation at any time during the study period. The study has been presented to the National Committee on Health Research Ethics (Ref. numb. 20202000-216) but according to Danish legislation, survey studies requires no approval by official Danish scientific or ethical committees. The study and procedure for data collection are registered and approved by The Danish Data Protection Agency (journal no.; 20/41457). All data are stored on a secure server under the Open Patient data Explorative Network, a database unit under Odense University Hospital. Furthermore, the project is conducted in accordance with the Helsinki II declaration and the Danish Code of Conduct for Research Integrity.

Data collection

Baseline and follow-up questionnaire (Type I data)

At baseline and at 1-, 2-, and 3-years follow-up we use a questionnaire (type I) constructed out of relevant parts of different validated surveys (see table I). The type I questionnaire will address the five main themes: 1) Exposure to traumatic events, 2) psychological/somatic symptoms, 3) sickness absenteeism and presenteeism, 4) work environment / management, and 5) individual factors. The rationale behind the 1-year follow-up interval is that this time period

corresponds to the time suitable to assess changes in the psychosocial work environment [28].

If participants do not answer, they will receive one reminder following two weeks and a second reminder following a month.

Table 1 Themes and Questionnaires in the Type I Data Collection.

Theme	Questionnaire
Exposure to traumatic events	
Extent / Duration	Critical Incident History [29] Questionnaire (CIHQ)
Psychological / Somatic symptoms	
PTSD	International Trauma Questionnaire (ITQ) simple and complex PTSD [30]
Depression	Major Depression Inventory [31]
Burnout	Personal and Patient/client related burnout [32]
Pain	Three pain-questions from the Nordic Questionnaire [33]
Work environment / Management	
Pace of work	Copenhagen Psychosocial Questionnaire (COPSOQ) [34]
Quantitative demands	COPSOQ
Role ambiguity	COPSOQ
Role conflict	COPSOQ
Meaning in work	COPSOQ

Bullying / conflict / unwanted sexual attention	COPSOQ
Quality of management	COPSOQ
Social capital at work	Questionnaire about social capital at work, developed by the Danish National Research Center for the Working Environment [35]
Individual factors	
Age	Work Environment and Health Questionnaire (WH) [36]
Sex	WH
Civil status	WH
Children	WH
Chronic and severe somatic disorders	WH
Trauma self-efficacy	Trauma Coping Self-Efficacy Scale (CSE-T) [37]
Smoking / Alcohol	WH
BMI	WH
Length of duty (in years)	
Professional training	
Lifetime traumas	Checklist from the National comorbidity study [3]
Social support	The Crisis Support Scale (CSS) [38]
Coping strategies	Coping Style Questionnaire (CSQ) [39]

Short version questionnaire (type II data)

Every third month, enrolled participants receive a short questionnaire (Type II) that address three categories: 1) Exposure to traumatic events during the last three months, 2) activation of symptoms in relation to exposure, and 3) presenteeism. This 3-months interval was chosen to reduce the risk of responders fatigue and attrition but at the same time include a shorter time period in order to reduce recall bias [40], and the assessment of a more stable manifestation of PTSD which according to DSM-5 is considered an actual diagnostic pathology when symptoms persist for more than 1-month.

Table 2 Themes and Questionnaires in The Type II Data Collection.

Theme	Questionnaire
Exposure to traumatic events	Categories adapted from the CIHQ[29]
Psychological / somatic symptoms	ITQ simple and a single stress item
Presenteeism	Two questions on presenteeism from the Danish Psychosocial Work Environment Questionnaire (DPQ) [41]
Participation in formal support initiatives?	"Have you received briefing or other professional counselling?"

Data of sickness absence from The Danish National Police

Data of sickness absence will be transferred from the Danish National Police to the secure server and saved in the project database with a unique participant ID-number. Questionnaire data and sickness absence are merged using the unique participant ID-number. Sickness absence data are collected from one year prior to baseline until one year after the last follow-up survey. For an overview of the study's timeline, please see Figure 1.

Insert Figure 1 Timeline - hear.

Statistical analysis

Based on experiences from similar studies, we expect a participation and response rate of 30 % corresponding to approximately 3300 officers. Similar cohort studies about violent events in Denmark typically reports a drop-out rate of 20 – 40 %. When considering the frequent

questionnaires (type II) and the long period of follow-time (3-years), we expect an additional drop-out. A conservative estimate of the final sample size is therefore a minimum of 1500 officers, also see Figure 2. Different statistical methods will be used, e.g. repeated measures logistic regression and time-to-event analysis.

Insert Figure 2 Flowchart - hear.

DISCUSSION

The AYA-project investigates associations between repeated exposure to traumatic events, mental health problems and absenteeism, including a broad variety of relevant individual and work environment factors. It is the first large scientific study among Danish police officers since 1993 [42]. The ongoing and comprehensive data collection provides valuable knowledge about the impact of work-related traumatic events on mental health and sickness absence among police officers. Due to the prospective design of the study, we can investigate the development of mental health problems over time, which is important, because we study the prolonged effects of repeated exposure to traumatic events.

As mental health problems most likely occur in interaction with individual and organisational factors, this study also identifies risk and protective factors and the interacting effect of the work environment and the individual coping. The 1-, 2-, and 3-year follow-up assessments (Type I questionnaire) provides knowledge of the long-term effects of exposure to work-related traumatic events in combination with individual and organisational risk factors. Thereby, potential delayed reactions after exposure to traumatic events and exacerbations of PTSD symptoms may become visible. Moreover, the repeated measure design of the quarterly survey (type II questionnaire) strengthens the study by minimising recall bias on both exposure and health, while also allowing us to separate exposure and health outcome within shorter time periods to better capture variability. Another methodological strength of the AYA-study is the

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objective quantification of individual sickness absence which allows us to analyse and compare mental health status and level of presenteeism with the actual sickness rate.

There are also some limitations to the study design and the use of self-reported surveys. The study relies on voluntary participation why a potential selection bias is present. Moreover, attrition is a challenge in longitudinal studies which might also contribute to a possible selection bias. In order to retain participants through the course of the study timeline, the researchers will ensure continued and motivational reminders following the initial survey mail. The AYA-study will be an important step in securing knowledge that is crucial for the clinical understanding of mental health problems in police officers and for the improvement of existing prevention initiatives. The findings of our study have implications for sickness prevention among police officers and workplace strategies used for screening and assessment when exposed to potential traumatic events. The results of this study are expected to identify early warning signs and specific circumstances in the police work where the risk of mental health problems is increased. Furthermore, knowing how and when exposure to traumatic events causes mental health problems may also have implications for subsequent psychological treatment. The results of this study are relevant for other occupational groups where repeated exposure to traumatic events is part of the daily work such as firefighters or rescue personal.

Authors' contributions:

NBH and JPT developed the original idea for the study and established the collaboration with The Danish Police in collaboration with SRM. NBH is principal investigator. The funding protocol was developed by NBH and JPT and discussed with LLA, LB, SRM and AE. The study design, selection of surveys and possible statically analyses were developed and discussed in a team of all included authors. The manuscript was drafted by NBH, SRM and

JPT followed by a critical reading from AE, LB and LLA. Thus, all authors have read and approved the manuscript and are responsible of its accuracy.

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Competing interests’ statement: None declared

Patient consent: is obtained.

Data Sharing statement: fully anonymized data and questionnaires are available upon reasonable request.

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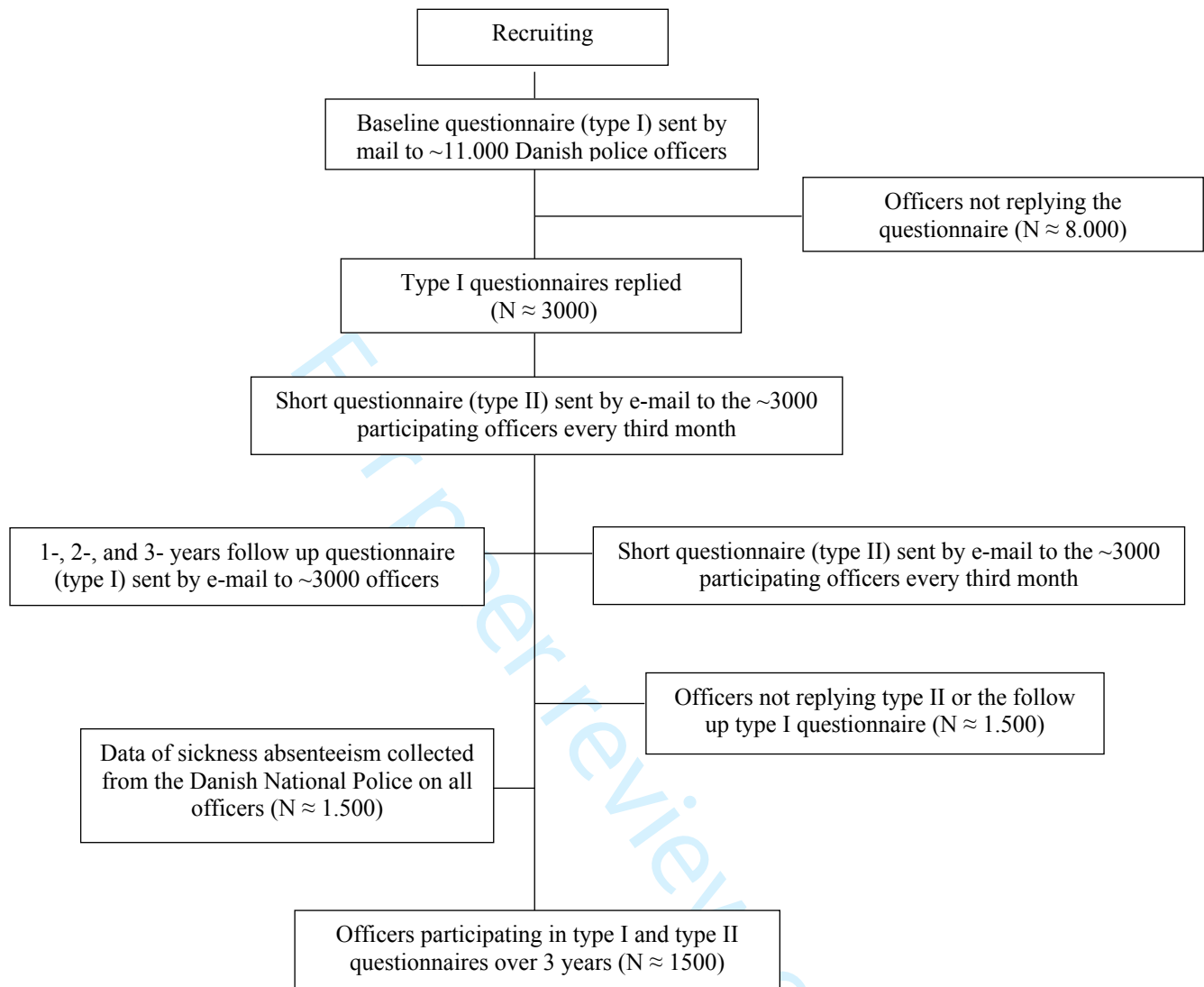
Figure 1 Timeline of the Study



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Figure 2 Flow Chart of the Data-collection and Expected Response Rates



BMJ Open

ARE YOU ALL RIGHT (AYA)? Association of cumulative traumatic events among Danish police officers with mental health, work environment and sickness absenteeism: Protocol of a 3-year prospective cohort study

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ARE YOU ALL RIGHT (AYA)? Association of cumulative traumatic events among Danish police officers with mental health, work environment and sickness absenteeism: Protocol of a 3-year prospective cohort study

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ABSTRACT

Introduction: Police officers are frequently exposed to potentially traumatic events at work that increases risk of developing mental health problems, in particular Posttraumatic Stress Disorder (PTSD). Individual and organizational factors may influence the detrimental effects of cumulative exposure to traumatic events. Occupational stress and lack of organizational support are associated with increased risk of PTSD among police officers. The Are You All right? (AYA) project is a prospective cohort study investigating the cumulative effect of traumatic events at work on mental health problems and absenteeism among police officers. The study also investigates whether potential risk and protective factors modify the association of traumatic events at work with mental health problems and absenteeism.

Method and analysis: The AYA-study includes the entire Danish police force. Prospective survey data are collected over a three-year period beginning in the spring of 2021. Electronic surveys are sent out at baseline with 1, 2- and 3-years follow-up. Further, short surveys are sent out every third month, covering exposure to traumatic events and current mental health status. The survey data are paired with workplace register data on sickness absence. Register data on sickness absence cover the period from 2020 to 2025. **Ethics and dissemination:**

This study was presented for evaluation at the National Ethics Committee in Denmark (Reference number 20202000-216), but according to Danish legislation, survey studies do not require approval by official Danish scientific or ethical committees. Participation in the project is based on informed consent, and data are handled in accordance with the Danish data legislation (Journal no.: 20/41457). Results are published in scientific journals and disseminated at international conferences.

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ARTICLE SUMMARY

- AYA is the first large prospective cohort study in police officers examining the impact of prolonged exposure to potentially traumatic events at work on mental health and sickness absenteeism.
- The study also addresses potentially modifying individual and work environmental factors on the development of mental health problems and sickness absence following exposure to traumatic events at work.
- The cohort includes the entire permanent staff employed in the Danish National Police Force in the period of 2021-2023, approximately 11.000 individuals.
- The study uses prospective validated survey data with systematic follow-up through a 3-year period. Survey data are paired with workplace registers on sickness absence.
- The study design counteracts the many biases associated with observational studies, but as participation is voluntary there is risk of selection bias and attrition.

INTRODUCTION

Police officers are frequently exposed to potentially traumatic events as part of their work.

Police-specific events may include violence, armed conflicts, as well as witnessing severe incidents such as child sexual abuse, mutilated dead bodies or seriously injured victims [1, 2].

Police officers are on average exposed to three traumatic events every sixth months [1, 2]. In comparison, more than half of the adult population is only exposed to one traumatic event during their entire life [3]. One of the primary mental disorders connected with traumatic experiences is Posttraumatic stress disorder (PTSD). PTSD is, according to the diagnostic criteria of ICD-10, defined as a prolonged or delayed reaction to a stressful event or situation of exceptionally threatening or catastrophic nature. The disorder is characterized by three main symptom categories: Experiencing the traumatic event, avoidance of trauma-related stimuli after the trauma, and altered physiological arousal [4,5]. A recent meta-analytic review reported an overall pooled point prevalence of 14.2 % for PTSD among police officers [6].

Previous research suggests that police officers may develop PTSD in a different pattern compared to people in the general population [7]. Due to professional selection and training, police officers possess a resilience to cope with traumatic events experienced at work.

However, this professionalism also retains officers in a context where they will be re-exposed to traumatic events for long periods [8]. Research has indicated that the cumulative strain experienced by repeated exposure to traumatic events over time constitutes a specific mental strain with a possible different pattern of PTSD symptom development [7,9]. McFarlane argues that a prolonged re-exposure to traumatic events among police officers leads to a gradual sensitization of the nervous system. This sensitization will eventually lower the threshold for reactions to psychological stressors, while the intensity of reactions gradually

heightens at the same time [7]. PTSD in police officers also seems to develop with a delayed onset either months or years after the traumatic event [10, 11]. In these cases, the officer may manage the experience of distress by adaptive means during the traumatic event, but the traumatic event constitutes a latent stressor that may become manifest at a future point in time due to subsequent environmental stress or traumatic re-exposure [11]. Thus, police officers may develop PTSD-symptoms gradually over even long periods of time, with a delayed manifestation of PTSD-psychopathology representing exacerbations of prior symptoms. Furthermore, in the 11th revision of the ICD, the diagnosis of complex PTSD (CPTSD) is included. CPTSD captures a posttraumatic disorder that can arise following repeated or chronic traumatic stress. Besides the three main core symptoms of PTSD, CPTSD include symptoms such as disturbances in affect regulation, negative self-concept, and difficulties in relationships [12]. CPTSD is associated with poorer treatment outcomes compared to PTSD. As police officers are repeatedly exposed to traumatic events, the CPTSD diagnosis seems relevant to investigate in a police cohort study. A recent cross-sectional study even indicated a higher prevalence of CPTSD than PTSD among a sample of police officers [13]. However, evidence from well-designed longitudinal studies is lacking.

In addition, police officers might not only react with PTSD symptoms to potential traumatic events. Research have indicated that the continued exposure to traumatic events at work can result in general mental health problems, including depressive and anxiety symptoms, and may appear in combination with somatic health complaints, sickness absence, problems with collegial cooperating and solving assignments, reduced productivity, and unemployment [14-17]. The exposure to traumatic events at work can also have more hidden consequences such as presenteeism. Presenteeism is defined as attending work while feeling ill and with reduced productivity [18, 19]. Presenteeism is interesting as it represents a grey zone between being fully functioning or completely absent due to illness. Presenteeism, thus, may be an important

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point for preventing long term sickness leave. A Danish study found that workers who had gone to work despite feeling ill more than six times in the year had a 74% higher risk of becoming long-term sick (absence from work for more than 2 months) [20]. Also, a prospective study with 11-years follow-up found presenteeism to be a strong predictor of disability pension [21]. Studies have reported a high level of presenteeism among police officers, with 47% of the total sample reporting presenteeism in a Swedish study and 74% of the sample in a German study [22, 23]. Also, emerging evidence indicates that presenteeism can have negative consequences on problem solving, which may become especially problematic in job functions with a high demand for safety and handling of situational crisis [24]. However, interest in presenteeism is new and evidence based on longitudinal studies is lacking, especially regarding presenteeism as a possible early warning signal for long-term sickness absence.

Therefore, the development of potential detrimental health effects of repeated trauma exposure in police work, information on PTSD, CPTSD, comorbidity symptoms and sickness absence, needs to be investigated using prospective designs to capture the prolonged and less clear prodromal phases of a definitive manifestation of psychopathology. This understanding is pivotal to enhance the effectiveness of prevention strategies that rely on post-exposure support as well as treatment where early detection of pathology is of utmost importance.

The influence of work environment and individual factors

Studies have indicated that severity and type of event, degree of exposure, prior traumatic experiences, work experience, family psychiatric history, personality characteristics, and coping style may influence the effect of exposure to traumatic events at work [25-29]. In specific, a previous study reported avoidant coping strategies to be a significant risk factor for PTSD development [6]. At the organisational level, occupational stress, shift work, a lack of

support (from colleagues and leaders), issues with colleagues and management, role ambiguity, and role conflict have been reported as risk factors for development of mental health problems among police officers [29-31]. In particular, recent research has identified occupational stress as the strongest risk factor for both suicidal ideation, depression, and PTSD [6]. Research also indicates that negative social support is an important factor in the development of PTSD [6, 32], and an existing prospective study found that the experience of deficient organisational support increased the risk of PTSD among police officers [27]. In which way these factors interact with exposure to traumatic events in the development of PTSD and other mental health problems remain unknown.

The present study

Several research gaps exist in the current understanding of the effects of exposure to work-related traumatic events on mental health among police officers. There is still only a limited focus on the effects of the cumulative exposure to traumatic events over time [7, 8], which limits our ability to identify early signs of mental health problem and thus the establishment of proper and effective preventive initiatives. Furthermore, existing research is mostly based on small populations in specific functions without long-term follow-up periods. This not only limits the generalisability of the results, but it also limits our understanding of how mental health problems develop over time as well as our understanding of the interplay and temporal dynamics of exposure and health problems. Also, current research has mainly focused on the independent effects of risk and protective factors at the individual or the organizational level respectively, though it is likely that health problems occur by the interaction of both individual and organisational factors [25]. Thus, our understanding of the complete and interacting effect of risk factors in the working environment and in the individual employee is sparse.

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The present prospective cohort study, situated in a Danish context, aims to increase our understanding of how and when police officers develop mental health problems, in particular PTSD and CPTSD, following exposure to traumatic events. The study also aims to identify preventive factors and thereby enhance sickness prevention at the workplace. Access to register-based sickness absence data allows us to analyse and compare mental health status and level of presenteeism, with the actual sickness rate at both individual and department level.

Objectives

The present project Are You All right? (AYA) addresses the following research questions:

1. What are the extent and character of traumatic events in the daily police work across different job functions?
2. What are the mental health consequences of repeated exposure to traumatic events at work over time?
3. What is the prospective association between traumatic events at work and presenteeism and sickness absence?
4. Which individual and work environmental factors have a modifying effect on the development of mental health problems after exposure to potential traumatic events at work?
5. Which individual and work environmental factors have a modifying effect on presenteeism and sickness absence after exposure to potential traumatic events at work?

METHODS AND ANALYSIS

Study design and population

The AYA-project is a prospective cohort study investigating the associations between exposure to traumatic events, mental health consequences, work environment and sickness absence among a cohort of Danish police officers. Data is collected at baseline and at 1-, 2- and 3-years follow-up using electronic questionnaire surveys send out to participants' work mail. The baseline and follow-up surveys measure sociodemographic and lifestyle factors, mental and somatic health, trauma relevant factors at work and outside of work, factors of the psychosocial work environment, instrumental and social support, as well as individual factors of coping and resiliency. In addition, short questionnaire data is collected every third month covering exposure to police relevant potential traumatic events, symptoms of PTSD, level of general stress, presenteeism, and participation in formal support initiatives. Survey data are analysed and paired with individual data on sickness absence registered at each department within the Danish National Police. The study includes all officers in the permanent staff of the Danish Police, both men and women and from different service areas. Approximately 11.000 employees are invited to participate. Based on experiences from similar studies, we expect response percentage of 30 % corresponding to approximately 3300 officers. Similar cohort studies about violent events in Denmark typically reports a drop-out rate of 20 – 40%. When considering the frequent questionnaires and the long period of follow-time (3-years), we expect an additional drop-out. A conservative estimate of the final sample size is therefore a minimum of 1500 officers, also see flowchart in Figure 1. Previous studies have reported a PTSD prevalence between of 7-19% and a subclinical level of PTSD of 34% [33]. With a conservative estimate of 5% PTSD and 10% subclinical PTSD in this sample we will have around 75-150 clinically relevant cases. Also, we expect that 20% of the cohort will have heightened levels of mental health symptoms representing 300 cases of the sample. As one study have indicated, a higher rate of CPTSD than PTSD exists among police officer, and we

therefore expect that at least the same number of cases will be represented with CPTSD in the sample [13].

The project is funded by The Working Environment Research Fund (Danish: Arbejdsmiljøforskningsfonden grant nr: 20205100185) in the period of 2021, 2022, and 2023 with the possibility of extension in case of for instance maternity or sick leave of some of the central project researchers. The funding covers salary expenses, conference participation and data manager hours. The funding source has no influence on the analyses, interpretation of the data, or decision to submit results.

Insert Figure 1 - Flow Chart of the Data-collection and Expected Response Rates - hear

Patient and Public Involvement

Patients were not involved in the design of this observational study. However, the research questions and design were developed in discussions with stakeholders from the Danish National Police, the police union, and a psychologist employed within the Danish police force. Results, conclusions, and recommendations are published in a report to the Danish National Police, a public report to the Working Environment Research Fund, in international scientific journals, and will also be disseminated on national and international conferences. Findings from the study will also be disseminated at meetings in the included police districts with the participating police officers.

Organizational structure and responsibilities

The project is organized around a 3-year PhD project with PhD Student Sara Rosenbeck Møller. Main supervisor is professor Ask Elklit from the Department of Psychology, University of Southern Denmark. Co-supervisors are Associate Professor Nina Beck Hansen

and Associate Professor Jesper Pihl-Thingvad from the Department of Occupational and Environmental Medicine, Odense University Hospital. The PhD student is employed at Department of Occupational and Environmental Medicine and is enrolled at the PhD School at the Faculty of Health Sciences, University of Southern Denmark. Associate Professor Nina Beck Hansen is principal investigator, and Associate Professor Jesper Pihl-Thingvad acts as data manager. Professor Lars Louis Andersen from the National Research Centre for Working Environment acts as statical supervisor.

The project is followed by an interest committee with representatives from the Danish National Police, the Danish police union, the police society Thin Blue Line, and stakeholders from other unions representing Danish ambulance workers. Research results are disseminated and discussed yearly with the interest committee.

Data collection

Baseline and follow-up questionnaire (Type I data)

At baseline and at 1-, 2-, and 3-years follow-up we use a questionnaire (type I) constructed out of relevant parts of different validated surveys, also see table 1. The type I questionnaire will address the five main themes: 1) Exposure to traumatic events, 2) psychological/somatic symptoms, 3) sickness absenteeism and presenteeism, 4) work environment / management, and 5) individual factors. The rationale behind the 1-year follow-up interval is that this time period corresponds to the time suitable to assess changes in the psychosocial work environment [34]. If participants do not answer, they will receive one reminder following two weeks and a second reminder following a month.

Table 1 Themes and Questionnaires in the Type I Data Collection.

Theme	Questionnaire
Exposure to traumatic events	

Extent / Duration	Critical Incident History [35] Questionnaire (CIHQ)
Psychological / Somatic symptoms	
PTSD	International Trauma Questionnaire (ITQ) PTSD and CPTSD [36]
Depression	Major Depression Inventory [37]
Burnout	Personal and Patient/client related burnout [38]
Pain	Three pain-questions from the Nordic Questionnaire [39]
Work environment / Management	
Pace of work	Copenhagen Psychosocial Questionnaire (COPSOQ) [40]
Quantitative demands	COPSOQ
Role ambiguity	COPSOQ
Role conflict	COPSOQ
Meaning in work	COPSOQ
Bullying / conflict / unwanted sexual attention	COPSOQ
Quality of management	COPSOQ
Social capital at work	Questionnaire about social capital at work, developed by the Danish National Research Center for the Working Environment [41]
Individual factors	

Age	Work Environment and Health Questionnaire (WH) [42]
Sex	WH
Civil status	WH
Children	WH
Chronic and severe somatic disorders	WH
Trauma self-efficacy	Trauma Coping Self-Efficacy Scale (CSE-T) [43]
Smoking / Alcohol	WH
BMI	WH
Length of duty (in years)	
Professional training	
Lifetime traumas	Checklist from the National comorbidity study [3]
Social support	The Crisis Support Scale (CSS) [44]
Coping strategies	Coping Style Questionnaire (CSQ) [45]

Short version questionnaire (type II data)

Every third month, enrolled participants receive a short questionnaire (Type II) that addresses three categories: 1) Exposure to traumatic events during the last three months, 2) activation of symptoms in relation to exposure, and 3) presenteeism, also see table 2. This 3-months interval was chosen to reduce the risk of responders’ fatigue and attrition but at the same time include a shorter time period in order to reduce recall bias [46], and to assess a more stable manifestation of PTSD, which according to DSM-5 is considered an actual diagnostic pathology when symptoms persist for more than 1-month.

Table 2 Themes and Questionnaires in The Type II Data Collection.

Theme	Questionnaire
Exposure to traumatic events	Categories adapted from the CIHQ[35]
Psychological / somatic symptoms	PTSD symptoms from the ITQ and a single stress item
Presenteeism	Two questions on presenteeism: <i>"How many days have you gone to work, although you were sick or not feeling well during the last three months? (0 days, 1-4 days, 8-14 days, more than 15 days)"</i> <i>"Overall, how likely is it that you go to work although you are ill? (Very unlikely, unlikely, neither/nor, likely, very likely)"</i>
Participation in formal support initiatives?	"Have you received debriefing or other professional counselling?"

Data of sickness absence from The Danish National Police

Data of sickness absence will be transferred from the Danish National Police to a secure server and saved in the project database with a unique participant ID-number. Questionnaire data and sickness absence are merged using the unique participant ID-number. Sickness absence data are collected from one year prior to baseline until one year after the last follow-up survey.

For an overview of the study's timeline, please see Figure 2.

Insert Figure 2 - Timeline of the Study - hear.

Statistical Analyses

In relation to research question 1, we will use descriptive analyses to investigate extent and character of trauma exposure. Accumulation of trauma exposure can be modelled in different ways. In the AYA project, we will measure accumulated exposure in two ways: 1) Frequency

of exposures using a sum score of the total number of critical events reported within the period, and 2) prolonged exposure measured as the sum of time periods with exposure throughout the period of analyses. This is an operationalization of repeated exposure used in similar studies on occupational risk factors [47, 48]. For both types of accumulated exposure, sensitivity analyses will be made adjusting for quality and experienced severity of the exposure, to assess the effect of accumulated repeated events. We will also examine exposure in relation to gender, age and duration of employment.

In relation to research question 2 and 3, we will use binominal logistic regression analyses with repeated measures with fixed and random effects, also known as generalized mixed models. Analyses comparing sickness absence (low/high), presenteeism (yes/no) and mental health symptoms (no symptoms, subclinical symptoms and clinical symptoms) within each follow-up period and in relation to level of exposure will be conducted. Furthermore, level of exposure in the previous period will be assessed in relation to sickness absence, presenteeism and mental health problems 6 month later.

In relation to research question 4 and 5, we will use latent class analyses and latent transfer analyses. We will identify different profiles of sickness development in relation to factors in the work environment, level of exposure and individual factors. We expect to identify different profiles on those who 1) increase their levels of mental health symptoms, 2) decrease their levels of mental health symptoms, and 3) have no change in mental health symptoms throughout the project period. Same profiles can be identified in terms of their level of sickness absence.

Using linear fixed effect models with repeated measures four times (baseline and three follow-ups) with three groups (no exposure, low exposure and high exposure), low effects (0.15) and low correlation between the follow-ups (0.05) will correspond to a power of 1- β -error probability = 0.99 calculated using G'Power 3.1 with 150 cases [49]. As mixed model

and latent class analyses are considered being more robust statistical analyses, we expect to have a sufficient level of statistical power.

The cohort will be compared with all invited participants in relation to age, gender, and duration of employment as we will get this information from the Danish Police. Thereby, we can examine if our cohort are representative with the entire police force on those parameters.

Furthermore, we will examine whether participants of the final cohort are different from those who drop out of the study on selected variables important for the specific analyses.

Attrition analyses are conducted as part of overall missing data analysis. If feasible, we will construct a weight variable based on register-information about non-respondents and drop-outs. Logistic regression models will be performed with dropout/no-dropout set as outcome, each of the factors at baseline set as predictors. Any baseline factor with moderate to strong association to dropout will be considered for inclusion in the main study analysis to adjust for sample bias. Factors with weak associations will not be included due to effects seen in large samples and the consideration of over adjustment in already complex models.

Ethics and Dissemination

All data are collected using the police officers' work mail, which we are allowed access to from The Danish National Police. In the Spring of 2021, all employees receive an information letter by e-mail which contains informed consent and a link to the baseline questionnaire. The participants were asked to tick off a consent formulation before answering the questionnaire, and the participants can withdraw consent and participation at any time during the study period. The study has been presented to the National Committee on Health Research Ethics (Ref. numb. 20202000-216) but according to Danish legislation, survey studies require no approval by official Danish scientific or ethical committees. The study and procedure for data collection are registered and have been approved by The Danish Data

Protection Agency (journal no.; 20/41457). All data are stored on a secure server under the Open Patient data Explorative Network, a database unit under Odense University Hospital. Furthermore, the project is conducted in accordance with the Helsinki II declaration and the Danish Code of Conduct for Research Integrity. The findings of AYA will be disseminated to relevant national and international audiences. We expect 5 peer-reviewed publications to result from the project, and the results will be disseminated regardless of the magnitude or direction of effect. Besides, we aim to deliver an academic impact by disseminating the project results as oral or poster presentations on scientific conferences such as the International Conference of Occupational Health (ICOH). Finally, the findings of AYA are communicated to stakeholders such as the Danish National Police and representatives in the interest committee.

DISCUSSION

The AYA-project investigates associations between repeated exposure to traumatic events, mental health problems and absenteeism, including a broad variety of relevant individual and work environment factors. It is the first large research study among Danish police officers since 1993 [50]. The ongoing and comprehensive data collection provides valuable knowledge about the impact of work-related traumatic events on mental health and sickness absence among police officers. Due to the prospective design of the study, we will be able to investigate the development of mental health problems over time, which is important to study the prolonged effects of repeated exposure to traumatic events. As mental health problems most likely occur in interaction with individual and organisational factors, this study also identifies risk and protective factors and the interacting effect of the work environment and the individual coping. The 1-, 2-, and 3-year follow-up assessments (Type I questionnaire) provide knowledge of the long-term effects of exposure to work-

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related traumatic events in combination with individual and organisational risk factors.

Thereby, potential delayed reactions after exposure to traumatic events and exacerbations of PTSD symptoms may become visible. Moreover, the repeated measure design of the quarterly survey (type II questionnaire) strengthens the study by minimising recall bias on both exposure and health, while also allowing to separate exposure and health outcome within shorter time periods to better capture variability. Another methodological strength of the AYA-study is the objective quantification of individual sickness absence which allows us to analyse and compare mental health status and level of presenteeism with the actual sickness rate.

There are also some limitations to the study design and the use of self-reported surveys. The study relies on voluntary participation, and therefore a potential selection bias is present. Moreover, attrition is a challenge in longitudinal studies which might also contribute to a possible selection bias. To retain participants through the course of the study timeline, we will ensure continued and motivational reminders following the initial survey mail. Also, evidence is currently lacking on how to investigate presenteeism in the best way [51]. In this study, we use two single-item questions with a wording often seen and used in the existing literature [52]. Furthermore, these two questions were also included in two other studies in a Danish context, whereby we will be able to compare findings. However, we acknowledge the limitations surrounding the lack of a golden standard to assess presenteeism, and we hope that AYA will contribute to the advancement of exiting knowledge and ways to measure presenteeism in the future.

The AYA-study will be an important step in securing knowledge that is crucial for the clinical understanding of mental health problems in police officers and for the improvement of existing prevention initiatives. The findings of our study have implications for sickness prevention among police officers and workplace strategies used for screening and assessment

when exposed to potential traumatic events. The results of this study are expected to identify early warning signs and specific circumstances in police work where a high risk of mental health problems exists. Furthermore, knowing how and when exposure to traumatic events causes mental health problems may also have implications for subsequent psychological treatment. The results of this study are relevant for other occupational groups where repeated exposure to traumatic events is part of the daily work such as firefighters or rescue personal.

Authors’ contributions:

NBH and JPT developed the original idea for the study and established the collaboration with The Danish Police in collaboration with SRM. NBH is principal investigator. The funding protocol was developed by NBH and JPT and discussed with LLA, LB, SRM and AE. The study design, selection of surveys and possible statically analyses were developed and discussed in a team of all included authors. The manuscript was drafted by NBH, SRM and JPT followed by a critical reading from AE, LB and LLA. Thus, all authors have read and approved the manuscript and are responsible of its accuracy.

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Competing interests’ statement: None declared

Patient consent: is obtained.

Data Sharing statement: fully anonymized data and questionnaires are available upon reasonable request.

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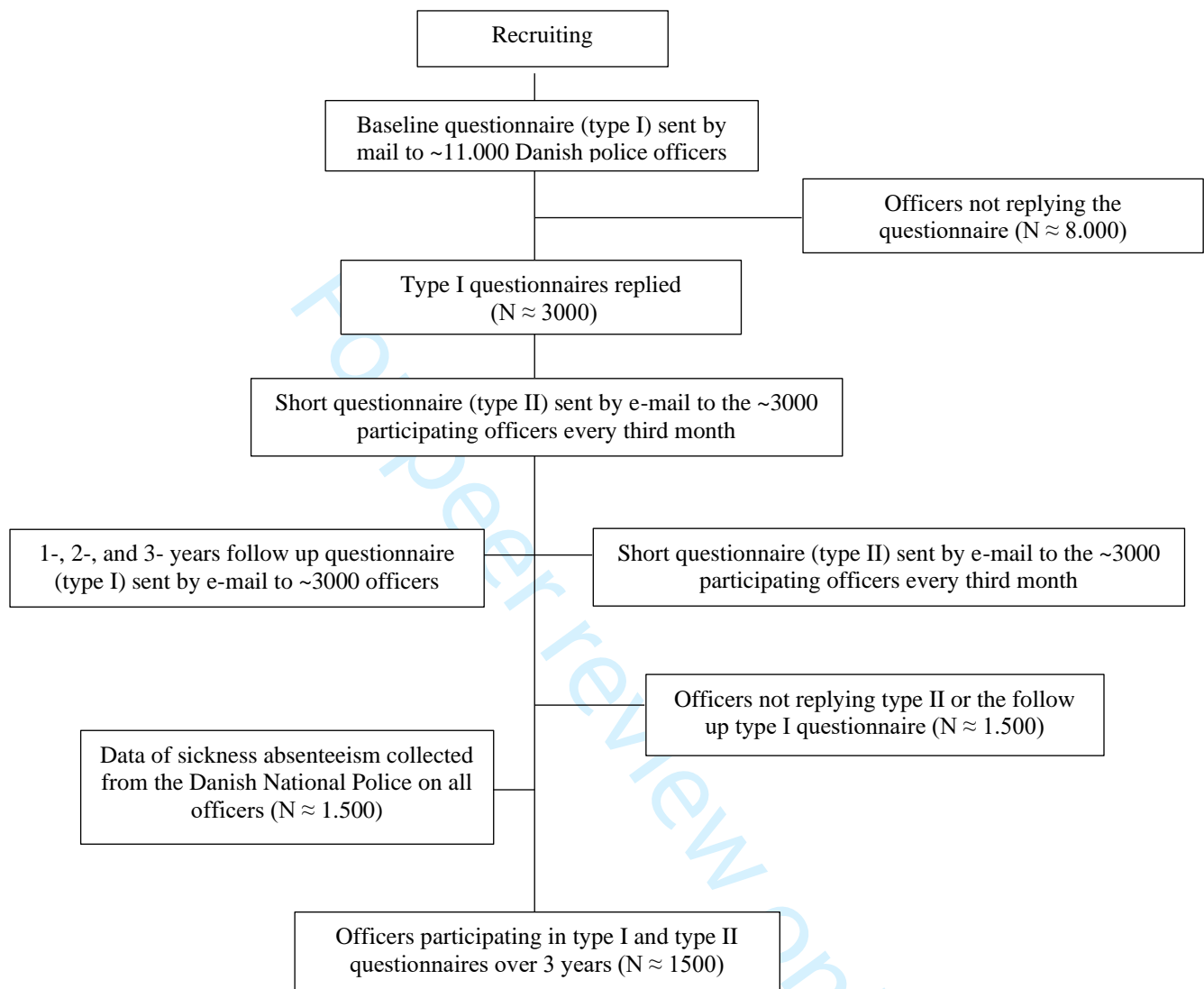
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Figure 1 Flow Chart of the Data-collection and Expected Response Rates



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Figure 2 Timeline of the Study



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BMJ Open

ARE YOU ALL RIGHT (AYA)? Association of cumulative traumatic events among Danish police officers with mental health, work environment and sickness absenteeism: Protocol of a 3-year prospective cohort study

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Keywords:	MENTAL HEALTH, OCCUPATIONAL & INDUSTRIAL MEDICINE, Adult psychiatry < PSYCHIATRY

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ARE YOU ALL RIGHT (AYA)? Association of cumulative traumatic events among Danish police officers with mental health, work environment and sickness absenteeism: Protocol of a 3-year prospective cohort study

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ABSTRACT

Introduction: Police officers are frequently exposed to potentially traumatic events at work that increases risk of developing mental health problems, in particular Posttraumatic Stress Disorder (PTSD). Individual and organizational factors may influence the detrimental effects of cumulative exposure to traumatic events. Occupational stress and lack of organizational support are associated with increased risk of PTSD among police officers. The Are You All right? (AYA) project is a prospective cohort study investigating the cumulative effect of traumatic events at work on mental health problems and absenteeism among police officers. The study also investigates whether potential risk and protective factors modify the association of traumatic events at work with mental health problems and absenteeism.

Method and analysis: The AYA-study includes the entire Danish police force. Prospective survey data are collected over a three-year period beginning in the spring of 2021. Electronic surveys are sent out at baseline with 1, 2- and 3-years follow-up. Further, short surveys are sent out every third month, covering exposure to traumatic events and current mental health status. The survey data are paired with workplace register data on sickness absence. Register data on sickness absence cover the period from 2020 to 2025. **Ethics and dissemination:**

This study was presented for evaluation at the National Ethics Committee in Denmark (Reference number 20202000-216), but according to Danish legislation, survey studies do not require approval by official Danish scientific or ethical committees. Participation in the project is based on informed consent, and data are handled in accordance with the Danish data legislation (Journal no.: 20/41457). Results are published in scientific journals and disseminated at international conferences.

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ARTICLE SUMMARY

- AYA is the first large prospective cohort study in police officers examining the impact of prolonged exposure to potentially traumatic events at work on mental health and sickness absenteeism.
- The study also addresses potentially modifying individual and work environmental factors on the development of mental health problems and sickness absence following exposure to traumatic events at work.
- The cohort includes the entire permanent staff employed in the Danish National Police Force in the period of 2021-2023, approximately 11.000 individuals.
- The study uses prospective validated survey data with systematic follow-up through a 3-year period. Survey data are paired with workplace registers on sickness absence.
- The study design counteracts the many biases associated with observational studies, but as participation is voluntary there is risk of selection bias and attrition.

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INTRODUCTION

Police officers are frequently exposed to potentially traumatic events as part of their work. Police-specific events may include violence, armed conflicts, as well as witnessing severe incidents such as child sexual abuse, mutilated dead bodies or seriously injured victims [1, 2]. Police officers are on average exposed to three traumatic events every sixth months [1, 2]. In comparison, more than half of the adult population is only exposed to one traumatic event during their entire life [3]. One of the primary mental disorders connected with traumatic experiences is Posttraumatic stress disorder (PTSD). PTSD is, according to the diagnostic criteria of ICD-11, defined as a prolonged or delayed reaction to an event or series of events with an exceptionally threatening or horrific nature. The disorder is characterized by three main symptom categories: Re-experiencing the traumatic event, avoidance of trauma-related stimuli after the trauma, and hyperarousal [4]. A recent meta-analytic review reported an overall pooled point prevalence of 14.2 % for PTSD among police officers (5), however, as the ICD-11 diagnosis is novel, this review was based on studies using the DSM-5 and ICD-10 diagnosis of PTSD. Further, in the 11th revision of the ICD, the diagnosis of complex PTSD (CPTSD) is included. CPTSD captures a posttraumatic disorder that can arise following repeated or chronic traumatic stress. Besides the three main core symptoms of PTSD, CPTSD include symptoms such as disturbances in affect regulation, negative self-concept, and difficulties in relationships [6]. CPTSD is associated with poorer treatment outcomes compared to PTSD. As police officers are repeatedly exposed to traumatic events, the CPTSD diagnosis seems relevant to investigate in a police cohort study. A recent cross-sectional study even indicated a higher prevalence of CPTSD than PTSD among a sample of police officers [7]. More studies are needed to investigate the occurrence of PTSD and CPTSD using the criteria of ICD-11

Also, previous research suggests that police officers may develop PTSD in a different pattern compared to people in the general population [8,9]. Due to professional selection and training, police officers possess a resilience to cope with traumatic events experienced at work. However, this professionalism also retains officers in a context where they will be re-exposed to traumatic events for long periods [10]. Research has indicated that the cumulative strain experienced by repeated exposure to traumatic events over time constitutes a specific mental strain with a possible different pattern of PTSD symptom development [9,10,11].

McFarlane argues that a prolonged re-exposure to traumatic events among police officers leads to a gradual sensitization of the nervous system. This sensitization will eventually lower the threshold for reactions to psychological stressors, while the intensity of reactions gradually heightens at the same time [9]. PTSD in police officers also seems to develop with a delayed onset either months or years after the traumatic event [12, 13]. In these cases, the officer may manage the experience of distress by adaptive means during the traumatic event, but the traumatic event constitutes a latent stressor that may become manifest at a future point in time due to subsequent environmental stress or traumatic re-exposure [13]. Thus, police officers may develop PTSD-symptoms gradually over even long periods of time, with a delayed manifestation of PTSD-psychopathology representing exacerbations of prior symptoms. However, evidence from well-designed longitudinal studies is lacking.

In addition, police officers might not only react with PTSD symptoms to potential traumatic events. Research have indicated that the continued exposure to traumatic events at work can result in general mental health problems, including depressive and anxiety symptoms, and may appear in combination with somatic health complaints, sickness absence, problems with collegial cooperating and solving assignments, reduced productivity, and unemployment [14-17]. The exposure to traumatic events at work can also have more hidden consequences such as presenteeism. Presenteeism is defined as attending work while feeling ill and with reduced

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productivity [18, 19]. Presenteeism is interesting as it represents a grey zone between being fully functioning or completely absent due to illness. Presenteeism, thus, may be an important point for preventing long term sickness leave. A Danish study found that workers who had gone to work despite feeling ill more than six times in the year had a 74% higher risk of becoming long-term sick (absence from work for more than 2 months) [20]. Also, a prospective study with 11-years follow-up found presenteeism to be a strong predictor of disability pension [21]. Studies have reported a high level of presenteeism among police officers, with 47% of the total sample reporting presenteeism in a Swedish study and 74% of the sample in a German study [22, 23]. Also, emerging evidence indicates that presenteeism can have negative consequences on problem solving, which may become especially problematic in job functions with a high demand for safety and handling of situational crisis [24]. However, interest in presenteeism is new and evidence based on longitudinal studies is lacking, especially regarding presenteeism as a possible early warning signal for long-term sickness absence.

Therefore, the development of potential detrimental health effects of repeated trauma exposure in police work, information on PTSD, CPTSD, comorbidity symptoms and sickness absence, needs to be investigated using prospective designs to capture the prolonged and less clear prodromal phases of a definitive manifestation of psychopathology. This understanding is pivotal to enhance the effectiveness of prevention strategies that rely on post-exposure support as well as treatment where early detection of pathology is of utmost importance.

The influence of work environment and individual factors

Studies have indicated that severity and type of event, degree of exposure, prior traumatic experiences, work experience, family psychiatric history, personality characteristics, and coping style may influence the effect of exposure to traumatic events at work [25-29]. In

specific, a previous study reported avoidant coping strategies to be a significant risk factor for PTSD development [5]. At the organisational level, occupational stress, shift work, a lack of support (from colleagues and leaders), issues with colleagues and management, role ambiguity, and role conflict have been reported as risk factors for development of mental health problems among police officers [29-31]. In particular, recent research has identified occupational stress as the strongest risk factor for both suicidal ideation, depression, and PTSD [5]. Research also indicates that negative social support is an important factor in the development of PTSD [5, 32], and an existing prospective study found that the experience of deficient organisational support increased the risk of PTSD among police officers [27]. In which way these factors interact with exposure to traumatic events in the development of PTSD and other mental health problems remain unknown.

The present study

Several research gaps exist in the current understanding of the effects of exposure to work-related traumatic events on mental health among police officers. There is still only a limited focus on the effects of the cumulative exposure to traumatic events over time [9, 10], which limits our ability to identify early signs of mental health problem and thus the establishment of proper and effective preventive initiatives. Furthermore, existing research is mostly based on small populations in specific functions without long-term follow-up periods. This not only limits the generalisability of the results, but it also limits our understanding of how mental health problems develop over time as well as our understanding of the interplay and temporal dynamics of exposure and health problems. Also, current research has mainly focused on the independent effects of risk and protective factors at the individual or the organizational level respectively, though it is likely that health problems occur by the interaction of both individual and organisational factors [25]. Thus, our understanding of the complete and

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interacting effect of risk factors in the working environment and in the individual employee is sparse.

The present prospective cohort study, situated in a Danish context, aims to increase our understanding of how and when police officers develop mental health problems, in particular PTSD and CPTSD, following exposure to traumatic events. The study also aims to identify preventive factors and thereby enhance sickness prevention at the workplace. Access to register-based sickness absence data allows us to analyse and compare mental health status and level of presenteeism, with the actual sickness rate at both individual and department level.

Objectives

The present project Are You All right? (AYA) addresses the following research questions:

1. What are the extent and character of traumatic events in the daily police work across different job functions?
2. What are the mental health consequences of repeated exposure to traumatic events at work over time?
3. What is the prospective association between traumatic events at work and presenteeism and sickness absence?
4. Which individual and work environmental factors have a modifying effect on the development of mental health problems after exposure to potential traumatic events at work?
5. Which individual and work environmental factors have a modifying effect on presenteeism and sickness absence after exposure to potential traumatic events at work?

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METHODS AND ANALYSIS

Study design and population

The AYA-project is a prospective cohort study investigating the associations between exposure to traumatic events, mental health consequences, work environment and sickness absence among a cohort of Danish police officers. Data is collected at baseline and at 1-, 2- and 3-years follow-up using electronic questionnaire surveys send out to participants’ work mail. The baseline and follow-up surveys measure sociodemographic and lifestyle factors, mental and somatic health, trauma relevant factors at work and outside of work, factors of the psychosocial work environment, instrumental and social support, as well as individual factors of coping and resiliency. In addition, short questionnaire data is collected every third month covering exposure to police relevant potential traumatic events, symptoms of PTSD, level of general stress, presenteeism, and participation in formal support initiatives. Survey data are analysed and paired with individual data on sickness absence registered at each department within the Danish National Police. The study includes all officers in the permanent staff of the Danish Police, both men and women and from different service areas. Approximately 11.000 employees are invited to participate. Based on experiences from similar studies, we expect response percentage of 30 % corresponding to approximately 3300 officers. Similar cohort studies about violent events in Denmark typically reports a drop-out rate of 20 – 40%. When considering the frequent questionnaires and the long period of follow-time (3-years), we expect an additional drop-out. A conservative estimate of the final sample size is therefore a minimum of 1500 officers, also see flowchart in Figure 1. Previous studies have reported a PTSD prevalence between of 7-19% and a subclinical level of PTSD of 34% [33]. With a conservative estimate of 5% PTSD and 10% subclinical PTSD in this sample we will have around 75-150 clinically relevant cases. Also, we expect that 20% of the cohort will have heightened levels of mental health symptoms representing 300 cases of the sample. As one

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study have indicated, a higher rate of CPTSD than PTSD exists among police officer, and we therefore expect that at least the same number of cases will be represented with CPTSD in the sample [13].

The project is funded by The Working Environment Research Fund (Danish: Arbejds miljø forsknings fonden grant nr: 20205100185) in the period of 2021, 2022, and 2023 with the possibility of extension in case of for instance maternity or sick leave of some of the central project researchers. The funding covers salary expenses, conference participation and data manager hours. The funding source has no influence on the analyses, interpretation of the data, or decision to submit results.

Insert Figure 1 - Flow Chart of the Data-collection and Expected Response Rates - hear

Patient and Public Involvement

Patients were not involved in the design of this observational study. However, the research questions and design were developed in discussions with stakeholders from the Danish National Police, the police union, and a psychologist employed within the Danish police force. Results, conclusions, and recommendations are published in a report to the Danish National Police, a public report to the Working Environment Research Fund, in international scientific journals, and will also be disseminated on national and international conferences. Findings from the study will also be disseminated at meetings in the included police districts with the participating police officers.

Organizational structure and responsibilities

The project is organized around a 3-year PhD project with PhD Student Sara Rosenbeck Møller. Main supervisor is professor Ask Elklit from the Department of Psychology,

University of Southern Denmark. Co-supervisors are Associate Professor Nina Beck Hansen and Associate Professor Jesper Pihl-Thingvad from the Department of Occupational and Environmental Medicine, Odense University Hospital. The PhD student is employed at Department of Occupational and Environmental Medicine and is enrolled at the PhD School at the Faculty of Health Sciences, University of Southern Denmark. Associate Professor Nina Beck Hansen is principal investigator, and Associate Professor Jesper Pihl-Thingvad acts as data manager. Professor Lars Louis Andersen from the National Research Centre for Working Environment acts as statical supervisor.

The project is followed by an interest committee with representatives from the Danish National Police, the Danish police union, the police society Thin Blue Line, and stakeholders from other unions representing Danish ambulance workers. Research results are disseminated and discussed yearly with the interest committee.

Data collection

Baseline and follow-up questionnaire (Type I data)

At baseline and at 1-, 2-, and 3-years follow-up we use a questionnaire (type I) constructed out of relevant parts of different validated surveys, also see table 1. The type I questionnaire will address the five main themes: 1) Exposure to traumatic events, 2) psychological/somatic symptoms, 3) sickness absenteeism and presenteeism, 4) work environment / management, and 5) individual factors. The rationale behind the 1-year follow-up interval is that this time period corresponds to the time suitable to assess changes in the psychosocial work environment [34]. If participants do not answer, they will receive one reminder following two weeks and a second reminder following a month.

Table 1 Themes and Questionnaires in the Type I Data Collection.

Theme	Questionnaire
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Exposure to traumatic events	
Extent / Duration	Critical Incident History [35] Questionnaire (CIHQ)
Psychological / Somatic symptoms	
PTSD	International Trauma Questionnaire (ITQ) PTSD and CPTSD [36]
Depression	Major Depression Inventory [37]
Burnout	Personal and Patient/client related burnout [38]
Pain	Three pain-questions from the Nordic Questionnaire [39]
Work environment / Management	
Pace of work	Copenhagen Psychosocial Questionnaire (COPSOQ) [40]
Quantitative demands	COPSOQ
Role ambiguity	COPSOQ
Role conflict	COPSOQ
Meaning in work	COPSOQ
Bullying / conflict / unwanted sexual attention	COPSOQ
Quality of management	COPSOQ
Social capital at work	Questionnaire about social capital at work, developed by the Danish National Research Center for the Working Environment [41]

Individual factors	
Age	Work Environment and Health Questionnaire (WH) [42]
Sex	WH
Civil status	WH
Children	WH
Chronic and severe somatic disorders	WH
Trauma self-efficacy	Trauma Coping Self-Efficacy Scale (CSE- T) [43]
Smoking / Alcohol	WH
BMI	WH
Length of duty (in years)	
Professional training	
Lifetime traumas	Checklist from the National comorbidity study [3]
Social support	The Crisis Support Scale (CSS) [44]
Coping strategies	Coping Style Questionnaire (CSQ) [45]

Short version questionnaire (type II data)

Every third month, enrolled participants receive a short questionnaire (Type II) that addresses three categories: 1) Exposure to traumatic events during the last three months, 2) activation of symptoms in relation to exposure, and 3) presenteeism, also see table 2. This 3-months interval was chosen to reduce the risk of responders’ fatigue and attrition but at the same time include a shorter time period in order to reduce recall bias [46], and to assess a more stable

manifestation of PTSD, which according to DSM-5 is considered an actual diagnostic pathology when symptoms persist for more than 1-month.

Table 2 Themes and Questionnaires in The Type II Data Collection.

Theme	Questionnaire
Exposure to traumatic events	Categories adapted from the CIHQ[35]
Psychological / somatic symptoms	PTSD symptoms from the ITQ and a single stress item
Presenteeism	Two questions on presenteeism: <i>"How many days have you gone to work, although you were sick or not feeling well during the last three months? (0 days, 1-4 days, 8-14 days, more than 15 days)"</i> <i>"Overall, how likely is it that you go to work although you are ill? (Very unlikely, unlikely, neither/nor, likely, very likely)"</i>
Participation in formal support initiatives?	"Have you received debriefing or other professional counselling?"

Data of sickness absence from The Danish National Police

Data of sickness absence will be transferred from the Danish National Police to a secure server and saved in the project database with a unique participant ID-number. Questionnaire data and sickness absence are merged using the unique participant ID-number. Sickness absence data are collected from one year prior to baseline until one year after the last follow-up survey.

For an overview of the study's timeline, please see Figure 2.

Insert Figure 2 - Timeline of the Study - hear.

Statistical Analyses

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In relation to research question 1, we will use descriptive analyses to investigate extent and character of trauma exposure. Accumulation of trauma exposure can be modelled in different ways. In the AYA project, we will measure accumulated exposure in two ways: 1) Frequency of exposures using a sum score of the total number of critical events reported within the period, and 2) prolonged exposure measured as the sum of time periods with exposure throughout the period of analyses. This is an operationalization of repeated exposure used in similar studies on occupational risk factors [47, 48]. For both types of accumulated exposure, sensitivity analyses will be made adjusting for quality and experienced severity of the exposure, to assess the effect of accumulated repeated events. We will also examine exposure in relation to gender, age and duration of employment.

In relation to research question 2 and 3, we will use binominal logistic regression analyses with repeated measures with fixed and random effects, also known as generalized mixed models. Analyses comparing sickness absence (low/high), presenteeism (yes/no) and mental health symptoms (no symptoms, subclinical symptoms and clinical symptoms) within each follow-up period and in relation to level of exposure will be conducted. Furthermore, level of exposure in the previous period will be assessed in relation to sickness absence, presenteeism and mental health problems 6 month later.

In relation to research question 4 and 5, we will use latent class analyses and latent transfer analyses. We will identify different profiles of sickness development in relation to factors in the work environment, level of exposure and individual factors. We expect to identify different profiles on those who 1) increase their levels of mental health symptoms, 2) decrease their levels of mental health symptoms, and 3) have no change in mental health symptoms throughout the project period. Same profiles can be identified in terms of their level of sickness absence.

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Using linear fixed effect models with repeated measures four times (baseline and three follow-ups) with three groups (no exposure, low exposure and high exposure), low effects (0.15) and low correlation between the follow-ups (0.05) will correspond to a power of $1-\beta$ -error probability = 0.99 calculated using G'Power 3.1 with 150 cases [49]. As mixed model and latent class analyses are considered being more robust statistical analyses, we expect to have a sufficient level of statistical power.

The cohort will be compared with all invited participants in relation to age, gender, and duration of employment as we will get this information from the Danish Police. Thereby, we can examine if our cohort are representative with the entire police force on those parameters.

Furthermore, we will examine whether participants of the final cohort are different from those who drop out of the study on selected variables important for the specific analyses.

Attrition analyses are conducted as part of overall missing data analysis. If feasible, we will construct a weight variable based on register-information about non-respondents and drop-outs. Logistic regression models will be performed with dropout/no-dropout set as outcome, each of the factors at baseline set as predictors. Any baseline factor with moderate to strong association to dropout will be considered for inclusion in the main study analysis to adjust for sample bias. Factors with weak associations will not be included due to effects seen in large samples and the consideration of over adjustment in already complex models.

Ethics and Dissemination

All data are collected using the police officers' work mail, which we are allowed access to from The Danish National Police. In the Spring of 2021, all employees receive an information letter by e-mail which contains informed consent and a link to the baseline questionnaire. The participants were asked to tick off a consent formulation before answering the questionnaire, and the participants can withdraw consent and participation at any time

during the study period. The study has been presented to the National Committee on Health Research Ethics (Ref. numb. 20202000-216) but according to Danish legislation, survey studies require no approval by official Danish scientific or ethical committees. The study and procedure for data collection are registered and have been approved by The Danish Data Protection Agency (journal no.; 20/41457). All data are stored on a secure server under the Open Patient data Explorative Network, a database unit under Odense University Hospital. Furthermore, the project is conducted in accordance with the Helsinki II declaration and the Danish Code of Conduct for Research Integrity. The findings of AYA will be disseminated to relevant national and international audiences. We expect 5 peer-reviewed publications to result from the project, and the results will be disseminated regardless of the magnitude or direction of effect.

Besides, we aim to deliver an academic impact by disseminating the project results as oral or poster presentations on scientific conferences such as the International Conference of Occupational Health (ICOH). Finally, the findings of AYA are communicated to stakeholders such as the Danish National Police and representatives in the interest committee.

DISCUSSION

The AYA-project investigates associations between repeated exposure to traumatic events, mental health problems and absenteeism, including a broad variety of relevant individual and work environment factors. It is the first large research study among Danish police officers since 1993 [50]. The ongoing and comprehensive data collection provides valuable knowledge about the impact of work-related traumatic events on mental health and sickness absence among police officers. Due to the prospective design of the study, we will be able to investigate the development of mental health problems over time, which is important to study the prolonged effects of repeated exposure to traumatic events.

As mental health problems most likely occur in interaction with individual and organisational factors, this study also identifies risk and protective factors and the interacting effect of the work environment and the individual coping. The 1-, 2-, and 3-year follow-up assessments (Type I questionnaire) provide knowledge of the long-term effects of exposure to work-related traumatic events in combination with individual and organisational risk factors.

Thereby, potential delayed reactions after exposure to traumatic events and exacerbations of PTSD symptoms may become visible. Moreover, the repeated measure design of the quarterly survey (type II questionnaire) strengthens the study by minimising recall bias on both exposure and health, while also allowing to separate exposure and health outcome within shorter time periods to better capture variability. Another methodological strength of the AYA-study is the objective quantification of individual sickness absence which allows us to analyse and compare mental health status and level of presenteeism with the actual sickness rate.

There are also some limitations to the study design and the use of self-reported surveys. The study relies on voluntary participation, and therefore a potential selection bias is present. Moreover, attrition is a challenge in longitudinal studies which might also contribute to a possible selection bias. To retain participants through the course of the study timeline, we will ensure continued and motivational reminders following the initial survey mail. Also, evidence is currently lacking on how to investigate presenteeism in the best way [51]. In this study, we use two single-item questions with a wording often seen and used in the existing literature [52]. Furthermore, these two questions were also included in two other studies in a Danish context, whereby we will be able to compare findings. However, we acknowledge the limitations surrounding the lack of a golden standard to assess presenteeism, and we hope that AYA will contribute to the advancement of exiting knowledge and ways to measure presenteeism in the future.

The AYA-study will be an important step in securing knowledge that is crucial for the clinical understanding of mental health problems in police officers and for the improvement of existing prevention initiatives. The findings of our study have implications for sickness prevention among police officers and workplace strategies used for screening and assessment when exposed to potential traumatic events. The results of this study are expected to identify early warning signs and specific circumstances in police work where a high risk of mental health problems exists. Furthermore, knowing how and when exposure to traumatic events causes mental health problems may also have implications for subsequent psychological treatment. The results of this study are relevant for other occupational groups where repeated exposure to traumatic events is part of the daily work such as firefighters or rescue personal.

Authors’ contributions:

NBH and JPT developed the original idea for the study and established the collaboration with The Danish Police in collaboration with SRM. NBH is principal investigator. The funding protocol was developed by NBH and JPT and discussed with LLA, LB, SRM and AE. The study design, selection of surveys and possible statically analyses were developed and discussed in a team of all included authors. The manuscript was drafted by NBH, SRM and JPT followed by a critical reading from AE, LB and LLA. Thus, all authors have read and approved the manuscript and are responsible of its accuracy.

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Competing interests’ statement: None declared

Patient consent: is obtained.

Data Sharing statement: fully anonymized data and questionnaires are available upon reasonable request.

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Figure 1 Flow Chart of the Data-collection and Expected Response Rates

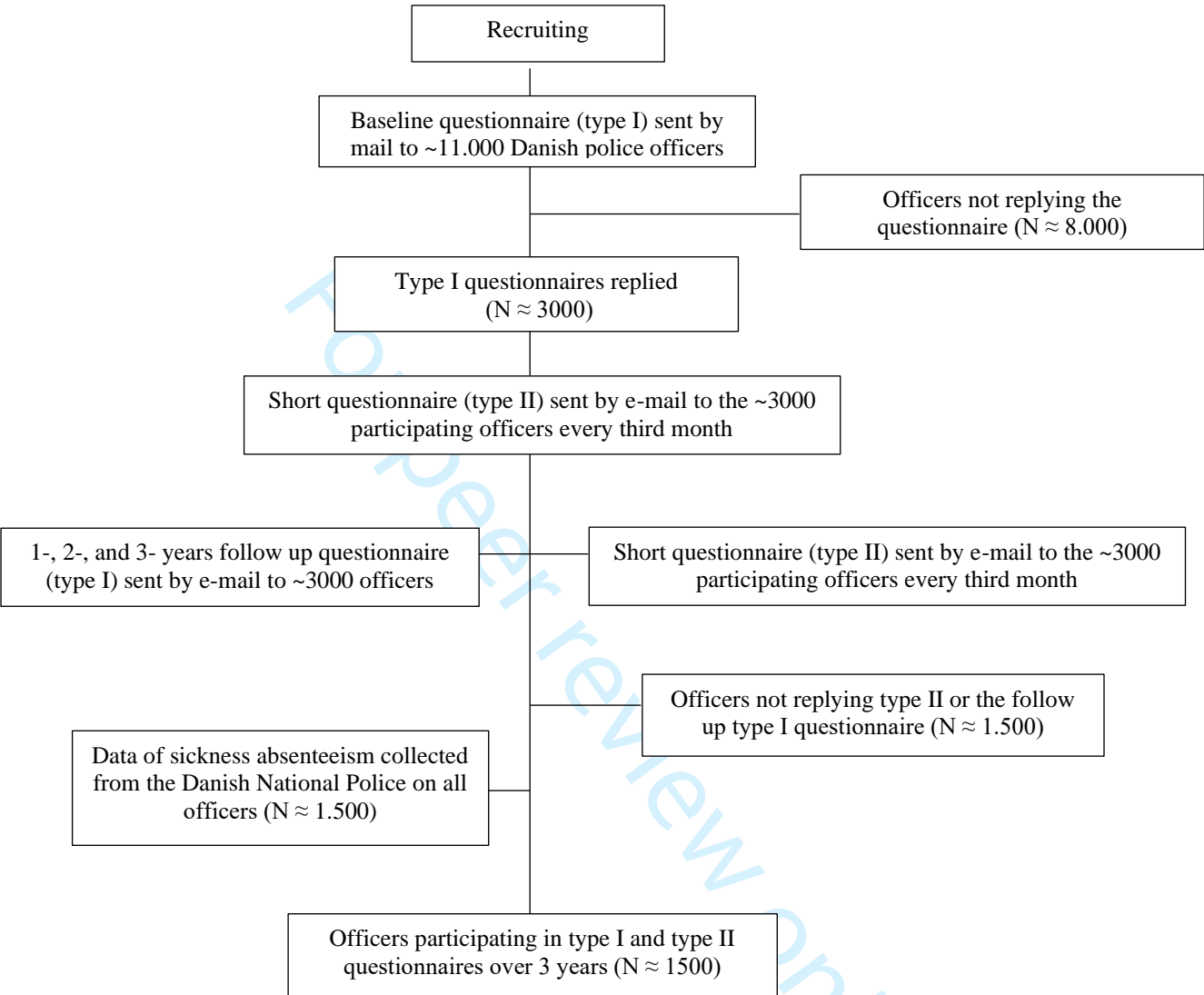


Figure 2 Timeline of the Study

