THE RELATIONSHIP BETWEEN TRAUMATIC EVENTS AND QUALITY OF SLEEP IN OLDER ADULTS IN RURAL SOUTH AFRICA

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A research report submitted to the Faculty of Health Sciences, University of Witwatersrand, in partial fulfilment of the requirements for the degree of Masters of Epidemiology and Biostatistics

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Declaration

I **Tsitsi Cherry Dzimbanhete** declare that this Thesis/Dissertation/Research Report is my own, unaided work. It is being submitted for the Degree of **Master in Epidemiology and Biostatistics** at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

__T C. Dzimbanhete__ (Signature of candidate)

_____31st_day of_March_2024_in__BULAWAYO_____

Dedication

I dedicate this to my family who have supported me throughout my journey.

Abstract

Introduction: A number of factors are associated with the quality of sleep, a broad measure that includes sleep duration and disturbance. There are many factors associated with quality of sleep including communicable and non-communicable diseases and life course traumatic events (TE). Older adults who have experienced life course TE and the onset of comorbidities may be at risk of fluctuations in their quality of sleep. However, there are limited data on the African continent examining these relationships. Therefore, this study aimed to bridge the aforementioned gap and 1. examine the prevalence of traumatic events (TE), 2. examined the prevalence of poor quality of sleep in adults in the Health and Aging in Africa: a longitudinal study (HAALSI) cohort 3. examine the relationship between the TEs and quality of sleep in the HAALSI cohort in the Mpumalanga Province of South Africa.

Methods: A cross sectional analysis using data from the second of four waves of the HAALSI cohort was undertaken. The second wave which recruited 4176 participants was conducted between 2018 and 2019. Measures include the English Longitudinal Study of Aging life history data to estimate prevalence of TE, brief version of Pittsburgh Sleep Quality Index (B-PSQI) to estimate the prevalence of poor sleep quality and the relationship between TE and poor sleep quality. Descriptive analysis, bivariate and multivariate analysis of the data was conducted in Stata 17.

Results: The mean age of the participants was 65 years (SD=13). The majority of the sample were of South African origin (70%). With regard to education status, less than half (43%) had not completed a formal education (i.e., primary school). Poor quality of sleep was reported by 27% of the participants. With regards to TEs 66% of the sample reported caregiving trauma, 58% accident and disaster TEs, 30% childhood trauma,

15% war related TEs and 22% community violence. The multivariate analysis suggested that participants with history of exposure to childhood TEs and war related TEs had higher risk of poor sleep quality (OR 1.5 (CI1.2-1.8)) and (OR 1.5(CI 1.2-2.0)) respectively. The other variables associated with higher risk of poor sleep quality were being married (OR=1.2 (CI 1.0-1.4)) history of smoking (OR=1.6 (CI 1.2-3.1)), mild to moderate (OR=1.7 (CI 1.3-2.1)) and major depression symptoms (OR=2.1 (CI 1.8-2.7)), being obese (OR =1.3 (CI 1.0-1.6)) and being HIV negative (OR= 1.4 (1.0-1.6)).

Conclusion: Exposure to war related and childhood TEs were found to be associated with poor sleep quality in the older adults in rural South Africa. While a cross-sectional analysis is valuable, an examination of the full cohort of the trauma at baseline and quality of sleep would inform trauma focused interventions that seek to improve quality of sleep in older adults.

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Chapter 1

1.1 Introduction

This introduction consists of the following: First,1.1.1 key definitions and concepts relating to sleep including sleep architecture, sleep quality, sleep disturbance and sleep disorder are presented. Thereafter 1.1.2 measurement of sleep, and 1.1.3. the definitions of traumatic events (TE).

1.1.1 Key Definitions and Concepts

Sleep is an integral physiological function as it is important in resetting the physical, emotional, and cognitive health each day. The known functions of sleep are extensive and are reported to include boosting immunity(1,2), appetite regulation and metabolism(1–3), enhancing of the clearance of metabolic waste(3,4), hormone regulation (2–4), memory formation and maintenance of cognitive health(1,5,6). Poor sleep quality affects the normal physiological and emotional health in individuals (7). The consequences of sleep disturbances include weakening of the immune system (2), increased risk of cardiovascular diseases (2–4), metabolic diseases like diabetes mellitus and obesity (1,2,4,8), psychiatric conditions like anxiety and depression (9), and poor cognition manifesting as poor memory and decreased cognitive function (10–12).

The epidemiological literature examining sleep also examines various exposures that can be associated with poor sleep quality. These exposures can include both physical and mental disorders

including an array of non-communicable diseases, depression, anxiety and traumatic events (TE) and post-traumatic stress disorder (PTSD) (13–16).

Quality, duration and timing are important concepts to consider when studying sleep. These are distinct concepts which are outlined below:

Good sleep is when the sleep is of sufficient duration, is regular, of good quality and has no disturbance. The National Sleep Foundation in the United States of America (USA) recommends 7-9 hours per night of sleep for adults which is important for developmental, restorative function and overall health of individuals (1,17–19). Less than 6 hours or more than 9 hours of sleep would be considered poor sleep (18,20). and is associated with an array of adverse health outcomes (1,21,22). Sleep duration differs by developmental stages, Neonates sleep between 14-17 hours a day while adults require 7-8 hours of sleep a day (13,18).

Sleep quality, another important concept concerning sleep, is a multi-dimensional construct that also captures sleep latency (the time it takes to fall asleep), number of awakenings, sleep architecture (patterns of sleep stages and their duration), sleep efficiency (ratio of time you spend sleeping to time you spend in bed) as well as individual perception of feeling well rested (23,24). According to a systematic review by Chaput et al, sleep timing and regularity have no clearly defined targets although the timing and regularity have to be consistent (13). Good sleep also includes the architecture of sleep in which there are multiple sleep cycles with each sleep cycle consisting of 4 individual stages, 3 stages are non-rapid eye movement (NREM) and 1 stage of rapid eye movement (REM) (10–12). The sleep cycle varies as the sleep duration increases, from night to night and can be affected by age, and sleeping habits among other causes (25,26).

1.1.2 Measurement of sleep

There are several instruments designed to examine the quality of sleep. These can be objective instruments, like polysomnography (PSG) and actigraphy, and subjective measurements like sleep questionnaires like the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), Insomnia Symptom Questionnaire (ISQ) and sleep diaries (27–33).

Polysomnography (PSG) is a sleep study performed in clinical or research settings for the evaluation of sleep disorders. It involves monitoring, recording and analysis of physiological changes occurring during sleep which include brain activity (electroencephalogram), eye movements (electrooculogram), respiratory parameters, muscle activity (electromyogram) and heart rate (electrocardiogram) (34,35). PSG provides information on sleep quantity, time of occurrence, distribution of sleep stages and diagnosis of sleep pathological events (34–36). Actigraphy is used to measure or assess the sleep-wake cycle using a device that is generally connected to the wrist or ankle. It measures sleep over 24 hours a day and weeks (32,33,37).

Sleep questionnaires can be used to evaluate specific sleep symptoms or general aspects of sleep. Sleep diaries are also used when participants record estimates of sleep parameters when they wake up in the morning (28). ISQ has 13 self-rated questions which are designed for identifying and assessing insomnia. The ISQ follows a stepwise approach of asking about the presence of sleep symptoms, if present then its frequency and duration and evaluation of any daytime consequences of the sleep symptom (38). ESS, an 8-item questionnaire assesses subjective daytime sleepiness (37). PSQI is a 24-item questionnaire with 19 self-reported and 5 questions reported by room or bed partner. The 19 self-reported questions assess sleep quality with a global score consisting of seven sleep components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, daytime dysfunction, sleep disturbance and use of sleeping medications over one-month intervals (31). PSQI has also been modified for example brief PSQI which is 6-item(39). PSQI subjectively measures sleep and a study done on college students using a shortened version can be an alternative to the long one

(40). Other instruments used in sleep research identified in a systematic review by Ali and colleagues include the Insomnia Severity Index and the Functional Outcomes of Sleep Questionnaire (41).

Peltzer in 2012 examined the quality of sleep among South Africans in a rural region. Measures included: "*Overall in the last 30 days, how much of a problem did you have with sleeping, such as falling asleep, waking up frequently during the night, or waking up too early in the morning?' Response options ranged from 1 (none) to 5 (extreme/cannot do). Poor sleep was then defined by the response to this question with 'severe' or 'extreme/cannot do'. In addition, a question. The survey also included two additional questions about self-reported hours of sleep in the last two nights: 'How many hours (and minutes) did you sleep?"* (42). Pengpid and Peltzer employed a self-rated questionnaire derived from PSQI have been used to describe sleep data in rural South Africans (43–45).

1.1.3 Traumatic events (TE)

Traumatic events (TEs) are an important source of poor sleep quality (46–49).

Trauma can occur to anyone and anywhere of people in all places, it has no respect of age, geographical location, sex, socioeconomic status, race or ethnicity and prevalence varies (50). A traumatic event (TE) is an event where there is exposure to actual or near death, sexual violence or serious injury that a person experiences, learns about or witnesses in which they respond with fear, horror and helplessness (51,52). TEs can be natural or man-made. Examples of natural TEs are floods and droughts while man-made ones are events that include war, criminal violence, and physical or sexual assault among other causes (51). TEs can also be classified as direct trauma, where an individual experiences or witnesses a TE or indirect trauma, where one learns about TEs like watching television, hearing about a loved one's trauma or working in emergency departments (53).

Trauma can also occur when one is in a situation or series of events that cause distress and make one feel helpless in their ability to change the situation they are experiencing and also cause a threat to their well-being and health (54,55). These situations, which may include caregiving and child abuse, may have a lasting psychological, emotional and or social impact on an individual (47). Events occurring in childhood threatening the loss of something or someone perceived to be important for psychological or physical self-integrity like repeated verbal abuse, disruptions in attachment relationships, betrayal trauma among other experiences and events can also be classified as TEs as they can leave the child helpless and overwhelmed (47,52,56). In caregiving, one can live through prolonged distress that can have an impact on their well-being emotionally and physically (57).

South Africa is one of the countries that have a high prevalence of violence due to its history and the effects post-independence, which increases the occurrence of TEs (58–60).

1.2 Literature review

The literature review seeks to elaborate on concepts introduced in the introduction. The literature review was conducted by searching the database PubMed mainly for relevant literature that examined sleep among older adults. I also searched for studies that examine the relationship between TE and sleep.

The themes that constitute the literature review are: 1.2.1 Global and African-based epidemiological studies of sleep; 1.2.2. Physical and mental comorbidities associated with quality of sleep or sleep disorders; 1.2.3. Sleep in older adults; 1.2.4. TEs and sleep disorders; 1.2.5 Justification and problem statement and 1.2.6. Objectives and hypothesis. The literature review makes a case for examining TE among adults in rural South Africa and suggests there is a gap in the field.

1.2.1 Global and African-based epidemiological studies of sleep

This section of the literature review synthesizes the prevalence and correlates of poor quality of sleep and sleep disorders. I seek to synthesize both global and African data. To my knowledge, there are few global prevalence data available of sleep quality or sleep disorders with several studies restricted to select groups including PLWHA, medical and nursing students (14,61–64). This paucity of nationally representative data makes it challenging to present a public health picture of the quality of sleep and sleep disorders.

A number of studies from high and low to middle-income countries have examined the epidemiology of sleep including studies of quality of sleep and of insomnia (42,45,65). As far back as 2011, a review of epidemiological studies of sleep was undertaken by Ohayon and colleagues suggesting that in the

general population, insomnia and general sleep disturbance was highly prevalent at 20% to 41.7% and 30% to 48% respectively (66). The review acknowledges that insomnia has been inconsistently defined in the literature (either as dissatisfaction with the quantity of or quality of sleep) and thus would be difficult to measure epidemiologically (66).

There are some sparse data from 2015 suggesting that the United States of America (USA) has about 50-70 million adults reporting poor sleep quality with disorders sleep apnoea at 10-25% and insomnia at 6-10% estimated to be the most prevalent (67). These data include the National Health and Nutrition Examination Survey (2017-2020) (NHANES) which samples adults of a minimum age of 20 years or older and has yielded nationally representative data related to sleep from the USA (68). A 2022 publication of cross-sectional data (n=9004) suggested a prevalence estimate of trouble sleeping to be 29.8%(68). Further, data from NHANES between 2017 and 2020 examined the relationship between sleep duration and wake timing particularly the difference between sleep on work days and sleep on work-free days (68). The mean sleep duration on work days was 7.59 hours while on work-free days was 8.24 hours and wake timing at 6:41 am and 7:41 am respectively (68). Results of this particular NHANES analysis suggested a prevalence estimate of trouble sleeping of 29.8% and daytime sleepiness of 27.2% (68).

Moving onto low to middle-income regions, a meta-analysis and systematic review by Chen and colleagues suggested a (pooled) prevalence of poor-quality sleep of 37% among children with higher risk among boys compared to girls(69). In addition, an African-based study by Cook and colleagues aimed to extract objective measures of sleep (i.e., not self-reported measures) (70). Cook and colleagues found differences in sleep by gender with preliminary results suggesting that comorbidities were also associated with higher adiposity and poor quality of sleep(70).

To solidify the view that the prevalence data of sleep in Africa has been limited to select samples, an Ethiopian study by Anbesaw and colleagues suggests a prevalence estimate of poor-quality sleep to be 30.8% among pregnant women (71). Correlates of poor sleep quality among these participants included perceived stress and depression (71). Wang C. et al conducted a cross-sectional study on community-dwelling older adults in 2 African settings, Uganda and South Africa showing the prevalence of reported sleep difficulty to be 32.6% for mild to moderate sleep difficulty and 23.0% for severe to extreme sleep difficulty (72). The prevalence of sleep quality was predicted using other variables but not TEs.

Pengpid and Peltzer conducted studies in South Africa on fruit and vegetable intake in relation to poor sleep quality and also sleep duration in relation to depressive symptoms in rural older adults (43,44). Studies on fruit and vegetable intake showed that higher fruit and vegetable intake was associated with incident poor sleep quality in men but not women, while higher fruit intake was associated with incident poor sleep quality in both men and women (43). A study on sleep duration and incident and persistent depressive symptoms showed that long sleep duration was associated with both incident and persistent depressive symptoms among men (44).

1.2.2 Physical and mental comorbidities associated with quality of sleep or sleep disorders

There are several comorbidities, i.e., physical and mental disorders that may be associated with sleep. These have a bi-directional relationship with sleep(73–76). Factors that influence the quality of sleep or the onset of a sleep disorder might be elucidated from prospective studies while cross-sectional studies may not be able to infer if the comorbid condition came before the poor quality of sleep or sleep disorder (77,78). These are elaborated below:

A review article by McDermott and colleagues traced the evidence of the relationship between sleep apnoea and incident stroke (i.e., from prospective cohort studies) acknowledging that too short or long sleep duration may be associated with incident stroke in the future (79). Further sleep apnoea can be in the causal pathway towards incident stroke (79). Potential mechanisms include the well-established relationship between sleep apnoea and hypertension and/or arrhythmias (also independent risk factors for stroke) (79,80). Data from the United Kingdom Biobank suggests from a prospective cohort study that both short and long sleep duration were associated with the risk of incident cardiovascular disease in people with type 2 diabetes (8).

Similarly, a cross-sectional sample from the above-mentioned NHANES suggests that hypertension and poor-quality sleep co-exist but it is difficult to determine what came first(81). Another cross-sectional study by Jordanian researchers Albqoor and Shaheen examined the quality of sleep among university students employing the PSQI (82). Income and academic performance were found to be associated with quality of sleep.

There are however studies mainly from high-income regions examining the relationship between sleep and incident cardiovascular disease that suggest conflicting results: For example, the Morgen study conducted in the Netherlands as far back as between 1993 and 1997 suggested that short sleep duration was associated with 12-year incidence of cardiovascular disease whereas long sleep duration was not found to be associated with this outcome (83). Results from a Japanese cohort, the Jichi Medical School Cohort Study (assembled in 1992 to track incident CVD) suggested that the risk of CVD was higher in male participants whose sleep duration was shorter than 6 h (84). However, when adjusting for the confounding variable of age, the incidence of CVD was found to be higher than in those who slept for 7 to 7.9 h per night. In another prospective study in 2015 from the MONICA-Brianza and PAMELA population-based cohorts, a significant increase in the hazard ratio of CVD events was

observed for participants who slept longer than 9 h with respect to 7–8 h per night (85). However, a study examining UK Biobank cohort data found that short (at most 5 h) sleep and long (at least 9 h) sleep durations were both associated with increased risk of CVD incidence after adjusting for confounding variables(86). Incident CVD was more likely among women.

A systematic review and meta-analysis led by Scott and colleagues suggest that despite variation between objective and subjective measures, sleep disturbances are associated with mood or psychotic disorders in adolescents and young adults (87). Similarly, a Netherlands-based study on gene-environment interactions in psychosis examined the relationship between sleep disturbance and negative symptom severity finding slight variation. Sleep disorders can predispose to mental health issues and chronic medical conditions but there seems to be a two-way relationship between sleep disorders and chronic medical and mental health conditions (48,74–76,88).

1.2.3 Sleep in Ageing Samples

There are changes in sleep quality and quantity that occur with age, from infancy to elderly (17,89). Several exposures like physiological and psychological changes occurring with age, medical and psychiatric illnesses, changes in lifestyle and social engagements that are likely prevalent in older adults can affect sleep and can also be a consequence of changes in sleep patterns (46,89–92). As people age there are changes in the sleep architecture, although not pathologic they increase their vulnerability to more problematic and disordered sleep (90,93,94). The onset of comorbidities increases the risk of sleep disturbances and vice versa (93). There is a shortening of the sleep duration, changes in the most refreshing and deep parts of the sleep, delayed onset of sleep, multiple awakenings causing fragmented sleep, prolonged night-time awakenings, increase in daytime napping among other sleep changes (89,95). These changes in the sleep architecture and other sleep

parameters peak at 60 years (91,93). Despite all these changes, there is no reduction in the need for adequate sleep in older adults(91,93). Fewer older adults complain of poor sleep quality and this could be since they accept, are tolerant of the changes as part of aging and/or that the changes impact their performance less than in young individuals (89,91).

A few of the citations presented and discussed above are also relevant to older adults who may experience changes in their sleep duration as well as experience fragmented sleep (5,96,97). A review by Tatineny et al (2020) discusses the changes in sleep in the elderly as primarily due to normal physiological changes (98). However, these changes may also be associated with comorbidities like medical and mental conditions, behavioural and environmental effects and also side effects of medication(98). There is a bidirectional relationship between sleep and mental disorders as participants who had subjective sleep quality had associated depression symptoms at follow-up. A study done on participants who had poor sleep quality at baseline physical and mental health has an effect on sleep quality(73).

Studies that examine the relationship between sleep quality and cognition in older adults have suggested inconsistent results (e.g., shorter versus longer sleep was found to be associated with cognitive decline in some studies but not in others). A 2012 study by Keage and colleagues drew a baseline sample from a cohort of older adults, the United Kingdom Medical Research Council (MRC) Cognitive Function and Ageing Study (CFAS) (99). They administered sleep measures at baseline mainly in relation to insomnia. In contrast to a later study on daytime napping and Alzheimer's' disease by Li and colleagues the Keage study found lower risk of cognitive decline in older adults who sleep during the day (99,100). A study recruiting a nationally representative sample from China suggests that short and long sleep duration had an association with lower cognitive scores (101). The study suggests that subjective or self-reported sleep duration can help in the identification of adults at risk

of cognitive function decline(102). In a study recruiting community-dwelling women 65 years old, there was an association between poor sleep quality and poor cognitive performance and verbal fluency(103). A study on older adults also suggests that short sleep duration was associated with a decline in cognitive performance and age-related brain atrophy (104). Similarly, another study suggests that sleep disruptions due to prefrontal cortex grey matter atrophy contribute to cognitive decline (105).

1.2.4 Traumatic events, quality of sleep and sleep disorders

Some studies have examined TE, PTSD and sleep among veterans who have experienced large-scale TE (106–108). Exposure to TEs is associated with adverse physical and mental health outcomes of which sleep disturbances and poor sleep quality are among the outcomes (109). Sleep disturbances are part of symptomatology and can be associated with the severity of mental health issues like PTSD (110–114). Additionally, sleep disturbances before exposure or in the acute aftermath of exposure to TE predispose to the development of PTSD (108,114). In sum, the link between PTSD and sleep is that: sleep disturbance can predispose to PTSD post-exposure to TEs, is a symptom and can be a predictor of the severity of PTSD.

Studies suggest a bidirectional relationship between TEs and sleep disturbances. Sleep is important for safety-related performance (88) therefore lack of sleep can predispose someone to TEs like fatigue-related traffic accidents (115). Studies have shown that poor sleep quality is associated with increased work-related injuries (115). A study done on the association between work-related injuries and inadequate sleep has stated that: lack of sleep is associated with poor driving and has been shown to contribute to road traffic accidents (115).

Disruption of sleep post-exposure to TEs is dependent on the individual; some individuals quickly recover from the TEs and have no residual sleep disturbances while others continue to have sleep disruption. The development of sleep disorders post-exposure to TEs can be explained by factors such as age or developmental stage at the time of exposure, liability to anxiety, and the severity and frequency of TEs among other factors (116,117)

Studies suggest that there may be a relationship between childhood trauma and sleep disturbances (7,118–121). Exposure to childhood trauma is associated with poor sleep quality in adulthood (7,118,121). One study suggested a dose-response relationship between childhood trauma and sleep in adults (122). Dysregulation of the physiological arousal which can predispose to sleep disturbances is linked to the chronic childhood TEs hence association between childhood TEs and sleep can also be a factor of chronicity (121). Exposure to childhood TEs affects the neurodevelopment and neurobiological functions in a child which predisposes them to poor sleep in their adulthood. (121,123). Sleep disturbances may be a pathway that childhood TEs cause adverse mental and health outcomes in adulthood. (7,121).

1.2.5 Justification and Problem Statement

It is important to understand sleep problems among older adults as sleep has a link to health and well-being. Poor sleep quality is associated with dementia and chronic illnesses in older adults (10,74,76,124,125). According to the World Bank and Statistics South Africa, life expectancy is increasing in South Africa from about 59.6 years in 2013 to 65 years (126,127). Since sleep affects,

and is affected by, age, quality of life, experiences and exposure to TEs, it is important to assess sleep in the older, vulnerable populations.

The people in Mpumalanga have experienced TEs due to the effects of apartheid, the Mozambican civil war of 1975 to 1990, criminal violence and (HIV/AIDS) (128,129). There is continued experience of violence and social and economic inequalities due to the effects of apartheid which are still present (128). Therefore, there is a need to understand the association between TEs exposure and poor sleep quality in older adults. Although other studies offer insights into the relationship between TE and sleep in the elderly there is a gap in the literature about South African data. There is a paucity of South African data in older adults in rural South Africa hence this study adds to the field examining the relationship between TEs exposure and sleep quality in older adults.

1.2.6 Objectives and Hypothesis

The study sought to investigate the prevalence of traumatic events, the prevalence of sleep quality in adults in the HAALSI cohort and the relationship between the TEs and sleep quality in the older adults in the HAALSI cohort. The hypothesis that was proposed: exposure to TEs both in childhood and adulthood is associated with poor sleep quality in older adults.

Chapter 2

2.1 Methods

2.1.1 Study population and cohort

The Medical Research Council (MRC)/Wits Rural Public Health and Health Transitions Research Unit (Agincourt) is situated in the Bushbuckridge sub-district, Mpumalanga Province, in North East South Africa (130–133). The unit co-ordinates several studies that source data from regular surveillance as well as life course studies of the rural community (129,133). The studies coordinated include those on adolescents, health care workers, older adults and mortality studies (129–131,134–139).

Concerning the former, the Agincourt Health and Demographic Surveillance Systems (HDSS) was developed in 1992 to support local health system development during the post-apartheid era (133,140). Since 1992, the Agincourt HDSS team has supported ongoing surveys on vital events in terms of birth, death and migration of household members and their residency status as well (129,130,140). By 2018, the Agincourt HDSS covered roughly 110000 people residing in 31 villages. Approximately 30% of the population arrived as refugees from Mozambique during the Mozambican Civil War (130,133,140,141). In this secondary analysis described below, we focus on the Health and Aging in Africa: A Longitudinal Study of an INDEPTH Community in South Africa (HAALSI) study. The methods have been described in several previous publications (141–143). HAALSI is a multidisciplinary, population-based longitudinal study aimed at examining biological, economic, social, physical and mental health factors of a sample size of 5059 individuals (130,144). The cohort was also

established to explore determinants of health in older adults residing in a rural region of South Africa and compare the differences with other countries (130). The randomly selected individuals were 40 years and above by the first of July 2014. A total of 6281 men and women were selected but the response rate was 85.9% which led to a total of 5059 men and women(130). A lower age limit of 40 years was chosen due to low life expectancy in South Africa at 61.1 years for males and 67.3 years for females and also for follow-up of any middle-age pre-disease pathways that can lead to health changes in the elderly in later life (130).

HAALSI cohort data is collected in waves. The first wave was from 2014 to 2015. The second wave was conducted between 2018 and 2019 on 4176 participants of the initial 5059 participants as some were lost to follow-up. Reasons for loss to follow-up included: death, refusal to participate or participants not being found (130,144). The data used are publicly available at the Harvard Center for Population and Development Studies (www.haalsi.org).

2.1.2 Secondary Data Analysis

For a secondary analysis, I communicated with my supervisors and the HAALSI collaborators when we met face-to-face in August 2022. We decided to work on Wave 2 data from HAALSI, a cross-sectional analysis that enabled us to examine the relationship between TEs and sleep. The number of participants included in the analytical sample was 3903 who had no missing data on sleep quality.

A Directed Acyclic Graph (DAG) was constructed (see Figure 1) as a conceptual framework. The DAG is an important part of epidemiological thought as it allows epidemiologists to perceive and present the

relationships between exposures and outcomes (145–147). Further to this, variables acting as confounders, mediators and modifiers can also be conceptualized and presented.

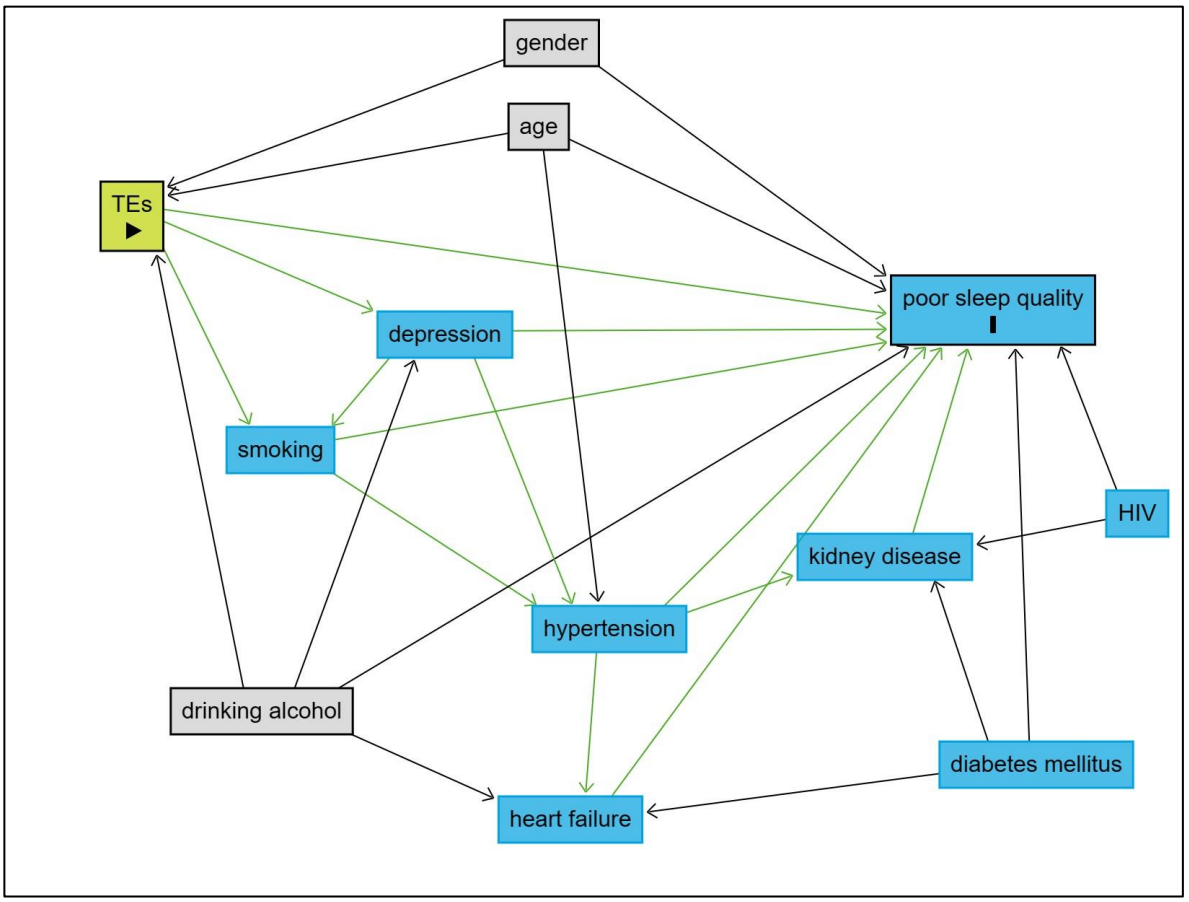

Figure 1: Direct Acyclic Graph. TEs (traumatic events) indicate exposure and poor sleep quality as the outcome.

The DAG presented in Figure 1 is used to show the association between TEs and poor sleep quality where TEs are the exposure and poor sleep quality is the outcome. Drinking alcohol, age and gender confound the relationship between TEs and sleep quality. The variables smoking, hypertension, depression, heart failure and kidney disease mediate the relationship between TEs and sleep quality.

2.1.2.1 Exposures and Outcome

Variables selected for the secondary analysis included sleep variables; traumatic events (TEs); sociodemographic characteristics: sex, marital status, country of origin, employment status, educational status; medical conditions: diabetes mellitus, heart failure, stroke, hypertension, kidney disease, HIV and depression; lifestyle variables: smoking and drinking all elaborated below:

Sociodemographic characteristics

Sociodemographic characteristics that were collected, included: sex, marital status, country of origin, employment status, education status and body mass index (BMI). The age variable was taken from the one documented in the data collected and for the participants with data on age missing, 4 years was added to the age documented in wave 1. There was a difference of 4 years between waves 1 and 2. BMI was taken as defined in the HAALSI cohort questionnaire. BMI was classified as underweight if below 18.5kg/m^2; normal if 18.5kg/m^2 to just less than 25kg/m^2; overweight if BMI is 25kg/m^2 to 30kg/m^2 and obese if greater than 30kg/m^2.

Medical conditions

In the HAALSI cohort questionnaire, some questions ask about self-reported health in the form “Have you ever been told by a doctor, nurse, or other healthcare worker that you have *a medical condition*?”. If the participant responded with “YES” to any of the following medical conditions: heart failure, heart attack, stroke or kidney disease they are classified as having a medical condition. Cardiovascular disease was then defined if one had any of the following heart failure, a history of heart attack, stroke, angina or high blood cholesterol.

The variable HIV status was generated by recoding of the variable “Have you ever tested positive for HIV?”. If the participant responded “yes”, they were classified as being “HIV positive” and if they responded “no”, they were classified as “HIV negative” and those who didn’t know as “don’t know”.

The variables for chronic conditions diabetes mellitus and hypertension were also taken from the variables diabetes and hypertension as defined as broad definitions in the HAALSI cohort questionnaire using at least two steps. The broad definition of hypertension was defined by self-reporting of ever being diagnosed with hypertension, a report of using antihypertensives and having a systolic blood pressure of more than or equal to 140mmHg and diastolic blood pressure of more than or equal to 90mmHg. Diabetes mellitus's broad definition was defined by self-report of ever being diagnosed with diabetes, fasting blood sugar of more or equal to 7mmol/litre or non-fasting blood sugar of 11.1mmol/litre. Pain variable was generated by asking the participants if they had any pain and if they were taking any medication to relieve the pain. Pain is classified as no pain; has pain but not on medication and has pain and is on pain relieving medication.

Depression was examined using the 20-item Centre for Epidemiologic Studies Depression Scale (CES-D Scale) which is a validated self-reported depression scale (148). The scoring for questions 1-3, 5-7, 9-11, 13-15, and 17-20 have 4-point Likert-style scale scores 0 to 3 with 0 as rare or none of the time (less than a day) and 3 as most or all of the time (5-7 days). The questions 4,8,12 and 6 have reverse scores with 0 as most or all of the time (5-7 days) and 3 as rare or none of the time (less than a day). The maximum score possible after adding the individual scores is 60. Grading of the scores is such that scores between 0-14 represented no depression symptoms, scores between 15-21 represented mild to moderate depression symptomatology and scores greater than 21 represented major depression symptoms (148–150).

Lifestyle conditions

The variable for smoking status was generated from the questions “Have you ever smoked any tobacco product such as cigarettes, cigars or pipes?” and “Do you currently smoke any tobacco products, such as cigarettes, cigars, or pipes?”. The variable includes those who never smoked, those who smoked but no longer smoked and the ones who currently smoke. The variable for alcohol status was generated from the questions “Have you ever consumed an alcoholic drink such as beer, wine, spirits, fermented cider, thothotho, or traditional beer?” and “Do you currently (or in the last 30 days) consume any alcoholic drinks such as beer, wine, spirits, fermented cider, thothotho or traditional beer?”. The variable classification includes those who never consumed alcohol, who consumed but no longer consumed and the ones who are currently consuming alcohol.

Traumatic Events

TEs are classified into 5 classes: natural disaster or accident, childhood trauma, community violence, war-related TEs and caregiving trauma as shown in Appendix 2. Natural disaster or accident which is a class that involves any experience of natural disaster or accident. Childhood trauma is a classification that involves trauma experienced in childhood (under 16) or under the care of parents. Community violence is a class which involves experiencing or witnessing physical assault; being sexually assaulted and/or raped and witnessing violent acts leading to death or severe injury. War-related TEs class involves experiencing, witnessing or hearing about TEs occurring during or due to war. Caregiving trauma class has variables that include events due to taking care of disabled or seriously ill relatives, witnessing someone close doing drugs and financial hardship. The TEs are derived and classified from questions on life course events which were previously used on a South African cohort (151).

Sleep variables

The Sleep variable is a binary variable that was generated from the questions on sleep employing the brief version of the Pittsburgh Sleep Quality Index (B-PSQI) from the HAALSI cohort (31). The B-PSQI was previously validated in an urban South African cohort (43). B-PSQI is used to subjectively measure sleep into good or poor sleep (31). The variables total sleep duration (number of hours one sleeps per night), sleep onset latency (the time it takes for one to sleep after getting into bed), subjective sleep quality (how the patient rates their sleep), sleep disturbance (disturbances in sleep causing one to wake up during sleep) and sleep efficiency variables (number of hours asleep compared to total time in bed) were used to generate the sleep quality score. The variables were all reported by participants. The *total sleep duration* variable is such that those with total sleep time greater than 7 hours are labelled as score 0, those with 6 to 7 hours of sleep time are labelled as score 1, with sleep hours 5-6 hours as score 2 with sleep hours 4 hours to 5 hours as score 3. The *sleep onset latency* variable was coded such that those who reported taking 20 minutes or less to sleep after getting into bed have a score of 0 and those who took greater than 20 minutes a score is 1. The *subjective sleep quality* variable was generated such that the scores are such that those who rated their sleep as never or rarely enough have a score of 2; while a score of 1 for sleep sometimes enough and a score of 0 for sleep often enough. The *sleep disturbance* variable was generated from questions about waking up in the middle of the night; snoring at night; snorting or gasping and struggling for breath or stopping to breathe during the night. The sleep disturbances variable was generated such that the score is 0 if there is no sleep disturbance; the score is 1 if a participant answered yes to any one of any sleep disturbances; the score is 2 if at least the participant answered yes to about two of sleep disturbance variables and the score is 3 if the participant answered yes to at least three of sleep disturbance variables. The *sleep efficiency* variable which is time spent asleep compared to time spent in bed was

coded such that the score is 0 if the sleep efficiency calculated is at least 85% and is 1 if sleep efficiency is less than 85%. The outcome variable of the sleep scale was generated by adding the scores of the five variables total sleep duration, sleep onset latency, subjective sleep quality, sleep disturbances and sleep efficiency. The outcome variable computed *sleep quality* is dichotomous and was classified such that a total score of less or equal to 2 was classified as good sleep and has a score of 0 and a total score of greater or equal to 3 was classified as poor sleep with a score of 1.

2.1.3 Data analysis

The data analysis consisted of many steps. Descriptive statistics of the sociodemographic characteristics, TEs, medical conditions, and lifestyle conditions of the participants were done.

Bivariate analysis of exposure variables and poor sleep quality was conducted using the chi-square test. Multivariable logistic regression analysis was conducted to analyse the association between poor sleep quality and traumatic events and other sociodemographic, medical and lifestyle factors. To choose the significant exposure variables for the final logistic regression model stepwise regression was done. All the analyses were done using Stata version 18 (152).

2.1.4 Ethics

An application for an ethics application waiver was done to the faculty since there was the use of secondary data. Permission to use the data was sought from the gatekeepers. The ethics clearance number is M180383. The information has been added to appendices 3 and 4.

2.2 Results

This section presents the description of the sociodemographic characteristics of the sample, the prevalence of TE, medical and behavioural variables as well as sleep. There is also a presentation of the bivariate and multivariate analysis of the exposures and the outcome variable which is poor sleep quality.

2.2.2 Description of Sociodemographic Characteristics

Table 1 presents the sociodemographic characteristics of the analytical sample. The cohort consists of 2186 (56%) females and 1717 (44%) males who have an average age of 64.12 years (SD 12.58). The marital status was such that 54% were single while 46% were married. A total of 30% were originally from Mozambique or any other country which is not South Africa while 70% were originally from South Africa. The BMI of the participants were such that 5% were underweight, 36% had normal BMI, 28% were overweight and 31% were obese. The employment status was such that 17% were employed, 82% were not employed and 2% were homemakers. The education status of participants was as follows: 43% had no formal education, 35% had some primary education, 12% had some secondary education and 9% had secondary education or more.

Table 1: Sociodemographic characteristics of the analytical sample

Variable	n (%)
Gender	
Male	1717 (44%)
Female	2186 (56%)
Age in years (mean±standard deviation)	65.12 years± 12.58
Age	
40-50 years	508 (12%)
50-59 years	1 045 (25%)
60- 69 years	1 170 (28%)
70-79 years	857 (21%)
80+	596 (14%)
Marriage status	
Single	2094 (54%)
Married	1799 (46%)
Country of origin	
South Africa	2 709 (70%)
Mozambique or other	1 180 (30%)
Employment status	
Employed	658 (17%)
Not working	3 171 (82%)
Homemaker	61 (2%)
Education status	
No formal	1683 (43%)
Some primary (1-7 years)	1375 (35%)
Some secondary (8-11 years)	473 (12%)
Secondary or more (12+ years)	363 (9%)
Body mass index	
Underweight	158 (5%)
Normal	1135 (36%)
Overweight	885 (28%)
Obese	938 (31%)

2.2.3 Prevalence of Sleep Variables

In the analytical sample, 27% of the participants had computed poor sleep quality as shown in table 2. The sleep durations reported by the participants were as follows: 79% had greater than 7 hours of sleep, 20% had 6-7 hours of sleep, 1% had 5-6 hours of sleep and less than 1% had less than 5 hours of sleep. The participants who reported sleep onset latency of 0-15 minutes were 83%, >15-30 minutes were 17% and > 30 minutes were 0.54%. Participants reported the subjective sleep quality as follows: very good subjective sleep quality was 38%, fairly good subjective sleep quality was 47%, fairly bad subjective sleep quality was 12% and bad subjective sleep quality was 2%. The participants who

reported not having any sleep disturbance were 52%, one sleep disturbance was 36%, two sleep disturbances were 10% and three or more sleep disturbances were 3%. Participants who reported of poor sleep efficiency were 0.08% while those with good sleep efficiency were 99.92%.

Table 2: Prevalence of sleep variables

Component	Prevalence %
Sleep duration	
>7hours	79%
>6-7hours	20%
5-6hours	1%
<5hours	0.29%
Sleep onset latency	
0-15minutes	83%
>15-30minutes	17%
>30-50minutes	0.54%
Subjective sleep quality	
Very good	38%
Fairly good	47%
Fairly bad	12%
Bad	2%
Sleep disturbance	
No sleep disturbance	52%
1 sleep disturbance	36%
2 sleep disturbance	10%
At least 3	3%
Sleep efficiency	
Good (≥85%)	99.92%
Poor (<85%)	0.08%
Sleep quality	
Good	73%
Poor	27%

2.2.4 Prevalence of traumatic events, medical and lifestyle conditions

The prevalence of the TEs as shown in Table 3 below were as follows: caregiving trauma 66%, accident and disaster 58%, childhood trauma 30%, community violence 22% and war-related trauma 15%.

The medical conditions prevalences were as follows: 11% were HIV positive, 5% had cardiovascular disease, 3% had kidney disease, 18% had diabetes mellitus, 68% had hypertension, 20% had mild to moderate depression and 26% had major depression. The smoking status of participants was that 85% of did not smoke, 6% had previously smoked and 9% were currently smoking. The drinking status of the participants was as follows: 67% did not drink, 12% had previously drank and 21% were currently drinking.

Table 3: prevalence of traumatic events, medical and lifestyle conditions

Variable	Prevalence	
	Number	%
Traumatic events		
Community violence	862	22%
Accident or disaster	2295	58%
War related trauma	596	15%
Childhood trauma	1182	30%
Caregiving trauma	2599	66%
Medical conditions		
HIV (positive)	455	11%
Cardiovascular disease	197	5%
Kidney disease	105	3%
Diabetes mellitus	581	18%
Hypertension	2551	68%
Depression		
Mild to moderate	763	20%
Major	998	26%
Lifestyle conditions		
Smoking status		
No smoking	3491	85%
Once smoked	247	6%
Smokes	387	9%
Drinking status		
No drinking	2773	67%
Once drinking	500	12%
Drinks	847	21%

2.2.5 Bivariate Analysis

Table 4 Chi-square of the variables and sleep quality

Variable	Chi-square (p-value)
Sociodemographic characteristics	
Gender	4.6 (0.030)
Age	4.6 (0.30)
Marital status	8.4 (0.004)
Country of origin	4.4 (0.035)
Employment status	3.7 (0.160)
Education status	3.0 (0.396)
Body mass index	3.4 (0.326)
Alcohol status	15.7 (0.00)
Smoking status	8.0 (0.02)
Medical conditions	
Depression	37.0 (0.00)
Pain	6.3 (0.044)
HIV status	3.4 (0.184)
Hypertension	3.0 (0.087)
Diabetes	2.7 (0.098)
Kidney disease	1.0 (0.306)
Cardiovascular disease	4.6 (0.032)
Traumatic events	
Accident-disaster	14.0 (0.000)
Childhood trauma	29.5 (0.000)
Community violence	24.1 (0.000)
War-related trauma	30.1 (0.000)
Caregiver trauma	5.3 (0.022)

As shown in Table 4: the sociodemographic characteristics that have a statistically significant relationship with poor sleep quality using the chi-square are gender, marital status and country of origin. The lifestyle conditions alcohol and smoking have a statistically significant relationship with poor sleep quality. The medical conditions with a statistically significant relationship with poor sleep quality are depression, pain and cardiovascular disease. All the traumatic events accident-disaster, childhood trauma, caregiving trauma, war-related trauma and community violence have a statistically significant relationship with poor sleep.

2.2.6 Multivariate Analysis

Table 5: Multivariate logistic regression predicting the likelihood of poor sleep quality; adjusted model

Variable	Odds ratio	p-value
Traumatic events		
Childhood trauma ***Ref: no history of childhood trauma***	1.5 (1.2-1.8)	0.000
War related trauma ***Ref: no history of war related trauma***	1.5 (1.2-2.0)	0.001
Sociodemographic characteristics		
Country of origin (Mozambique/other countries) ***Ref: South African origin***	0.7 (0.6-0.9)	0.004
Employment status		
Not working ***Ref: employed***	0.7 (0.6-0.9)	0.003
Marriage status	1.2 (1.0-1.4)	0.066
Married ***Ref: single***		
Body mass index		
Obese ***Ref: Normal BMI***	1.3 (1.0-1.6)	0.014
Smoke status		
History of smoking ***Ref: no smoking***	1.6 (1.2-2.1)	0.003
Medical conditions		
HIV status		
Negative ***Ref: positive HIV status***	1.4 (1.0-1.8)	0.027
Cardiovascular disease ***Ref: cardiovascular disease***	0.4 (0.2-1.0)	0.045
Depression		
Mild to moderate depression	1.7 (1.3-2.1)	0.000
Major depression	2.1 (1.8-2.7)	0.000
Ref: no depression		

The odds of poor sleep quality in participants with a history of exposure to childhood trauma is 1.5 times the odds of poor sleep quality in participants with no history of exposure to childhood trauma. The odds of poor sleep quality in participants with a history of exposure to war-related trauma is 1.5 times the odds of poor sleep quality in participants with no history of exposure to war-related trauma.

The odds of poor sleep quality in participants who were originally from Mozambican or other country was 0.7 times the odds of poor sleep quality in participants originally from South Africa. The odds of poor sleep quality in participants who are not working is 0.7 times the odds of poor sleep quality in those who are employed. The odds of poor sleep quality in participants who are married is 1.2 times the odds of poor sleep quality in those who are single. The odds of poor sleep quality in participants who are obese is 1.3 times the odds of poor sleep quality in participants with normal body mass index. The odds of poor sleep quality in participants with a previous history of smoking is 1.6 times the odds of poor sleep quality in participants with no history of smoking.

The odds of poor sleep quality in participants who are HIV negative is 1.4 times the odds of poor sleep quality in participants who are HIV positive. The odds of poor sleep quality in participants with no cardiovascular disease is 0.4 times the odds of poor sleep quality in participants with cardiovascular disease. The odds of poor sleep quality in participants with mild to moderate depression is 1.7 times the odds of poor sleep quality in participants with no depression. The odds of poor sleep quality in participants with major depression is 2.1 times the odds of poor sleep quality in participants with no depression.

2.3 Discussion

This study aimed to examine the relationship between TE and quality of sleep in older adults in a rural region of South Africa. A summary of the most salient results is presented as follows: The mean age of the participants was 65 years (SD=13). The majority of the sample were of South African origin (70%). Concerning education status, less than half (43%) had not completed a formal education (i.e., primary school). Poor quality of sleep was reported by 27% of the participants. With regards to TEs 66% of the sample reported caregiving trauma, 58% accident and disaster TEs, 30% childhood trauma, 15% war-related TEs and 22% community violence. The multivariate analysis suggested that participants with a history of exposure to childhood TEs and war-related TEs had higher odds of poor sleep quality (OR 1.5 (CI1.2-1.8)) and (OR 1.5(CI 1.2-2.0)) respectively. The other variables associated with higher odds of poor sleep quality were being married (OR=1.2 (CI 1.0-1.4)) history of smoking (OR=1.6 (CI 1.2-3.1)), mild to moderate (OR=1.7 (CI 1.3-2.1)) and major depression symptoms (OR=2.1 (CI 1.8-2.7)), being obese (OR =1.3 (CI 1.0-1.6)) and being HIV negative (OR= 1.4 (1.0-1.6)).

These findings are now reflected upon below and elaborated in the context of previous studies:

The prevalence estimate of poor quality of sleep of 27 percent is not surprising. The estimate appears consistent with the prevalence of self-reported nocturnal sleep problems in a multinational study done which included South Africa which suggested a prevalence estimate of 31% for women and 27% for men ages 50 and above (153). A Nigerian cross-sectional study reported by Jemilohun and colleagues in 2022 yielded a prevalence estimate of 42.2 % of self-reported poor sleep quality in a sample of 515 adults (154).

In my analytical sample, participants who were not of South African origin were less likely to report poor quality of sleep. These results are consistent with a systematic review synthesizing sleep disorders in migrants and refugees, which concluded that there are differences in terms of sleep disturbances depending on the premigration status and post-migration status. Migrants and refugees who manage to integrate, into the community, and adapt to changes in diet and lifestyles, of the community they move into were more likely to have good sleep quality (155). A study on Iraqi migrants who migrated to the US pre- or post-Gulf war examined TE scores, PTSD and sleep disorders specifically obstructive sleep apnoea (156). While the results suggested a relationship between pre-migration TE and depression and PTSD, there was no significant difference in obstructive sleep apnoea between the two groups until PTSD was examined as a mediator (156). These findings suggest that there are complex paths between TE, PTSD and sleep and further studies could use sophisticated statistical models to examine these complexities (156). The participants originally from Mozambican and other African countries could have integrated well into the Agincourt community leading to them having a less likelihood of poor sleep quality compared to those of South African origin (157).

In this study being married was related to better sleep quality. Longitudinal studies conducted to examine marriage and sleep quality in US older adults have studied negative relationship quality (using a scale that used dyadic satisfaction, cohesion, consensus, and affection expression) had sleep problems (158,159). A cross-sectional study on older adults and also a systematic review synthesized that loneliness was associated with poor sleep quality (160,161). Marriage or having a partner could help in reducing loneliness which could help in better sleep quality.

In this study, participants who reported smoking had associated poor quality of sleep as compared to non-smokers. This is consistent with findings from some studies done before that a greater proportion

of smokers reported sleep disturbances (162–164). For example, in a 2018 nationally representative sample of Korean adults, an unadjusted model found that smoking was related to poor quality of sleep in both males and females. However, the model that adjusted for depression and perceived stress only found a relationship between smoking and quality of sleep in females under the age of 65 (165). A study done on nonsmokers aged between 20 years to 33 years found that nicotine has stimulating effects (166). These findings suggest that poor quality of sleep may be due to the stimulating effects of nicotine on the sleep-wake cycle.

There is an increased likelihood of poor quality of sleep in participants who have depression symptoms mild to moderate and major symptoms using the CES-D scale in this sample. Maglione J. E. et al (2014) did a study on older women which showed that women who at baseline had no depression symptoms but had sleep disturbances measured subjectively and objectively had a high likelihood of having depression symptoms 5 years later (167). Fang H. et. al. (2018) had a review that concluded that there is a bidirectional relationship between depression and quality of sleep where depression is a risk factor for insomnia (168). Longitudinal studies done on older adults in China and Taiwan identified a bidirectional relationship between depression and sleep duration and obstructive sleep apnoea respectively (169,170). These studies suggest and are consistent with the studies of an association between depression and sleep quality.

Studies conducted have suggested that HIV is associated with poor quality of sleep and sleep disturbances with one meta-analysis showing a prevalence of self-reported sleep disturbance among PLWHA to be 58%. In this cohort, there is a high likelihood of poor quality of sleep in participants who are HIV-negative. This is not consistent with studies that compared the HIV-negative and positive individuals where poor sleep quality was more likely in the HIV-positive individuals (171,172). I

theorise that there may be confounding variables we have not been able to test that may be impacting this relationship.

With regard to TEs, the main exposure tested in this analysis, childhood TE and war-related TE were found to be associated with the odds of poor sleep quality when compared to those who had not experienced TE. The findings from this study that support the hypothesis that exposure to childhood trauma is associated with poor quality of sleep in adulthood are consistent with previous studies done on individuals who reported experiencing any childhood events, that is at least at 18 years of age and below who in adulthood had poor quality of sleep (7,49,118,173,174). The studies suggested that this could be due to the negative impact that they have on neurobiological and neurodevelopmental functions that later on affect their sleep quality in adult life (173,175). Children who have been exposed to childhood trauma are likely to have poor sleep that can persist into adulthood and they also are predisposed to mental health issues in adulthood which also can further lead to sleep disturbances (173,176,177).

War-related trauma in this study has an increased likelihood of poor quality of sleep. War results in people losing their relatives, close friends, homes, property, a place which was meant to be a haven and people fleeing from affected areas and witnessing and experiencing violence leading to severe injury and death. There have been studies on war-related trauma on war veterans about exposure to TEs causing PTSD which has its diagnostic criteria with insomnia and nightmares as sleep disturbances (106,107,178–181). Poor quality of sleep or sleep disturbances persisting after TEs can be an indicator that someone will likely develop PTSD (181,182). A number of studies have examined war-related TE, particularly among veterans who have fought in the Afghanistan and Iraq wars (183–185). These studies indicated the association of poor sleep quality to traumatic brain injury due to exposure to war TE (183). A study to compare sleep quality in those with or without mental health

diagnoses among the veterans showed that both groups had poor sleep quality but with the former scoring higher in PSQI score (184). These studies support and are consistent with the hypothesis of this study that suggests a likelihood of poor sleep quality in those exposed to war-related TEs.

2.3.6 Limitations

The HAALSI cohort may not be representative of older adults who are not based in the rural setting as the data used was only of those who were in rural settings. There is also a likelihood of recall bias and social desirability in self-reported exposure to traumatic events and other reported variables. The questionnaire does not also give more information on the frequency of exposure to the TEs which might also affect the association with poor sleep quality. Repeated exposure to TEs can increase the likelihood of poor sleep quality (122). The data used in data analysis was of the participants who had complete data on sleep quality which can also be a limitation.

Some studies have shown that reported sleep disorders are usually different from laboratory sleep disorders but in this context, the quality of life of the individual will be best measured by how they report their sleep (186). In this study, the sleep quality only included the shorter sleep duration rather than hypersomnia (greater than normal duration sleep).

The study is a cross-sectional study design which we cannot use to establish the causal relationship between traumatic events and poor sleep quality. There is a need for a cohort study to establish

causality. The study also adjusted for some of the confounders hence there is a potential for residual confounders that have not been included.

2.3.7Conclusion

In conclusion, exposure to childhood TEs and war-related TEs has a high likelihood of poor sleep quality in the HAALSI cohort. Previous history of smoking, obesity, cardiovascular disease married participants, and negative HIV status is associated with poor sleep quality. Mild to moderate and major depression symptoms were associated with poor sleep quality. Not working and being originally from Mozambique and other countries has a less likelihood of poor sleep quality. There is reduced quality of life due to poor sleep quality hence there is a need to routinely ask older adults and recognise any sleep problems and educate them on their importance. These findings highlight the importance of asking about TEs in participants who present with sleep problems and the need to include issues of sleep quality in the rehabilitation of people exposed to trauma.

2.4References

1. Watson NF, Badr MS, Belenky G, Bliwise DL, Buxton OM, Buysse D, et al. Joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society on the recommended amount of sleep for a healthy adult: Methodology and discussion. Sleep. 2015 Aug 1;38(8):1161–83.

2. Medic G, Wille M, Hemels MEH. Short- and long-term health consequences of sleep disruption. Vol. 9, Nature and Science of Sleep. Dove Medical Press Ltd; 2017. p. 151–61.

3. Van Cauter E, Spiegel K, Tasali E, Leproult R. Metabolic consequences of sleep and sleep loss. Sleep Med. 2008 Sep;9(SUPPL. 1).

4. Leproult R, Van Cauter E. Role of sleep and sleep loss in hormonal release and metabolism. Vol. 17, Endocrine Development. 2009. p. 11–21.

5. Lee VV, Schembri R, Jordan AS, Jackson ML. The independent effects of sleep deprivation and sleep fragmentation on processing of emotional information. Behavioural Brain Research. 2022;

6. Deliens G, Gilson M, Peigneux P. Sleep and the processing of emotions. Vol. 232, Experimental Brain Research. Springer Verlag; 2014. p. 1403–14.

7. Brindle RC, Cribbet MR, Samuelsson LB, Gao C, Frank E, Krafty RT, et al. The Relationship between Childhood Trauma and Poor Sleep Health in Adulthood. Psychosom Med. 2018 Feb 1;80(2):200–7.

8. Han H, Wang Y, Li T, Feng C, Kaliszewski C, Su Y, et al. Sleep Duration and Risks of Incident Cardiovascular Disease and Mortality Among People With Type 2 Diabetes. Diabetes Care [Internet]. 2023 Jan 2 [cited 2023 Mar 28];46(1):101–10. Available from: https://diabetesjournals.org/care/article/46/1/101/147933/Sleep-Duration-and-Risks-of-Incident

9. Dyas J V., Apekey TA, Tilling M, Ørner R, Middleton H, Siriwardena AN. Patients' and clinicians' experiences of consultations in primary care for sleep problems and insomnia: A focus group study. British Journal of General Practice. 2010 May;60(574).

10. Spira AP, Chen-Edinboro LP, Wu MN, Yaffe K. Impact of Sleep on the Risk of Cognitive Decline and Dementia. Curr Opin Psychiatry [Internet]. 2014 [cited 2023 Mar 26];27(6):478. Available from: /PMC/articles/PMC4323377/

11. Ma Y, Liang L, Zheng F, Shi L, Zhong B, Xie W. Association Between Sleep Duration and Cognitive Decline. JAMA Netw Open. 2020 Sep 1;3(9):e2013573.

12. Whitney P, Hinson JM, Jackson ML, Van Dongen HPA. Feedback blunting: Total sleep deprivation impairs decision making that requires updating based on feedback. Sleep. 2015 May 1;38(5):745–54.

13. Chaput JP, Dutil C, Sampasa-Kanyinga H. Sleeping hours: What is the ideal number and how does age impact this? Vol. 10, Nature and Science of Sleep. Dove Medical Press Ltd; 2018. p. 421–30.

14. Redman KN, O'Brien KE, Ruiz FS, Rae DE, Gómez-Olivé FX, von Schantz M, et al. Delayed circadian rhythms in older Africans living with human immunodeficiency virus (HIV). J Pineal Res [Internet]. 2023 Jan 1 [cited 2023 Mar 27];74(1):e12838. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/jpi.12838

15. Leng Y, Byers AL, Barnes DE, Peltz CB, Li Y, Yaffe K. Traumatic Brain Injury and Incidence Risk of Sleep Disorders in Nearly 200,000 US Veterans. Neurology. 2021;96(13):e1792–9.

16. Peltzer K, Pengpid S. Self-reported sleep duration and its correlates with sociodemographics, health behaviours, poor mental health, and chronic conditions in rural persons 40 years and older in South Africa. Int J Environ Res Public Health. 2018;15(7).

17. Buysse DJ. Sleep Health : Can We Define It ? Does It Matter ? Sleep. 2014;37(1):9–17.

18. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, et al. National Sleep Foundation's updated sleep duration recommendations: final report. Sleep Health [Internet]. 2015 Dec 1 [cited 2023 Mar 26];1(4):233–43. Available from: https://pubmed.ncbi.nlm.nih.gov/29073398/

19. Ramar K, Malhotra RK, Carden KA, Martin JL, Abbasi-Feinberg F, Aurora RN, et al. Sleep is essential to health: An American Academy of Sleep Medicine position statement. Journal of Clinical Sleep Medicine. 2021 Oct 1;17(10):2115–9.

20. Ohayon M, Wickwire EM, Hirshkowitz M, Albert SM, Avidan A, Daly FJ, et al. National Sleep Foundation's sleep quality recommendations: first report. Sleep Health [Internet]. 2017 Feb 1 [cited 2023 Mar 26];3(1):6–19. Available from: https://pubmed.ncbi.nlm.nih.gov/28346153/

21. Kwok CS, Kontopantelis E, Kuligowski G, Gray M, Muhyaldeen A, Gale CP, et al. Self-reported sleep duration and quality and cardiovascular disease and mortality: A dose-response meta-analysis. J Am Heart Assoc. 2018 Aug 1;7(15).

22. Prather AA, Janicki-Deverts D, Hall MH, Cohen S. Behaviorally assessed sleep and susceptibility to the common cold. Sleep. 2015 Sep 1;38(9):1353–9.

23. Denison HJ, Jameson KA, Sayer AA, Patel HP, Edwards MH, Arora T, et al. Poor sleep quality and physical performance in older adults. Sleep Health [Internet]. 2021 Apr 1 [cited 2023 Mar 26];7(2):205–11. Available from: https://pubmed.ncbi.nlm.nih.gov/33223446/

24. Zhong X, Gou F, Jiao H, Zhao D, Teng J. Association between night sleep latency and hypertension: A cross-sectional study. Medicine [Internet]. 2022 Oct 10 [cited 2023 Mar 30];101(42):E31250. Available from: /PMC/articles/PMC9592274/

25. Colten HR, Altevogt BM. Sleep Physiology. In: Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem [Internet]. National Academies Press (US); 2006 [cited 2023 Mar 26]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK19956/

26. Aakash Patel AK, Reddy V, Shumway KR, Araujo Affiliations JF. Physiology, Sleep Stages. 2023.

27. Marino M, Li Y, Rueschman MN, Winkelman JW, Ellenbogen JM, Solet JM, et al. Measuring sleep: Accuracy, sensitivity, and specificity of wrist actigraphy compared to polysomnography. Sleep. 2013 Nov 1;36(11):1747–55.

28. Fabbri M, Beracci A, Martoni M, Meneo D, Tonetti L, Natale V. Measuring subjective sleep quality: A review. Vol. 18, International Journal of Environmental Research and Public Health. MDPI AG; 2021. p. 1–57.

29. Ibáñez V, Silva J, Cauli O. A survey on sleep assessment methods. PeerJ. 2018;2018(5).

30. Carney CE, Buysse DJ, Ancoli-Israel S, Edinger JD, Krystal AD, Lichstein KL, et al. The consensus sleep diary: Standardizing prospective sleep self-monitoring. Vol. 35, Sleep. 2012. p. 287–302.

31. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res [Internet]. 1989 [cited 2023 Apr 6];28(2):193–213. Available from: https://pubmed.ncbi.nlm.nih.gov/2748771/

32. Smith MT, McCrae CS, Cheung J, Martin JL, Harrod CG, Heald JL, et al. Use of Actigraphy for the Evaluation of Sleep Disorders and Circadian Rhythm Sleep-Wake Disorders: An American Academy of Sleep Medicine Clinical Practice Guideline. Journal of Clinical Sleep Medicine. 2018 Jul 15;14(7):1231–7.

33. Ancoli-Israel S, Cole R, Alessi C, Chambers M, Moorcroft W, Poolak CP. The Role of Actigraphy in the Study of Sleep and Circadian Rhythms. Sleep. 2003;26(3):342–92.

34. Markun LC, Sampat A. Clinician-Focused Overview and Developments in Polysomnography. Available from: https://doi.org/10.1007/s40675-020-00197-5

35. Patil SP. what clinicians should know about polysomnography. Respir Care. 2010;55(9):1179–93.

36. Krystal AD, Edinger JD. Measuring sleep quality [Internet]. Vol. 1, Sleep Medicine 9 Suppl. 2008. Available from: www.elsevier.com/locate/sleep

37. Luyster FS, Choi JY, Yeh CH, Imes CC, Johansson AEE, Chasens ER. Screening and evaluation tools for sleep disorders in older adults. Applied Nursing Research. 2015 Nov 1;28(4):334–40.

38. Okun ML, Kravitz HM, Sowers MF, Moul DE, Buysse DJ, Hall M. Psychometric Evaluation of the Insomnia Symptom Questionnaire: a Self-report Measure to Identify Chronic Insomnia. Journal of Clinical Sleep Medicine. 2009;5(1):41–51.

39. Sancho-Domingo C, Carballo JL, Coloma-Carmona A, Buysse DJ. Brief version of the Pittsburgh Sleep Quality Index (B-PSQI) and measurement invariance across gender and age in a population-based sample. Psychol Assess. 2021 Feb 1;33(2):111–21.

40. Famodu OA, Barr ML, Holásková I, Zhou W, Morrell JS, Colby SE, et al. Shortening of the Pittsburgh Sleep Quality Index Survey Using Factor Analysis. Sleep Disord. 2018;2018:1–9.

41. Ali RM, Zolezzi M, Awaisu A. A systematic review of instruments for the assessment of insomnia in adults. Nat Sci Sleep. 2020;12:377–409.

42. Pengpid S, Peltzer K. Prevalence and social and health correlates of insomnia symptoms among middle-and older-age persons in rural South Africa. Journal of Psychology in Africa. 2018 Nov 2;28(6):472–8.

43. Pengpid S, Peltzer K. Fruit and vegetable intake and incident and persistent poor sleep quality in a rural ageing population in South Africa: a longitudinal study. BJPsych Open. 2022 Sep;8(5).

44. Pengpid S, Peltzer K. Sleep duration and incident and persistent depressive symptoms among a rural ageing population in South Africa. Compr Psychiatry. 2022 Nov 1;119.

45. Peltzer K, Pengpid S. Prevalence, and social and health correlates of insomnia among persons 15 years and older in South Africa. South African Journal of Psychology. 2019 Dec 1;49(4):467–78.

46. Porcheret K, Iyadurai L, Bonsall MB, Goodwin GM, Beer SA, Darwent M, et al. Sleep and intrusive memories immediately after a traumatic event in emergency department patients. Sleep. 2020;43(8):1–12.

47. Mcwhorter KL, Parks CG, D'aloisio AA, Rojo-Wissar DM, Sandler DP, Jackson CL. Traumatic childhood experiences and multiple dimensions of poor sleep among adult women. 2019 [cited 2023 Apr 6]; Available from: https://sisterstudy.niehs.nih.gov/English/researchers.htm.

48. E MM. Traumatic Event Exposure, Posttraumatic Stress Disorder, and Sleep Disturbances in a National Sample of U.S. Adults. 2019;

49. Thordardottir EB, Hansdottir I, Valdimarsdottir UA, Shipherd JC, Resnick H, Gudmundsdottir B. The manifestations of sleep disturbances 16 years post-trauma. Sleep. 2016;39(8):1551–4.

50. Magruder KM, Mclaughlin KA, Borbon DLE, Magruder KM, Mclaughlin KA, Borbon DLE. Trauma is a public health issue. Eur J Psychotraumatol. 2017;8(1).

51. Exhibit 1.3-4, DSM-5 Diagnostic Criteria for PTSD - Trauma-Informed Care in Behavioral Health Services - NCBI Bookshelf [Internet]. [cited 2023 Apr 4]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK207191/box/part1_ch3.box16/

52. Mcdonald MK, Cameo MA, Borntrager FF, Whitney Rostad MA. Measuring Trauma: Considerations for Assessing Complex and Non-PTSD Criterion A Childhood Trauma. Journal of Trauma & Dissociation [Internet]. 2014 [cited 2023 Apr 4];15(2):184–203. Available from: https://www.tandfonline.com/action/journalInformation?journalCode=wjtd20

53. Benjet C, Bromet E, Karam EG, Kessler RC, McLaughlin KA, Ruscio AM, et al. The epidemiology of traumatic event exposure worldwide: results from the World Mental Health Survey Consortium. Psychol Med. 2016;46(2):327–43.

54. Schulz R, Beach SR. Caregiving as a Risk Factor for Mortality The Caregiver Health Effects Study [Internet]. Available from: https://jamanetwork.com/

55. Wathen CN, Schmitt B, MacGregor JCD. Measuring Trauma- (and Violence-) Informed Care: A Scoping Review. Vol. 24, Trauma, Violence, and Abuse. SAGE Publications Ltd; 2023. p. 261–77.

56. Kerig PK. Introduction to the Special Section: Developmental Perspectives on Trauma Exposure and Posttraumatic Stress. Vol. 16, Journal of Child and Adolescent Trauma. Springer Science and Business Media Deutschland GmbH; 2023. p. 381–90.

57. Castro CM, Lee KA, Bliwise DL, Urizar GG, Woodward SH, King AC. Sleep patterns and sleep-related factors between caregiving and non-caregiving women. Behavioral Sleep Medicine. 2009 Jul;7(3):164–79.

58. Norman R, Matzopoulos R, Groenewald P, Bradshaw D. The high burden of injuries in South Africa. Bull World Health Organ. 2007;85(9):695–702.

59. Glaser C. Violent crime in South Africa: Historical perspectives. South African Historical Journal. 2008;60(3):334–52.

60. Breetzke GD. Understanding the magnitude and extent of crime in post-apartheid South Africa. Social Identities. 2012 May;18(3):299–315.

61. Sheppard N, Hogan L. Prevalence of insomnia and poor sleep quality in the prison population: A systematic review. J Sleep Res. 2022 Dec 1;31(6).

62. Abdu Z, Hajure M. Prevalence and Associated Factors of Poor Quality of Sleep among Prisoners in Mettu Town Prison, Oromia, South West Ethiopia, 2019. Open Public Health J. 2020 Mar 27;13(1):94–100.

63. Baylan S, Griffiths S, Grant N, Broomfield NM, Evans JJ, Gardani M. Incidence and prevalence of post-stroke insomnia: A systematic review and meta-analysis. Sleep Med Rev. 2020 Feb 1;49:101222.

64. Moon HM, Kim Y. Mental health according to sleep duration in stroke survivors: A population-based nationwide cross-sectional study. Geriatr Gerontol Int [Internet]. 2020 Mar 1 [cited 2023 Mar 31];20(3):223–8. Available from: https://pubmed.ncbi.nlm.nih.gov/31837251/

65. Ancoli-Israel S, Martin JL. Insomnia and daytime napping in older adults. Journal of Clinical Sleep Medicine. 2006 Jul 15;2(3):333–42.

66. Ohayon MM. epidemiological overview of sleep disorders in the general population. Sleep Med Res. 2011;2(1):1–9.

67. Chai-Coetzer CL, Antic NA, McEvoy RD. Identifying and managing sleep disorders in primary care. Lancet Respir Med [Internet]. 2015 May 1 [cited 2023 Apr 4];3(5):337–9. Available from: http://www.thelancet.com/article/S2213260015001411/fulltext

68. Di H, Guo Y, Daghlas I, Wang L, Liu G, Pan A, et al. Evaluation of Sleep Habits and Disturbances Among US Adults, 2017-2020. JAMA Netw Open [Internet]. 2022 Nov 1 [cited 2023 Mar 28];5(11):e2240788. Available from: /PMC/articles/PMC9644264/

69. Chen X, Ke Z ling, Chen Y, Lin X. The prevalence of sleep problems among children in mainland China: a meta-analysis and systemic-analysis. Sleep Med. 2021 Jul 1;83:248–55.

70. Cook I, Mohlabe M, Alberts M. Descriptive epidemiology of objectively-measured, free-living sleep parameters in a rural African setting. BMC Res Notes [Internet]. 2020 Jul 1 [cited 2023 Mar 28];13(1):1–8. Available from: https://bmcresnotes.biomedcentral.com/articles/10.1186/s13104-020-05153-8

71. Anbesaw T, Abebe H, Kassaw C, Bete T, Molla A. Sleep quality and associated factors among pregnant women attending antenatal care at Jimma Medical Center, Jimma, Southwest Ethiopia, 2020: cross-sectional study. BMC Psychiatry. 2021 Dec 1;21(1).

72. Wang C, Liu J, Li Z, Ji L, Wang R, Song H, et al. Predictor of sleep difficulty among community dwelling older populations in 2 African settings. Medicine (United States). 2019 Nov 1;98(47).

73. Corbo I, Forte G, Favieri F, Casagrande M. Poor Sleep Quality in Aging: The Association with Mental Health. International Journal of Environmental Research and Public Health 2023, Vol 20, Page 1661 [Internet]. 2023 Jan 17 [cited 2023 Mar 26];20(3):1661. Available from: https://www.mdpi.com/1660-4601/20/3/1661/htm

74. Mellman TA, Bustamante V, Fins AI, Pigeon WR, Nolan B. REM sleep and the early development of posttraumatic stress disorder. American Journal of Psychiatry. 2002;159(10):1696–701.

75. Short NA, Boffa JW, Wissemann K, Schmidt NB. Insomnia symptoms predict the development of post-traumatic stress symptoms following an experimental trauma. J Sleep Res. 2020 Feb 1;29(1).

76. Polimanti R, Wendt FR, Polimanti R. Posttraumatic stress disorder: From gene discovery to disease biology. Psychol Med. 2021;51(13):2178–88.

77. Buka SL, Rosenthal SR, Lacy ME. Epidemiological study designs: Traditional and novel approaches to advance life course health development research. In: Handbook of Life Course Health Development. Springer International Publishing; 2017. p. 541–60.

78. Munnangi S, Boktor SW. Epidemiology Of Study Design. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.

79. McDermott M, Brown DL, Chervin RD. Sleep disorders and the risk of stroke. Expert Rev Neurother [Internet]. 2018 Jul 3 [cited 2023 Mar 28];18(7):523. Available from: /pmc/articles/PMC6300163/

80. Somers VK, Dyken ME, Clary MP, Abboud FM. Sympathetic Neural Mechanisms in Obstructive Sleep Apnea Key words: sympathetic nerve activity * blood pressure-hypertension hypoxia. Vol. 96, J. Clin. Invest. 1995.

81. Li C, Shang S. Relationship between Sleep and Hypertension: Findings from the NHANES (2007–2014). International Journal of Environmental Research and Public Health 2021, Vol 18, Page 7867 [Internet]. 2021 Jul 25 [cited 2023 Mar 28];18(15):7867. Available from: https://www.mdpi.com/1660-4601/18/15/7867/htm

82. Albqoor MA, Shaheen AM. Prevalence and differences in habitual sleep efficiency, sleep disturbances, and using sleep medication: a national study of university students in Jordan. Sleep and Breathing [Internet]. 2021 Jun 1 [cited 2024 Jan 25];25(2):1127–34. Available from: https://link.springer.com/article/10.1007/s11325-020-02174-2

83. Hoevenaar-Blom MP, Spijkerman AMW, Kromhout D, Verschuren WMM. Sufficient sleep duration contributes to lower cardiovascular disease risk in addition to four traditional lifestyle factors: The MORGEN study. Eur J Prev Cardiol. 2014 Nov 11;21(11):1367–75.

84. Amagai Y, Ishikawa S, Gotoh T, Kayaba K, Nakamura Y, Kajii E. Sleep duration and incidence of cardiovascular events in a Japanese population: The Jichi medical school Cohort study. J Epidemiol. 2010;20(2):106–10.

85. Gianfagna F, Veronesi G, Bertù L, Cesana G, Grassi G, Stranges S, et al. Influence of sleep disturbances on age at onset and long-term incidence of major cardiovascular events: The MONICA-Brianza and PAMELA cohort studies. Sleep Med. 2016 May 1;21:126–32.

86. Tao F, Cao Z, Jiang Y, Fan N, Xu F, Yang H, et al. Associations of sleep duration and quality with incident cardiovascular disease, cancer, and mortality: a prospective cohort study of 407,500 UK biobank participants. Sleep Med. 2021 May 1;81:401–9.

87. Scott J, Kallestad H, Vedaa O, Sivertsen B, Etain B. Sleep disturbances and first onset of major mental disorders in adolescence and early adulthood: A systematic review and meta-analysis. Sleep Med Rev. 2021;

88. Watson NF, Badr MS, Belenky G, Bliwise DL, Buxton OM, Buysse D, et al. Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society on the Recommended Amount of Sleep for a Healthy Adult : Methodology and Discussion. J Clin Sleep Med. 2015;11(8):931–52.

89. Yaremchuk K. Sleep Disorders in the Elderly. Clin Geriatr Med [Internet]. 2018;34(2):205–16. Available from: https://doi.org/10.1016/j.cger.2018.01.008

90. Li J, Neurobiology C, Vitiello M V, Sciences B, Gooneratne N, Neurobiology C. Sleep in Normal Aging. Sleep Medicine Clin. 2019;13(1):1–11.

91. Patel D, Steinberg J, Patel P. Insomnia in the Elderly : A Review. 2018;

92. Suzuki K, Miyamoto M, Hirata K. Sleep disorders in the elderly : Diagnosis and management. 2017;(February 2016):61–71.

93. Miner B, Kryger MH. Sleep in the Aging Population. Sleep Medicine Clin. 2017;12(1):31–8.

94. Gulia KK, Kumar VM. Sleep disorders in the elderly: a growing challenge. Psychogeriatrics. 2018;18(3):155–65.

95. Wolkove N, Elkholy O, Baltzan M, Palayew M. Sleep and aging: 1. Sleep disorders commonly found in older people. Can Med Assoc J. 2007;176(9):1299–304.

96. Insana SP, Kolko DJ, Germain A. Early-life trauma is associated with rapid eye movement sleep fragmentation among military veterans. Biol Psychol. 2012 Mar;89(3):570–9.

97. Potter GDM, Skene DJ, Arendt J, Cade JE, Grant PJ, Hardie LJ. Circadian rhythm and sleep disruption: Causes, metabolic consequences, and countermeasures. Vol. 37, Endocrine Reviews. Endocrine Society; 2016. p. 584–608.

98. Tatineny P, Shafi F, Gohar A, Bhat A. Sleep in the elderly. Vol. 117. 2020.

99. Keage HAD, Banks S, Yang KL, Morgan K, Brayne C, Matthews FE. What sleep characteristics predict cognitive decline in the elderly? Sleep Med [Internet]. 2012 Aug [cited 2023 Apr 6];13(7):886–92. Available from: https://0-pubmed-ncbi-nlm-nih-gov.innopac.wits.ac.za/22560827/

100. Li P, Gao L, Yu L, Zheng X, Ulsa MC, Yang HW, et al. Daytime napping and Alzheimer's dementia: A potential bidirectional relationship. Alzheimer's & Dementia [Internet]. 2023 Jan 1 [cited 2023 Apr 6];19(1):158–68. Available from: https://0-onlinelibrary-wiley-com.innopac.wits.ac.za/doi/full/10.1002/alz.12636

101. Hua J, Zhuang S, Shen Y, Tang X, Sun H, Fang Q. Exploring the Bidirectional Associations Between Short or Long Sleep Duration and Lower Cognitive Function: A 7-Year Cohort Study in China. Front Aging Neurosci [Internet]. 2021 Oct 6 [cited 2023 Apr 6];13. Available from: /pmc/articles/PMC8528020/

102. Li C, Min X, Cheng G, Yan Y, Li Z. Bidirectional relationship between nocturnal subjective sleep duration and cognitive performance in Chinese over 45 years old: a national representative longitudinal study. BMC Geriatr. 2022 Dec 1;22(1).

103. Parra-Díaz AB, Aibar-Almazán A, Martínez-Amat A, Jiménez-García JD, Álvarez-Salvago F, Hita-Contreras F. Associations of Sleep Quality, Anxiety, and Depression with Cognitive and Executive Functions among Community-Dwelling Women Aged ≥ 65 Years: A Cross-Sectional

Study. Healthcare (Basel) [Internet]. 2021 Nov 1 [cited 2023 Mar 26];9(11). Available from: https://pubmed.ncbi.nlm.nih.gov/34828644/

104. Lo JC, Loh KK, Zheng H, Sim SKY, Chee MWL. Sleep duration and age-related changes in brain structure and cognitive performance. Sleep. 2014 Jul 1;37(7):1171–8.

105. Mander BA, Rao V, Lu B, Saletin JM, Lindquist JR, Ancoli-Israel S, et al. Prefrontal atrophy, disrupted NREM slow waves and impaired hippocampal-dependent memory in aging. Nat Neurosci. 2013 Mar;16(3):357–64.

106. Harb GC, Cook JM, Gehrman PR, Gamble GM, Ross RJ. Post-traumatic stress disorder nightmares and sleep disturbance in Iraq war veterans: A feasible and promising treatment combination. J Aggress Maltreat Trauma. 2009 Jul;18(5):516–31.

107. Khazaie H, Masoudi M. Sleep disturbances in veterans with chronic war-induced PTSD. J Inj Violence Res. 2016;8(2):99–107.

108. Baird T, McLeay S, Harvey W, Theal R, Law D, Romaniuk M, et al. Sleep Disturbances in Australian Vietnam Veterans With and Without Posttraumatic Stress Disorder. Journal of Clinical Sleep Medicine [Internet]. 2018 May 1 [cited 2023 Apr 6];14(5):745–52. Available from: https://jcsm.aasm.org/doi/10.5664/jcsm.7096

109. Benjet C, Bromet E, Karam EG, Kessler RC, Mclaughlin KA, Ruscio AM, et al. The epidemiology of traumatic event exposure worldwide: results from the World Mental Health Survey Consortium. Psychol Med [Internet]. 2016;46(2):327–43. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4869975/pdf/nihms783910.pdf

110. Yehuda R. Post-traumatic stress disorder. New. 2002;346(2):108–14.

111. Glaubman H, Mikulincer M, Porat A, Wasserman O, Birger M. Sleep of chronic post-traumatic patients. J Trauma Stress. 1990;3(2):255–63.

112. HABUKAWA M, UCHIMURA N, KOTORII N, OGi K, YAMAMOTO H, HIEJIMA H, et al. Evaluation of sleep disturbance in post-traumatic stress disorder. Sleep Biol Rhythms. 2003;1(3):241–3.

113. Sheikh JI, Woodward SH, Leskin GA. Sleep in post-traumatic stress disorder and panic: Convergence and divergence. Depress Anxiety. 2003;18(4):187–97.

114. Meinhausen C, Prather AA, Sumner JA. PTSD, Sleep, and Cardiovascular Disease Risk: A Mechanism-Focused Narrative Review. Health Psychology. 2022;41(10):663–73.

115. Vargas-Garrido H, Moyano-Díaz E, Andrades K. Sleep problems are related to commuting accidents rather than to workplace accidents. BMC Public Health. 2021 Dec 1;21(1).

116. Vahtera J, Kivimaki M, Hublin C, Korkeila K, Suominem S, Paunio T, et al. Liability to anxiety and severe life events as predictors of new-onset sleep disturbances. Sleep. 2007;30(11):1537–46.

117. Mysliwiec V, Brock MS, Creamer JL, O'Reilly BM, Germain A, Roth BJ. Trauma associated sleep disorder: A parasomnia induced by trauma. Vol. 37, Sleep Medicine Reviews. W.B. Saunders Ltd; 2018. p. 94–104.

118. Greenfield EA, Lee C, Friedman EL, Springer KW. Childhood abuse as a risk factor for sleep problems in adulthood: Evidence from a U.S. National Study. Annals of Behavioral Medicine. 2011 Oct;42(2):245–56.

119. Hoag JR, Wu H, Grady JJ. Impact of childhood abuse on adult sleep quality among low-income women after Hurricane Ike. Sleep Health. 2015 Dec 1;1(4):293–9.

120. Sheehan CM, Li L, Friedman EM. Quantity, timing, and type of childhood adversity and sleep quality in adulthood. Sleep Health. 2020 Apr 1;6(2):246–52.

121. Ng ASY, Chan WS. Sleep Quality, Sleep-Related Experiences, and Dissociation in Adult Survivors of Childhood Trauma. Behavioral Sleep Medicine. 2023;21(6):659–70.

122. Ng ASY, Chan WS. Sleep Quality, Sleep-Related Experiences, and Dissociation in Adult Survivors of Childhood Trauma. Behavioral Sleep Medicine. 2022;1–12.

123. Chapman DP, Wheaton AG, Anda RF, Croft JB, Edwards VJ, Liu Y, et al. Adverse childhood experiences and sleep disturbances in adults. Sleep Med. 2011 Sep;12(8):773–9.

124. Guarnieri B, Sorbi S. Sleep and Cognitive Decline: A Strong Bidirectional Relationship. It Is Time for Specific Recommendations on Routine Assessment and the Management of Sleep Disorders in Patients with Mild Cognitive Impairment and Dementia. Eur Neurol [Internet]. 2015 Dec 1 [cited 2023 Mar 26];74(1–2):43–8. Available from: https://www.karger.com/Article/FullText/434629

125. Pepin JL, Borel AL, Tamisier R, Baguet JP, Levy P, Dauvilliers Y. Hypertension and sleep: Overview of a tight relationship. Sleep Med Rev. 2014;18(6):509–19.

126. South Africans are living longer | Statistics South Africa [Internet]. [cited 2023 Apr 2]. Available from: https://www.statssa.gov.za/?p=1086

127. Life expectancy at birth, total (years) - South Africa | Data [Internet]. [cited 2023 Apr 2]. Available from: https://data.worldbank.org/indicator/SP.DYN.LE00.IN?locations=ZA

128. Tackling Violence in South Africa: The Context – Learn how – SaferSpaces [Internet]. [cited 2023 Apr 3]. Available from: https://www.saferspaces.org.za/learn-how/entry/tackling-violence-in-south-africa-the-context

129. Kabudula CW, Tollman S, Mee P, Ngobeni S, Silaule B, Xavier Gómez-Olivé F, et al. Two decades of mortality change in rural northeast South Africa. Glob Health Action. 2014;7(1).

130. Xavier Gómez-Olivé F, Montana L, Wagner RG, Kabudula CW, Rohr JK, Kahn K, et al. Cohort profile: Health and ageing in Africa: A longitudinal study of an indepth community in South Africa (HAALSI). Int J Epidemiol. 2018;47(3):689-690J.

131. Wade AN, Payne CF, Berkman L, Chang A, Gómez-Olivé FX, Kabudula C, et al. Multimorbidity and mortality in an older, rural black South African population cohort with high prevalence of HIV findings from the HAALSI Study. BMJ Open. 2021 Sep 15;11(9).

132. Payne CF, Mall S, Kobayashi L, Kahn K, Berkman L. Adverse life events and late-life wellbeing: Risk and resilience in an aging post-Apartheid South African cohort.

133. Kahn K, Tollman SM, Collinson MA, Clark SJ, Twine R, Clark BD, et al. Research into health, population and social transitions in rural South Africa: Data and methods of the Agincourt health and demographic surveillance system. Scand J Public Health. 2007 Aug;35(SUPPL. 69):8–20.

134. Seabi TM, Wagner RG, Norris SA, Tollman SM, Twine R, Dunger DB, et al. Adolescents' understanding of obesity: a qualitative study from rural South Africa. Glob Health Action. 2021;14(1).

135. Sedibe HM, Kahn K, Edin K, Gitau T, Ivarsson A, Norris SA. Qualitative study exploring healthy eating practices and physical activity among adolescent girls in rural South Africa. BMC Pediatr. 2014 Aug 26;14(1).

136. West RL, Lippman SA, Twine R, Maritze M, Kahn K, Leslie HH. Providers' definitions of quality and barriers to providing quality care: a qualitative study in rural Mpumalanga Province, South Africa. Journal of Global Health Science. 2021;3(1).

137. Kabudula CW, Houle B, Collinson MA, Kahn K, Gómez-Olivé FX, Clark SJ, et al. Progression of the epidemiological transition in a rural South African setting: findings from population surveillance in Agincourt, 1993-2013. BMC Public Health. 2017 May 10;17(1).

138. Payne CF, Gómez-Olivé FX, Kahn K, Berkman L. Physical Function in an Aging Population in Rural South Africa: Findings from HAALSI and Cross-National Comparisons with HRS Sister Studies. Journals of Gerontology - Series B Psychological Sciences and Social Sciences. 2017 Jul 1;72(4):665–79.

139. Garenne M, Collinson MA, Kabudula CW, Gómez-Olivé FX, Kahn K, Tollman S. Completeness of birth and death registration in a rural area of South Africa: The Agincourt health and demographic surveillance, 1992-2014. Glob Health Action. 2016;9(1).

140. Kahn K, Collinson MA, Xavier Gómez-olivé F, Mokoena O, Twine R, Mee P, et al. Profile: Agincourt health and socio-demographic surveillance system. Int J Epidemiol. 2012;41(4):988–1001.

141. Payne CF, Mall S, Kobayashi L, Kahn K, Berkman L. Life-Course Trauma and Later Life Mental, Physical, and Cognitive Health in a Postapartheid South African Population: Findings From the HAALSI study. J Aging Health. 2020;32(9):1244–57.

142. Harling G, Payne CF, Davies JI, Gomez-Olive FX, Kahn K, Manderson L, et al. Impairment in Activities of Daily Living, Care Receipt, and Unmet Needs in a Middle-Aged and Older Rural South African Population: Findings From the HAALSI Study. J Aging Health. 2020 Jun 1;32(5–6):296–307.

143. Adams LB, Farrell M, Mall S, Mahlalela N, Berkman L. Dimensionality and differential item endorsement of depressive symptoms among aging Black populations in South Africa: Findings from the HAALSI study. J Affect Disord [Internet]. 2020 Dec 12 [cited 2023 Mar 19];277:850. Available from: /pmc/articles/PMC7575820/

144. Bassil DT, Farrell MT, Wagner RG, Brickman AM, Glymour MM, Langa KM, et al. Cohort Profile Update: Cognition and dementia in the Health and Aging in Africa Longitudinal Study of an INDEPTH community in South Africa (HAALSI dementia). Int J Epidemiol [Internet]. 2022 Aug 10;51(4):e217–26. Available from: https://academic.oup.com/ije/article/51/4/e217/6453864

145. VanderWeele TJ, Hernán MA, Robins JM. Causal directed acyclic graphs and the direction of unmeasured confounding bias. Epidemiology. 2008 Sep;19(5):720–8.

146. Diemer EW, Hudson JI, Javaras KN. More (Adjustment) Is Not Always Better: How Directed Acyclic Graphs Can Help Researchers Decide Which Covariates to Include in Models for the Causal Relationship between an Exposure and an Outcome in Observational Research. Psychother Psychosom. 2021 Aug 1;90(5):289–98.

147. Tennant PWG, Murray EJ, Arnold KF, Berrie L, Fox MP, Gadd SC, et al. Use of directed acyclic graphs (DAGs) to identify confounders in applied health research: review and recommendations. Vol. 50, International Journal of Epidemiology. Oxford University Press; 2021. p. 620–32.

148. Radloff LS. The CES-D Scale: A Self-Report Depression Scale for Research in the General Population [Internet]. Available from: http://www.copyright.com/

149. Benson J, Severn C, Hudnut-Beumler J, Simon SL, Abramson N, Shomaker LB, et al. Depression in Girls With Obesity and Polycystic Ovary Syndrome and/or Type 2 Diabetes. Can J Diabetes. 2020 Aug 1;44(6):507–13.

150. Marando F, Gualberti G, Costanzo AM, Di Luzio Paparatti U, Franzetti M, Ammassari A, et al. Discrepancies between physician's perception of depression in HIV patients and self-reported CES-D-20 assessment: The DHIVA study. AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV. 2016 Feb 1;28(2):147–59.

151. Payne CF, Mall S, Kobayashi L, Kahn K, Berkman L. Life-Course Trauma and Later Life Mental, Physical, and Cognitive Health in a Postapartheid South African Population: Findings From the HAALSI study HHS Public Access. J Aging Health [Internet]. 2020;32(9):1244–57. Available from: http://dx.doi.org/10.7910/DVN/F5YHMLandhttps://doi.org/10.7910/DVN/TW84UI

152. StataCorp. Stata Statistical Software: Release 18. College Station TX: StataCorp LLC; 2023.

153. Stranges S, Tigbe W, Gómez-Olivé FX, Thorogood M, Kandala NB. Sleep problems: An emerging global epidemic? Findings from the INDEPTH WHO-SAGE study among more than 40,000 older adults from 8 countries across Africa and Asia. Sleep. 2012 Aug 1;35(8):1173–81.

154. Jemilohun AC, Fasesan OA, Kolawole AO. Sleep Quality in a Nigerian Community: Prevalence of Poor Sleep Quality, Risk Factors and Health-Related Quality of Life [Internet]. Available from: https://www.researchgate.net/publication/362506034

155. Richter K, Baumgärtner L, Niklewski G, Peter L, Köck M, Kellner S, et al. Sleep disorders in migrants and refugees: a systematic review with implications for personalized medical approach. Vol. 11, EPMA Journal. Springer; 2020. p. 251–60.

156. Arnetz BB, Templin T, Saudi W, Jamil H. Obstructive sleep apnea, posttraumatic stress disorder, and health in immigrants. Psychosom Med. 2012;74(8):824–31.

157. Jamil H, Nassar-Mcmillan S, Lambert R, Wang Y, Ager J, Arnetz B. Pre-and post-displacement stressors and time of migration as related to self-rated health among Iraqi immigrants and refugees in Southeast Michigan.

158. Chen JH, Waite LJ, Lauderdale DS. Marriage, relationship quality, and sleep among U.S. older adults. J Health Soc Behav. 2015 Jan 1;56(3):356–77.

159. Troxel WM, Braithwaite SR, Sandberg JG, Holt-Lunstad J. Does Improving Marital Quality Improve Sleep? Results From a Marital Therapy Trial. Behavioral Sleep Medicine. 2017 Jul 4;15(4):330–43.

160. Griffin SC, Williams AB, Ravyts SG, Mladen SN, Rybarczyk BD. Loneliness and sleep: A systematic review and meta-analysis. Vol. 7, Health Psychology Open. SAGE Publications Inc.; 2020.

161. Cacioppo JT, Hawkley LC, Crawford LE, Ernst JM, Burleson MH, Kowalewski RB, et al. Loneliness and health: potential mechanisms. Psychosom Med [Internet]. 2002 [cited 2024 Mar 26];64(3):407–17. Available from: https://pubmed.ncbi.nlm.nih.gov/12021415/

162. Wetter DW, Young TB. The relation between cigarette smoking and sleep disturbance. Prev Med (Baltim) [Internet]. 1994 Jan 1 [cited 2023 Mar 18];23(3):328–34. Available from: https://pubmed.ncbi.nlm.nih.gov/8078854/

163. Liao Y, Xie L, Chen X, Kelly BC, Qi C, Pan C, et al. Sleep quality in cigarette smokers and nonsmokers: Findings from the general population in central China. BMC Public Health. 2019 Jun 24;19(1).

164. Mcnamara JPH, Wang J, Holiday DB, Warren JY, Paradoa M, Balkhi AM, et al. Sleep disturbances associated with cigarette smoking. Psychol Health Med [Internet]. 2014 Jul 4 [cited 2023 Mar 18];19(4):410–9. Available from: https://pubmed.ncbi.nlm.nih.gov/24040938/

165. Hwang JH, Park SW. The relationship between poor sleep quality measured by the Pittsburgh Sleep Quality Index and smoking status according to sex and age: an analysis of the 2018 Korean Community Health Survey. Epidemiol Health. 2022;44.

166. Griesar WS, Zajdel DP, Oken BS. Nicotine effects on alertness and spatial attention in non-smokers. Nicotine and Tobacco Research. 2002;4(2):185–94.

167. Maglione JE, Ancoli-Israel S, Peters KW, Paudel ML, Yaffe K, Ensrud KE, et al. Subjective and objective sleep disturbance and longitudinal risk of depression in a cohort of older women. Sleep [Internet]. 2014 Jul 1 [cited 2023 Mar 18];37(7):1179–87. Available from: https://pubmed.ncbi.nlm.nih.gov/25061246/

168. Fang H, Tu S, Sheng J, Shao A. Depression in sleep disturbance: A review on a bidirectional relationship, mechanisms and treatment. J Cell Mol Med. 2019 Apr 1;23(4):2324–32.

169. Pan ML, Tsao HM, Hsu CC, Wu KM, Hsu TS, Wu YT, et al. Bidirectional association between obstructive sleep apnea and depression A population-based longitudinal study. Medicine (United States). 2016;95(37).

170. Sun Y, Shi L, Bao Y, Sun Y, Shi J, Lu L. The bidirectional relationship between sleep duration and depression in community-dwelling middle-aged and elderly individuals: evidence from a longitudinal study. Sleep Med. 2018 Dec 1;52:221–9.

171. Ning C, Lin H, Chen X, Qiao X, Xu X, Xu X, et al. Cross-sectional comparison of various sleep disturbances among sex- and age-matched HIV-infected versus HIV-uninfected individuals in China. Sleep Med. 2020 Jan 1;65:18–25.

172. Gómez-Olivé FX, Rohr JK, Roden LC, Rae DE, von Schantz M. Associations between sleep parameters, non-communicable diseases, HIV status and medications in older, rural South Africans. Sci Rep. 2018 Dec 1;8(1).

173. Chapman DP, Wheaton AG, Anda RF, Croft JB, Edwards VJ, Liu Y, et al. Adverse childhood experiences and sleep disturbances in adults. Sleep Med. 2011 Sep;12(8):773–9.

174. Reffi AN, Kalmbach DA, Cheng P, Jovanovic T, Norrholm SD, Sexton MB, et al. Sleep reactivity as a potential pathway from childhood abuse to adult insomnia. Sleep Med. 2022 Jun 1;94:70–5.

175. Greenfield EA, Lee C, Friedman EL, Springer KW. Childhood abuse as a risk factor for sleep problems in adulthood: Evidence from a U.S. National Study. Annals of Behavioral Medicine. 2011 Oct;42(2):245–56.

176. Brewin C, Andrews B, Valentine J. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. Consult Clin Psychol [Internet]. 2000;68(Oct):748–66. Available from: https://liverpool.idm.oclc.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=jlh&AN=106793803&site=ehost-live&scope=site

177. Young JC, Widom CS. Long-term effects of child abuse and neglect on emotion processing in adulthood. Child Abuse Negl [Internet]. 2014;38(8):1369–81. Available from: http://dx.doi.org/10.1016/j.chiabu.2014.03.008

178. Foley DJ, Monjan AA, Brown SL, Simonsick EM, Wallace RB, Blazer DG, et al. RISK FOR POSTTRAUMATIC STRESS DISORDER ASSOCIATED WITH DIFFERENT FORMS OF INTERPERSONAL VIOLENCE INSOUTH AFRICA. Sleep [Internet]. 2008;67(10):1589–95. Available from: http://dx.doi.org/10.1371/journal.pmed.1003090

179. Pudikov I, Smirnova D. 1499 – Neurodynamic patterns of sleep disturbances related to posttraumatic stress disorder in war veterans. European Psychiatry. 2013 Jan;28:1.

180. Atwoli L, Stein DJ, Koenen KC, McLaughlin KA. Epidemiology of posttraumatic stress disorder: Prevalence, correlates and consequences. Vol. 28, Current Opinion in Psychiatry. Lippincott Williams and Wilkins; 2015. p. 307–11.

181. Cox RC, Tuck BM, Olatunji BO. Sleep Disturbance in Posttraumatic Stress Disorder: Epiphenomenon or Causal Factor? Vol. 19, Current Psychiatry Reports. Current Medicine Group LLC 1; 2017.

182. Bryant RA, Creamer M, O'Donnell M, Silove D, McFarlane AC. Sleep disturbance immediately prior to trauma predicts subsequent psychiatric disorder. Sleep. 2010;33(1):69–74.

183. Debeer BB, Kimbrel NA, Mendoza C, Davidson D, Meyer EC, La Bash H, et al. Traumatic Brain Injury, Sleep Quality, and Suicidal Ideation in Iraq/Afghanistan Era Veterans. Journal of Nervous and Mental Disease. 2017 Jul 1;205(7):512–6.

184. Ulmer CS, Van Voorhees E, Germain AE, Voils CI, Beckham JC. A comparison of sleep diffi culties among Iraq/Afghanistan theater veterans with and without mental health diagnoses. Journal of Clinical Sleep Medicine. 2015;11(9):995–1005.

185. Seelig AD, Jacobson IG, Smith B, Hooper TI, Boyko ; Edward J, Gackstetter GD, et al. Sleep Patterns Before, During, and After Deployment to Iraq and Afghanistan. Sleep. 2010;33(12):1615–22.

186. Lauderdale DS, Knutson KL, Yan LL, Liu K, Rathouz PJ. Self-reported and measured sleep duration: How similar are they? Epidemiology. 2008 Nov;19(6):838–45.

Appendix 1

SCHOOL OF PUBLIC HEALTH

STUDENT DECLARATION

PLAGIARISM

I TSITSI CHERRY DZIMBANHETE (student number: 2485949) am a post-graduate student registered for the degree / programme MSc EPIDEMIOLOGY in THE FIELD OF EPIDEMIOLOGY AND BIOSTATISTICS in the Wits School of Public Health.

I am submitting written work for assessment for the module COMH7178A I

hereby declare the following:

- I am aware that plagiarism is the use of someone else's work without their permission and/or without acknowledging the original source.
- I am aware that plagiarism is wrong
- I confirm that the work submitted for the above course and module, is my own work, except where I have stated otherwise
- I have followed the required conventions in referencing the thoughts and ideas of others
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or if I have failed to acknowledge the ideas or writing.

Signature: T C. Dzimbanhete Date: 29 March 2024

Appendix 2

Table 6: Traumatic events classification

TRAUMATIC EVENTS
Natural disaster or accident • Experienced Natural disaster • Ever had life-threatening Illness or accident • Someone close dying or risk of death
War related • Ever lost close friend or relative in war or military service • Ever fired a weapon or fired on in combat • Witnessed death or injury in war or military action
Community violence • Ever been a victim of physical attack or assault • Ever been victim of sexual assault • Witnessed accident or violent act leading to death or severe injury
Childhood trauma (when under 16) • Either parent unemployed for more than 6months • Parents fight or argue very often • Parents drinking excessively abusing alcohol and drugs or having mental health problems • Physical abuse by your parents
Caregiving • Long term caregiver of disabled or impaired relative or friend • Experiencing severe financial hardship • Spouse addicted to drugs or alcohol

Appendix 3

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG	HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research & Post Graduate Affairs)

TO: Professor SM Tollman et al
MRC/Wits Rural Public & Health Transitions Research Unit
School of Public Health
Medical School
University

E-mail: Stephen.Tollman@wits.ac.za

CC: Supervisor: Not applicable <>
and <HREC-Medical.ResearchOffice@wits.ac.za>

FROM: Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 22/08/2018

REF: *R14/49*

PROTOCOL NO: **M180383** *(This is your ethics application study reference number. Please quote this reference number in all correspondence relating to this study)*

PROJECT TITLE: *Health and Ageing in Africa: Longitudinal Studies of an INDEPTH Community in South Africa (HAALSI)*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to the Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

R14/49 Professor SM Tollman et al

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M180383

NAME: (Principal Investigator)	Professor SM Tollman et al
DEPARTMENT:	MRC/Wits Rural Public & Health Transitions Research Unit School of Public Health Medical School University
PROJECT TITLE:	Health and Ageing in Africa: Longitudinal Studies of an INDEPTH Community in South Africa (HAALSI)
DATE CONSIDERED:	06/04/2018
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Not applicable
APPROVED BY:	Professor CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	22/08/2018

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on 3rd floor, Phillip V Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in **March** and will therefore be due in the month of **March** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 4

10 November 2023

Professor Paul Ruff
Human Research Ethics Committee (HREC), Faculty of Health Sciences
University of the Witwatersrand

Dear Professor Ruff / Paul
A/ Professor Sumaya Mall who works in the Division of Epidemiology and Biostatistics in SPH is a researcher who works closely with teams of the SAMRC/Wits Rural Public Health and Health Transitions Research Unit (Agincourt) as well as Center for Population and Development Studies in the Harvard SPH. A key involvement is with the HAALSI project: Health and Ageing in Africa: longitudinal studies in an INDEPTH community.
To-date HAALSI consists of 3 completed waves of survey data collection, with carefully curated and anonymised data in the public domain. A Wave 4 survey is planned for 2024.
Sumaya works with a tailored HAALSI dataset, of which she is the steward and accountable, and within which she nests graduate student research. This includes students who analyse HIV related data for their research reports. She is seeking ethical approval for the work of such students who can in effect be regarded as conducting a sub-study of the data she is analysing. Where such students need to submit an ethics application, they would do so.
Sumaya herself is a co-author on several HAALSI publications.
Do not hesitate with any queries.
Best wishes,
Steve

Stephen Tollman, research professor, SPH
Co-PI, HAALSI
PA: Dawn Dalby +27-11-7172085

cc: A/Prof Sumaya Mall