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The relationship between lifecourse traumatic events and pain in an older rural South African population: A cross-sectional study

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Abstract

Background

Pain in older adults is an increasing concern in low- and middle-income countries (LMICs), with literature suggesting an association with past traumatic events (TEs) in high-income settings. We aim to investigate this relationship in a population-representative sample of older adults with high burden of TEs in a rural South African community.

Methods

The Health and Aging in Africa: A longitudinal Study of an INDEPTH Community in South Africa (HAALSI) study collected data pain intensity, using the Brief Pain Inventory, and TEs with a 16-item questionnaire, from 2411 participants aged 40–79 in 2014–15. We used logistic regression models to test the association between TE exposure and self-reported pain status.

Results

TE experience was near-universal (99.1% experience of at least one), while 9.0% of participants reported current pain, of which 86.6% was moderate/severe. In multivariable regression, increased odds of moderate/severe pain was associated with more TEs of any kind (OR 1.08; 95%CI 1.02–1.15 per additional TE) and with past exposure to disasters, accidents and illnesses (men and women), violence in the community (women only) and social/family environment problems (men only)–but not with childhood or war-related TEs.

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Abbreviations: HAALSI, Health and Aging in Africa: A longitudinal Study of an INDEPTH Community in South Africa; NCDs, Non-communicable diseases; YLDs, Years lived with disability; LMICs, Low and middle-income countries; TE, Traumatic event; PTSD, Post-traumatic stress disorder; HDSS, Health and socio-demographic surveillance system; ELSA, English Longitudinal Study of Aging; AIC, Akaike Information Criterion; CI, Confidence interval; SADHS, South African Demographic and Health Survey; SASH, South Africa Stress and Health.

Conclusions

TEs were associated with pain even within a rural resource-limited setting where trauma experiences were extremely common. However, associations varied by TE type and sex. Interventions to prevent pain in older adults need to be targeted to block specific mechanisms that vary within even at-risk populations.

Introduction

Pain, as defined by International Association for the Study of Pain (IASP) is an adverse sensory and emotional experiences potentially associated with tissue damage [1]. However, the notion has shifted from a protective response to a pathologic disease state in recent years [2]. Pain was classified as acute or chronic based on duration [3]. At least 10% of the world's population is estimated to suffer from chronic pain [4], a figure projected to increase as the world's population ages [5]. Chronic pain co-occurs with non-communicable diseases (NCDs), such as mental disorders, diabetes mellitus, arthritis and cancer, whose burden also is increasing, leading to more comorbidities [6,7]. Older populations with high rates of mulitmorbidity, are disproportionally more prone to suffer chronic pain [8]. The consequences of chronic pain are substantial: lower back pain alone is the greatest contributor to worldwide years lived with disability (YLDs) [9]. Although chronic pain is a worldwide concern, evidence on chronic pain and its risk factors in low and middle-income countries (LMICs) is more limited than in high-income countries; much LMIC pain research has focused around HIV, post-operative pain and sickle cell disease [10–13].

Acute pain, with a clear causality such as musculoskeletal injuries, is typically short-term [14]; Chronic pain, however, is believed to be predicted by the combination of biological, psychological and social factors [8,15–17]. While biological and psychological risks factors for chronic pain development are relatively well-researched, social perspectives on pain are gradually receiving more attention–not least because social determinants of NCDs, such as low socioeconomic status, educational and poverty can also be associated with pain [6,16]. One important aspect of social risk factors is that of traumatic events (TEs). While most studies focused on TEs in childhood (i.e., adverse childhood experiences) as a critical period for neurodevelopment and human capital development [18], there is increasing evidence that TEs experienced throughout the lifecourse may be associated with negative health outcomes [19]. TEs, especially if chronic or severe, can generate biopsychological effects, including physcial and mental health conditions [20–22].

Adults exposed to TEs have higher odds of future chronic pain, including headache or migraine, back and neck pain, chronic pelvic pain, chronic widespread pain and fibromyalgia [20,23–26]. Much existing literature on this relationship is cross-sectional and retrospective. However, a UK longitudinal analysis demonstrated that TEs in childhood including family financial hardship, experiencing institutional care and maternal death were each associated with increased chronic widespread pain even after adjustment for social class and psychological distress [27].

Several mechanisms linking TEs and later-life pain have been proposed, including biological (e.g., dysregulation of allostatis) and psychological (e.g., psychopathology) ones [17]. Allostatic overload, a harmful response to TEs, can manifest as chronic inflammation throughout the life course [28,29], increasing the risk of chronic pain both directly and by promoting development of chronic NCDs [30]. Psychopathology, notably anxiety, depression and post-

traumatic stress disorder (PTSD), can also mediate the relationship between TEs and chronic pain [30–33].

Despite much work in higher-income settings, little is known about the impact of TEs on pain in LMICs. Associations might be expected to differ in LMICs for several reasons. First, there is evidence that TEs are prevalent in LMICs, including Mexico, the Philippines, Malawi and South Africa [34–37]. Second, the relative frequencies of TEs likely differ, e.g., war and conflict-related experiences may be more prevelant in LMICs [38]. Third, NCDs develop on average at earlier ages among populations in LMICs than in HICs [39,40]. South Africa typifies all these differences. The majority Black African population experienced apartheid from 1948 to 1994, with resulting exposure to political and economic deprivation which led to near-universal traumatic experiences, often violence-related (both witnesses and experiences)– 88% of the population-representative Birth to 20+ cohort in the Gauteng Province of South Africa reported at least one TEs by early adulthood [41,42]. These experiences have been linked to increased likelihood of physical and psychological ill-health in older age [19]. Some settings in northern and eastern South Africa also accommodate large number of refugees and migrants from violence beyond the country's borders, e.g., from the Mozambican Civil War in the 1980s and Zimbabwe's economic troubles of the past two decades and more.

Despite this high burden of TEs, and a national adult prevalence of chronic pain estimated at 18.3% [43], the association between TEs and pain is little-studied. One past study using the South Africa Stress and Health study (2002–05) with a nationally representative sample of over-15-year olds found a dose-response association between cumulative count of TEs and chronic pain [42]. However, it is likely both that associations between TEs and pain will differ both at older ages, especially as overall health conditions increase with age, and by rurality, especially given likely higher levels of TE and pain in former Apartheid homelands. In this work, we seek to understand the connection between TEs and pain in a context where TE exposure is near universal. We focus on current pain as a reflection of both acute and chronic pain, acknowledging it may not only capture the chronicity in a large cohort of older adults (aged 40+ in 2015) living in rural Mpumalanga province, South Africa. One-third of this cohort moved to the area as refugees from Mozambique due to its 1977–1992 civil war–an experience linked with substantive long-term trauma for many who lived through it [44]–while the remainder grew up under Apartheid. Both experiences generated a wide range of traumatic experiences that have the potential to have life-long repercussions, including pain. While this context of two potentially overlapping sources of societal trauma may be near-unique, we expect our analyses to identify how patterns of TEs affect later-life pain in settings where almost everyone has experienced some TEs.

Materials and methods

Study setting and sample

Health and Aging in Africa: a Longitudinal Study of an INDEPTH community in South Africa (HAALSI), was initiated within the established Agincourt health and socio-demographic surveillance system (HDSS) located in Mpumalanga province, notheastern South Africa [45]. The Agincourt HDSS is located within the former homeland of Gazankulu, with a long history of underprovision of public services, very high unemployment and high prevalence of HIV and other health conditions. Due to its proximity to Mozambique, around one-third of the local population are Mozambican migrants and their descendants, many of who arrived during the Mozambican Civil War from 1977 to 1992 [46].

HAALSI randomly sampled 6281 HDSS-resident adults aged over 40 on 1 July 2014, of whom 5059 were found and consented to participate in 2014–15 [45]. Face-to-face interviews

were conduncted by experienced local field workers using table computers; interviews comprised household, individual questionnaries, anthropometric measurements and blood draws. Our analytic sample utilised cross-sectional data from the baseline wave of HAALSI and comprised the random subsample of HAALSI respondents aged 40 to 79 who were invited to complete additional activities, including an in-depth life-history questionnaire and laboratory visit; participants did not differ substantially from same-aged non-participants [19].

Ethical approval

Ethical approval for HAALSI was obtained from the University of the Witwatersrand Human Research Ethics Committee, the Harvard T.H. Chan School of Public Health Office of Human Research Administration, and the Mpumalanga Provincial Research and Ethics Committee. HAALSI participants provided written informed consent prior to participation. Participants who could not read had a signed witness assisted them and provided an inked fingerprint as signature. The data used in this analysis was anonymised and publicly available, and thus did not require additional ethical approval. The datasets generated and analysed during the current study are available in the HAALSI Baseline Survey repository, https://doi.org/10.7910/DVN/F5YHML, which we accessed on 16th, January, 2020.

Measures

Outcomes. Pain intensity was assessed by the short-form version of Brief Pain Inventory, a 15-item self-reported questionnaire, measuring: 1) pain intensity; 2) pain location; and 3) the interference in life and well-being [47]. If respondents reported any pain today, they were asked four pain intensity questions, each on an 11-point scale ranging from 0 (no pain) to 10 (pain as bad as you can imagine). These questions covered the worst, least and average pain over the past 24 hours, and pain level right now, but not the duration of pain. A similar pain questionnaire, the Wisconsin Brief Pain Questionnaire [48] with the same questions regarding pain intensity had been validated in Xitsonga/Shangaan, the local language [49]. The HAALSI questions were also back-translated for reliability.

Our primary outcome measure was the intensity of 'average pain', as it implicity reflects the persistent of pain, with 'pain now' included as a sensitivity analysis. We categorised 'average pain' intensity into four levels: none (0); mild (1–3), moderate (4–6) and severe (7–10) in line with widely used cutpoints [50,51]. In regression analysis, we further divided responses into no/mild and moderate/severe pain, based on mild pain's relatively low impact on daily function and health-related quality of life [52,53].

Exposures. The TE questions in HAALSI were derived from the life-history section in the English Longitudinal Study of Aging (ELSA) [54]. The questionnaire comprised yes-no questions regarding experience of 16 adversities (wording given in Table 2). We coded individuals skipping individual questions as 'don't know/refuse to answer' unless they had skipped eight or more TEs, in which case they were dropped from our analysis. We grouped TEs into five categories based on previous trauma studies: childhood household dysfunction; social/family environment; violence in the community; natural disasters, accidents and illnesses; and war-related events [19,55]–since each type of traumatic experience may have different effects on mental and physical health [56]. We separated war-related events from violence in the community to underscore the influences of the Mozambican Civil War.

We used two exposure variables. First, we calculated the cumulative number of TEs by summing the number of affirmed events (from 0 to 16), treating "don't know" answers as non-affirmative. This parameterisation was based on the cumulative risk hypothesis which expects risk factors to accumulate and to increase the possibility of later-life negative health outcomes

[29,57]. Second, to examine the impacts of specific TE types, we created five binary variables to indicate any TE experience in each TE category. A TE category was deemed affirmative if any one item was affirmed; any respondent who did not affirm any response in a TE category, but answered "don't know" to at least one question, were grouped separately as "any don't know". This parameterisation assumed that any TE in a category was equally important and that a single exposure would have as much effect as multiple types within a category. Overall, the parameterisation mirrored earlier analysis of the same data for a broad range of mental, physical and cognitive health outcomes [19]. We chose not to regress individual traumatic events to avoid the risk of multiple testing.

Covariates. We identified several potential confounders using a directed acyclic graph focused on our exposure-outcome relationship (see S1 Fig in S1 File). We controlled for age and country of origin (South Africa and Mozambique/other) since TE exposure and pain experiences may differ across birth cohort and by past experiences such as civil war and Apartheid [19,55,58]. We also controlled for sex given past evidence of differences in reporting and perceiving pain, as well as in TE exposure risk [55,59]. Finally, we controlled for childhood socioeconomic status via the proxy measure of father's occupation [60,61], categorised into two levels (i.e., skilled and unskilled) according to International Standard Classification of Occupations 2008 (ISCO-08) definitions [62,63].

Data analysis

We excluded any respondent missing 50% or more of TE responses (n = 25), respondents aged under 40 (n = 8) or over 80 (n = 27), those missing country of origin (n = 1) and those not answering the 'pain today' question (n = 25). All remaining respondents were included in a complete case analysis.

First, we summarised the distribution of baseline characteristics, count of TEs and pain intensity using frequencies and proportions. We then conducted bivariate and multivariable logistic regression analyses for both exposure parameterisations. For all regressions, we grouped"any don't know" TE values with those without exposure due to small numbers. First, we assessed dose-response relationships between TEs and the binary pain outcome. Second, we assessed the association of each TE category with pain. Third, we stratified our sample into men and women and reran our regression analyses for sex-differences in perception of pain, processing pain [59] and exposure to TEs [55], in order test for potential effect-modification by sex. We conducted three sensitivity analyses. First, we used ordinal logistic regression to assess whether results differed when looking at pain as a four-level outcome. Second, we added a quadratic TE count term to assess whether this improved model fit using the Akaike Information Criterion (AIC) and predicted probability plots. Third, we stratified our sample by country of origin (South Africa and Mozambique/other) and conducted regression analyses to assess whether pain outcomes varied between these distinct settings. All analysis was conducted in R version 3.6.1 [64].

Results

We included 2411 of 2492 respondents who consented to the life history module (96.7%) as a complete case analysis (Table 1). Respondents were more likely to be female but were relatively balanced by age. Almost 30% were born outside of South Africa, almost all in Mozambique, and over half of respondents' fathers had had a skilled occupation. Overall pain prevalence was 9.0%, with the great majority (86.6%) of these reporting moderate or severe pain. Pain generally rose with age and was most frequent for women aged 60–69 (Fig 1).

Table 1. Descriptive characteristics of HAALSI life history cohort (N = 2411).

	N (%)
Sex	
Male	1015 (42.1)
Female	1396 (57.9)
Age	
40–49	582 (24.1)
50–59	800 (33.2)
60–69	522 (21.7)
70–79	507 (21.0)
Father's occupation	
Skilled	1217 (50.5)
Unskilled	694 (28.8)
Other	263 (10.9)
Unknown	237 (9.8)
Country of origin	
South Africa	1721 (71.4)
Mozambique/other	690 (28.6)
Count of traumatic events	
0 TEs	21 (0.9)
1 TE	150 (6.2)
2 TEs	202 (8.4)
3 TEs	311 (12.9)
4 TEs	384 (15.9)
5+ TEs	372 (15.4)
Pain intensity	
No pain	2195 (91.0)
Mild	29 (1.2)
Moderate	86 (3.6)
Severe	101 (4.2)

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Almost all respondents (99.1%) had experienced at least one TE, with modal class of four for women and five for men, and wide variation (Fig 2). The most common TE was severe financial hardship experience (82.6%), followed by risk of death or death from accidents for close friends or relatives (67.4%); the least common TE was sexual assault (2.1%). The commonest TE categories were negative social and family environment (87.9%) and exposure to natural disaster, accident, and illness (87.3%); the least common was war-related events (23.1%). The most common unknown TEs were those for parental experiences within childhood household dysfunction (0.5–7.7% don't know), while items relating directly to respondents were almost always known ($\leq$0.7% don't know) (Table 2).

In bivariate analysis, each additional TE was associated with an 8% increase (95% confidence interval (CI) 1.02–1.15) in the odds of reporting moderate/severe pain (Table 3); this was little changed after adjustment for potential confounders or stratification by sex. In regressions for TE categories, two categories–violence in the community and disasters, illnesses and accidents–were associated with significantly increased odds of moderate/severe pain, with odds ratios of 1.62 (95%CI 1.17–2.27) and 1.70 (95%CI 1.01–3.05) respectively among all respondents. In sex-stratified models, pain was slightly more strongly associated with disasters, illnesses and accidents in women than men (OR 1.81; 95%CI 0.93–3.98 vs OR 1.56; 95%CI 0.70–4.00) but much more strongly associated with violence in the community for women

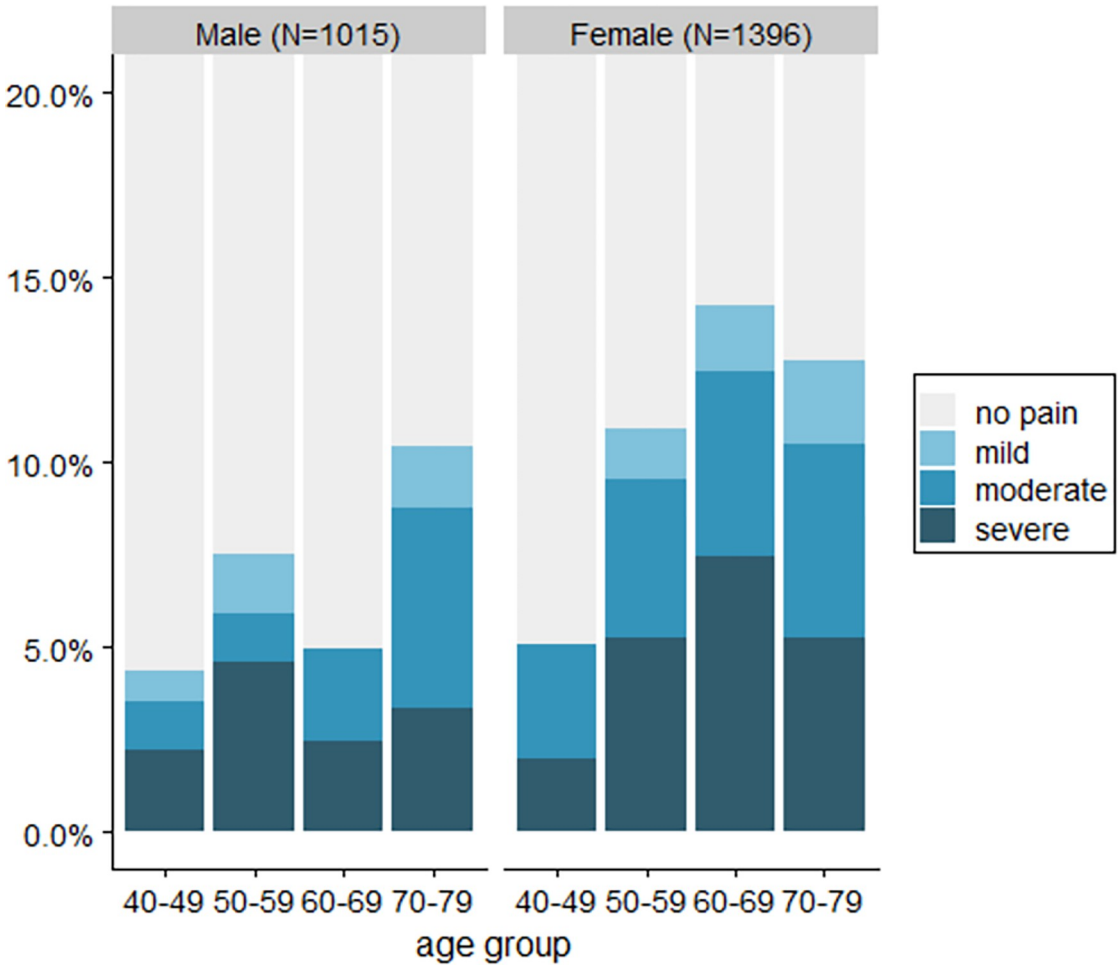

Fig 1. Proportion of respondents reporting pain intensity by sex and age.

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than men (OR 1.93; 95%CI 1.30–2.90 vs OR 1.14; 95%CI 0.64–2.12). In contrast, adverse social/family environment was markedly more strongly associated with pain for men than women (OR 1.80; 95%CI 0.77–5.31 vs OR 0.97; 95%CI 0.56–1.78).

The sensitivity analysis using four levels of pain did not give qualitatively different results from the two-level models (see S1 Table in S1 File). The quadratic TE model fit the data slightly better (AIC 1286.3 vs 1289.1 for the linear model), suggesting a possible decline in pain above eight TEs; however given the small number of individuals with such high values this inflection was highly uncertain (see S2 Fig in S1 File). The stratified analyses by country of origin showed small differences in the association between pain and TE categories, except for a weaker association with war-related events in respondents from Mozambique/other (OR 1.52 95%CI 0.91–2.47 vs OR 0.71 95%CI 0.39–1.25) (see S2 Table in S1 File).

Discussion

Among older adults (ages 40 to 79) in rural Mpumalanga, South Africa, 9% of respondents reported current pain, with higher rates at older ages and for women. Moderate/severe pain prevalence rose with increasing numbers of reported traumatic events. Exposure to illnesses, accidents and disasters (men and women), violence in the community (women) and social/

Table 2. Reported lifecourse traumatic events by item and category (N(%)).

	Items		Categories	
	Affirmative	Don't know	Any affirmative	Any don't know†
Childhood household dysfunction			1419 (58.9)	62 (2.6)
Parents unemployed more than 6 months	328 (13.6)	186 (7.7)		
Parents often argued and fought	559 (23.2)	149 (6.2)		
Parental substance use and mental disorder	585 (24.3)	107 (4.4)		
Physical abuse from parents	905 (37.5)	11 (0.5)		
Social/family environment			2119 (87.9)	2 (0.1)
Husband, wife, partner, or child addicted to drugs or alcohol	510 (21.2)	1 (0.0)		
Provided long term-care to a disabled relative/friend	512 (21.2)	0 (0.0)		
Experienced severe financial hardship	1991 (82.6)	2 (0.1)		
Violence in the community			1491 (61.8)	3 (0.1)
Sexual assault (include rape or harassment)	51 (2.1)	4 (0.2)		
Physical attack or assault	636 (26.4)	4 (0.2)		
Witnessed serious accidents or violent acts	1190 (49.4)	0 (0.0)		
Natural disaster, accident and illness			2105 (87.3)	1 (0.0)
Major fire, flood, earthquake and other natural disaster	1160 (48.1)	2 (0.1)		
Life-threatening illness or accident	1223 (50.7)	3 (0.1)		
Close friends/relatives died/at risk of death from illness/accident	1625 (67.4)	2 (0.1)		
War-related			558 (23.1)	13 (0.5)
Fired a weapon	119 (4.9)	0 (0.0)		
Witnessed serious injury or death in war	370 (15.3)	2 (0.1)		
Lost close friends or relatives in war	333 (13.8)	17 (0.7)		

Note: †"Any don't know "respondents are those with no affirmative response, but at least one "don't know" response, in a category.

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family environment problems (men) were most strongly associated with later pain. The study population has no doubt experienced political oppression and economic deprivation as children under Apartheid and one-third were civil war refugees from Mozambique, and thus a unique cohort to explore the connection between TEs and pain.

Pain prevalence in HAALSI was lower than in existing nationally representative South African studies: chronic pain was reported by 24.1% of Mpumalanga respondents in the 2016 South African Demographic and Health Survey (SADHS) [43], and by 46.6% of South Africa Stress and Health (SASH) study respondents [42]. The wide variation in pain prevalence may in part be a function of inconsistent definitions of pain and its chronicity. Both SADHS and SASH asked about a range of experiences of pain and discomfort, which might capture perceptions other than pain. HAALSI's use of the Brief Pain Inventory, comprising questions about pain sites, intensity and life interference, may have helped provide a systematic measurement of pain via visualization, rather than capturing discomfort. However, the pattern of pain prevalence seen in HAALSI was similar to that elsewhere, with women and older individuals reporting more pain [8,59].

Our findings of a positive association between cumulative TE exposure and later-life pain are consistent with prior research in both high-income settings and LMICs [42,65,66]. This association is congruent with accumulation of risk models from lifecourse theory that hypothesise the negative effects of repeated exposures [67,68]. Potential biological and psychological pathways in support of these theories have been demonstrated: a dose-response relationship (i.e., accumulation) between cumulative trauma in childhood and inflammatory

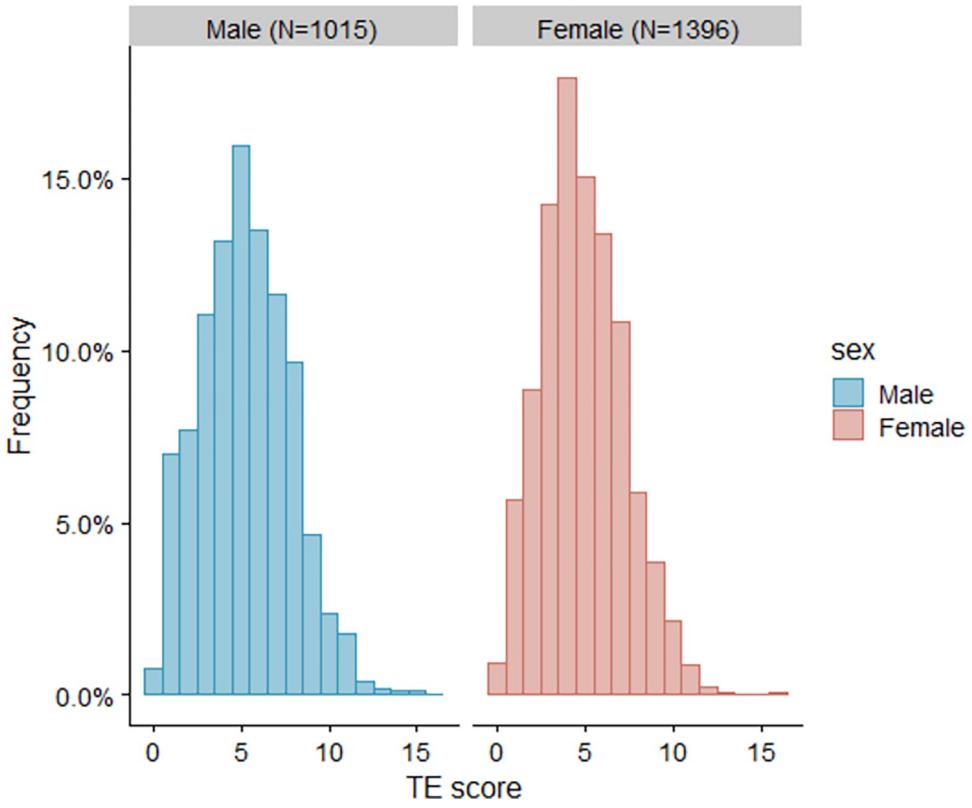

Fig 2. The distribution of traumatic events count, stratified by sex.

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biomarkers (e.g., C-reactive protein) in middle-aged UK cohorts [29,69], and more widely with mental health issues, especially PTSD among older populations [19,70]. Our quadratic sensitivity analysis suggested that more TEs beyond some substantial number may add no additional risk of pain, or even reduce it. However, the substantial uncertainty around the estimate at high number of TEs warrants caution and further exploration.

Some TEs were more strongly associated with pain than others in HAALSI. Our findings align with existing evidence that exposure to violence (first-hand or witnessed) is associated

Table 3. Logistic regressions of moderate and severe pain with exposure to TE score and TE categories.

	Bivariate analysis	Multivariable analysis		
	OR (95% CI)	AOR (95% CI)		
		Total	Female	Male
Traumatic event count	1.08 (1.02–1.15)	1.09 (1.03–1.16)	1.09 (1.01–1.18)	1.09 (0.98–1.21)
Childhood household dysfunction	0.91 (0.67–1.23)	1.00 (0.73–1.36)	0.91 (0.63–1.32)	1.26 (0.72–2.28)
Social/family environment	1.16 (0.73–1.94)	1.18 (0.74–1.97)	0.97 (0.56–1.78)	1.80 (0.77–5.31)
Violence in the community	1.49 (1.08–2.07)	1.62 (1.17–2.27)	1.93 (1.30–2.90)	1.14 (0.64–2.12)
Natural disaster, illness and accident	1.60 (0.98–2.82)	1.70 (1.01–3.05)	1.81 (0.93–3.98)	1.56 (0.70–4.00)
War-related	0.99 (0.69–1.40)	1.06 (0.71–1.57)	1.09 (0.64–1.80)	1.06 (0.56–1.93)

Note: Results are from twenty-four separate logistic regressions. Reference group in all cases is the combination of 'did not experience any TE in the category' and those with 'any don't know' answers in that TE category. Multivariable models were adjusted for age, sex, country of origin and father's occupation, except when stratified on sex (full models shown in S3-S8 Tables in S1 File). OR = odds ratio; AOR: Adjusted odds ratio; CI = confidence interval.

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with mental health conditions, somatic complaints or chronic pain in high-income settings [71–74] and LMICs [75]. Despite an abundance of literature on violence and pain, most studies have focused on psychological impacts–especially from intimate partner violence; our findings highlight that a wider range of violence types can predict physical pain. We also found stronger associations between violence and pain in females. This may reflect South African females' greater experience of domestic and sexual violence, and less criminal assault, than South African men [76,77]–when linked to evidence that sexual abuse may be most pathogenic violence to mental health and chronic pain among females [74].

The significant association seen between illnesses, accidents and disaster and later-life pain tallies with previous evidence that experiencing disasters increases risks of subsequent physical and mental health, including pain in many settings [27,78–80]. Some chronic pain may reflect physical sequelae of life-threatening injury or accident, such as fractures in earthquake survivors [78]. But traumas appraised as serious may also generate chronic pain via various mental pathways of threat experience. These include uncertainty about safety of self or loved ones [81], and negative life events such as job loss [82], social network disruption [83], displacement [84] and bereavement. Both uncertainty and negative event pathways can lead to autonomic arousal and hypervigilance, and thus PTSD and chronic pain [85]. The sudden change and aspects of loss relating to negative events are stressors for all, but the elderly can find adaption particularly hard [86].

We found social and family environment to be non-significantly associated with higher odds of later-life pain in males but not females. While the mechanism for this difference is not entirely clear, it is notable that long-term care provision (one of the three items in this category) has been found to be associated with depression, stress, chronic illness, health decline and pain [87,88]. These associations are particularly strong in households with food insecurity and low income [89], which describes much of the Agincourt population. In South Africa, male migration for work leads to a particular emphasis on women providing care for children and the ill, especially where HIV is highly prevalent [90], generating greater caregiver burden for women [91]. The stronger association between family TEs and pain in males may reflect South Africa women considering long-term caregiving as a standard duty [92], while perceive such activity as unusual, outside their gender role and thus more stressful [93].

The absence of association between pain and childhood household dysfunction was perhaps surprising given past evidence on the negative impact of household dysfunction on chronic physical conditions [35,94]. Our result may reflect attenuation due to very high prevalence of these TEs in a population who grew up in during Apartheid in a 'homeland' with very limited income and public services [95]. As a result, our TE measures may not be precise enough to capture gradations of hardship. Alternatively, unmeasured history of chronic pain in families could generate residual confounding: chronic pain clusters within families so family history of pain increases the likelihood of children reporting the same issue [96], and familial chronic pain could increase child experience of TEs from, e.g., parental substance use, marital conflict or unemployment [17,97].

Exposure to war is unusually common in HAALSI, as one-third of the sample migrated from Mozambique due to civil war. However, our findings are congruent with Atwoli et al. [42] in not finding an association between war experience and chronic pain in South Africa. One possible reason for this lack of association may be selection bias–only the more resilient or least-affected individuals who had experienced war may have survived to be recruited into this study of older adults. This argument is somewhat supported by results from models stratified by country of origin: amongst South African origin respondents, war is non-significantly associated with more pain amongst South African origin respondents, but amongst Mozambiquan origin respondents where war experience is more common, the association is reversed.

The mechanisms between exposure to TEs and pain are unlikely to be identifiable in this cross-sectional study, and we therefore did not test for potential biological or psychological mediating processes proposed by existing literature. Future studies could use mediation analysis on longitudinal HAALSI data to investigate such hypotheses. Disentangling the etiology of pain, notably whether pain is more due to biological factors like diabetes or HIV neuropathy or psychological factors like PTSD or depression, would provide insight into appropriate approaches to pain prevention and treatment in this area.

Our study had some limitations. Although TEs and later life pain status have a clear temporal ordering, the data here were collected cross-sectionally, introducing the potential for reverse causation of TE reporting, if those experiencing pain now were more careful in recalling traumatic experiences. Path analysis, often used to emphasise causality in lifecourse research, was not perform due to the absence of temporal data on traumatic events. Social desirability bias for sensitive questions, such as sexual violence experiences, can lead to an underestimate TE prevalence, but the effect on associational estimates is unclear. More general recall failure may also occur when reporting on long-past events or those centred on others, something hinted at by the higher level of "don't know" responses to TE questions on parental experiences. Unlike some other work, we could not differentiate between acute and chronic pain, since the Brief Pain Inventory evaluates severity rather than duration–although the question about 'average pain' intensity implicitly conveys chronicity. Since acute pain in Africa typically represents direct tissue injuries, such as trauma, labor, burns, or post-procedural pain [98], rather than the result of interactions between biopsychosocial factors [99,100], the association between earlier TEs and pain is more likely to reflect chronic pain than acute pain. Still, our results may contain additional imprecision if respondents were not always explicitly reporting chronic pain, indicating that further research is needed. As noted above, while similar questions relating to pain have been validated in this setting, the Brief Pain Inventory itself has not been. In-depth enquiry into cultural perceptions and manifestations of pain, and to formally validate pain measures in Shangaan and other South African Bantu languages, are important future steps. Finally, the HAALSI sample is from one rural area in western South Africa; the degree to which its results can be generalized to other settings should be carefully considered.

Conclusions

Our findings suggest that the accumulation of TEs is associated with moderate-severe pain in later life among older rural South Africans, with notably strong associations for some specific TEs. Our work highlights the need for more research on TEs and pain in LMICs, given the high prevalence of both owing to unstable political and social contexts and aging populations, and the need for longitudinal follow-up to evaluate how TEs affect pain trajectories as well as point prevalence and causal mechanisms that might be amenable to later-life intervention to prevent chronic pain in older South African adults.

Supporting information

S1 File. SUPPORTING FIGURES S1-S2 AND SUPPORTING TABLES S1-S8.
(DOCX)

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