The Impact of Life Events on Later Life: A Latent Class Analysis of the English Longitudinal Study of Ageing

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Abstract:

Objectives:

Inequalities in life events can lead to inequalities in older age. This research aimed to explore associations between life events reported by older people and quality of life (QoL) and functional ability.

Study Design:

A latent class analysis (LCA) of the English Longitudinal Study of Ageing wave 3.

Methods:

Participants were grouped according to eight life events: parental closeness, educational opportunities in childhood, financial hardship, loss of an unborn child, bereavement due to war, involvement in conflict, violence, and experiencing a natural disaster. Linear and logistic regression were used to explore associations between these groups and the main outcomes of functional ability and QoL.

Results:

7,555 participants were allocated to four LCA groups: “Few life events” (n=6,250), “Emotionally cold mother” (n=724), “Violence in combat” (n=274) and “Many life events” (n=307). Reduced QoL was reported in the “many life events” (coefficient -5.33, 95%CI -6.61 to -4.05), “emotionally cold mother” (-1.89, -2.62 to 1.15) and “violence in combat” (-1.95, -3.08 to -0.82) groups, compared to the “few life events” group. The “many life events” group also reported more difficulty with activities of daily living.

Conclusions:

Policies aimed at reducing inequalities in older age should consider events across the life course.

Background

Within society each individual lives a unique life shaped by events, experiences and their environment. Inequalities in exposures to different events over a lifetime are associated with inequalities in health trajectories[1-3]. This 'life course' perspective provides a dynamic holistic framework for considering the impact of events over or an individual's lifetime[4]. Several life course models have been proposed to explain how life events affect health, such as critical sensitive periods of emotional and physical growth during childhood altering disease risk[5] or life events having a cumulative effect overtime[6]. These distinct theories are often difficult to distinguish due to the multifaceted nature of exposures, such as socioeconomic status[7]. The Marmot review highlighted critical periods during childhood, such as school education, and proposed strategies to reduce these health inequalities, such as focusing social determinants of health interventions proportionally across the gradient of socio-economic disadvantage[8]. Adverse childhood events, such as bereavement or exposure to violence are likely to negatively affect these critical periods of childhood.

Research has identified the importance of positive interactions between a child and their primary caregiver during these formative years[9]. This theory of attachment described by Bowlby has been further associated with the development of diseases[10]. Moreover, secure attachment has been associated with the tendency to implement positive emotional adaption to chronic disease[11]. Violence has been shown to affect mental and physical health and thus subsequently an individual's social network at home[12].

A recent literature review on healthy ageing and improving health inequity highlighted causes such as adverse prenatal and early childhood events, accumulation of disadvantage, life course trajectories and the intergenerational transmission of health inequalities[13]. The results are in keeping with Grundy and colleagues who found that many life events have a negative effect, but adds that specific negative life events in isolation can also have an impact, such as an emotionally

cold mother[14]. The authors also argue that data collection should be carried out across a life course to better understand the broader determinants of healthy ageing[13].

Sutin AR. *et al,* showed that stressful life events are associated with changes in self-rated health across a ten-year time span[15]. In particular, negative turning points in the participants' lives were associated with worse outcomes in self-rated health changes when compared to more positively perceived life events[15].

To understand the effect of events over a life course, it is important to identify common events in older individuals and investigate the association with health or disease. Whilst many studies have looked at the impact of life events on later life, few have sought to identify common groups or patterns of life events. This is important because multiple life events often occur together. Sadana and colleagues recommended several areas for future research of which this article has addressed two: first, to strengthen evidence available to support the design of policies and interventions in a diverse context; and second, to learn when to intervene at critical points across a life course[13]. This study aimed to identify latent groups of older people with similar life events and explore associations between these groups and their physical, mental and social health in later life. The main outcomes were quality of life (QoL) and functional ability, because they are clinically important and objectively measurable.

Methods:

Data Source and Participants

The English Longitudinal study of Ageing (ELSA) is a longitudinal study of adults over 50 living in England[16]. This study contains information on health, functioning, social participation, and economic position[16,17]. ELSA aimed to be representative of the general population, and eight waves of data are currently available[16]. 12,099 participants were recruited from the Health Survey for England and completed the main questionnaire for wave 1. Refreshment samples consisting of people aged 50-52 were added prior to the wave 3 (2006) questionnaire (n=9,771) to replenish the younger group of study participants[17]. Wave 3 was used as a cross-sectional data source as it was the only wave in which life course data was collected[17].

Computer-assisted personal face-to-face interviews and a self-completed questionnaire are undertaken with participants every two years. Respondents in wave 3 were invited to answer a self-completion life history-based questionnaire in addition to the main face-to-face questionnaire. The study flow is shown in Figure 1.

Latent Class Analysis

Responses to eight specific questions as shown in Figure 2 were chosen to represent broad topics in life-history including: a mother figure who was emotionally cold towards me; a father figure who was emotionally cold towards me; experiencing a major fire, flood, earthquake or other natural disaster; being a victim of serious physical attack or assault; having fired a weapon in combat or been fired upon; losing a very close friend or relative in a war or military service; experiencing severe financial hardship; and the estimated number of books in their home at 10 years old.

Latent class analysis (LCA) was used to identify groups, or patterns, of life events. Within the LCA a combination of binary and categorical variables was used. Groups were generated according to the eight life-history questions above. We explored the LCA which generated two to six groups. Bayesian

Information Criterion (BIC), Akaike Information Criterion (AIC) and discussion within the research team were used to determine the most informative number of groups. Through the LCA each participant was allocated membership to specific groups of highest probability. The LCA was undertaken in Stata 15 using the LCA plug-in[18.] Baseline characteristics of each group were described and descriptors for each group were determined through discussion with the research team.

Multivariate Regression Models

Linear and logistic regression were used to explore associations between these groups and pre-specified health and wellbeing factors. The analysis was weighted by LCA probability to give greater weight to those individuals with higher probability of group membership. This regression was adjusted for age, sex, ethnicity and socioeconomic status.

Sex was defined as male or female and ethnicity was defined as white or non-white. Age was self-recorded based on the age of the participant on their last birthday prior to answering the questionnaire. Socioeconomic status was based on National Statistics Socio-Economic Classification (NS-SEC) which categorises participants by 1 being managerial and professional occupations, 2 being in intermediate occupations, and 3 being routine and manual occupations.

The main outcomes of this research were functional ability and QoL. Functional ability was the number of difficulties performing activities of daily living (ADLs). ADLs were measured based on the independent ability to carry out each of 6 activities: dressing, walking across a room, bathing or showering, eating, getting in or out of bed, using the toilet[19]. ADL scores ranged from 0 being independent to 6 being completely dependent[19]. Instrumental ADLs (iADLs) included seven activities: using a map to get to a strange place, preparing a hot meal, grocery shopping, making phone calls, taking medications, doing work around the house or garden and money management[20]. IADL scores were based on a scale of 0-7[20]. QoL was measured through CASP-19, which uses the 4 domains of control, autonomy, self-realisation and pleasure for a 19-item measurement scale which was put into percentiles[21].

Secondary outcomes were analysed including self-reported diagnosis of psychiatric problems such as anxiety, depression or manic depression which were recorded based on whether or not the patient mentioned these conditions in the questionnaire. Then those who mention anxiety, hallucinations, emotional problems, schizophrenia, psychosis, mood swings, manic depression or any other psychiatric problems were grouped together for a variable relating to experiencing any psychiatric problem variable.

Participants reported information regarding long-standing illness, social network participation, friendships, long-term illness, general health, life-threatening illness, social club membership and experiencing the long-term effect of injury which was recorded as either yes or no. General health status was self-reported as very good, good, fair, bad or very bad.

Results:

Latent Class Analysis

7,855 of the 9,771 who responded to the main questionnaire also completed the life-history questionnaire (Figure 1). A total of 7,555 answered at least one of the eight questions chosen to carry out the Latent class analysis (LCA). Comparison of model fit and discussion within the research team indicated that four groups with common life events offered the most meaningful interpretation. Table 1 shows the pattern of respondents within the four groups. The 6,250 members of group A were labelled 'few/no life events' due to the absence of many chosen life events. The 724 members of group B were labelled 'emotionally cold mother' because maternal coldness was the distinctive feature. The 274 members of group C were labelled 'violence in combat' because members were more likely to have lost someone in war or military service and had fired a weapon in combat or been fired upon. The 307 members of group D were labelled 'many life events' because those belonging to this group had several life events.

Those with many life events where characterised as having the lowest average age at 60 years and QoL whilst experiencing the highest iADL scores (Table 2). Those characterised by having experienced violence in combat had the highest mean age at 73 years, higher ADL and iADL interquartile ranges of 0 to 1 (Table 2). All groups had a similar mean socioeconomic status of 2 being intermediate occupations (Table 2).

The majority of those categorised by violence in combat were white males, with males making up 91.6% of the group (Table 2). Other groups had a female majority. Females comprised 70.0% of those within the 'emotionally cold mother' group, 56.9% of those with 'few life events' and 58.5% of those with 'many life events' (Table 2). Compared to other groups those individuals characterised into having many life events or an emotionally cold mother had a greater proportion of individuals reporting any psychiatric problem (18.2% and 12.1% respectively) (Table 2). Compared to other

groups a higher proportion of those in the 'many life events group' were likely to be detached from a social network at 40.4% (Table 2).

Regression Analysis

The main outcomes analysed were QoL and functional ability. Adjusted regression showed that, compared to the "few life events" group, those in the "emotionally cold mother" (coefficient -1.89, 95%CI -2.62 to -1.15) and "violence in combat" groups (coefficient -1.94, 95%CI -3.08 to -0.82) were significantly less likely to experience a good QoL(Table 3).

Those in the "many life events" group were 5.3 times more likely to experience a lower QoL (95%Cl -6.61 to-4.05) and also worse functional ability, with higher ADL (coefficient 0.35, 95%Cl 0.20 to 0.50) and iADL (coefficient 0.41, 95%Cl 0.27 to 0.56) scores (Table 3).

Analysis of secondary outcomes showed that, compared to the "few life events" group, the "violence in combat" group were more likely to have had a life-threatening illness/accident (OR 1.98, 95%CI 1.52 to 2.59) (Table 3). Adjusted regression analysis indicated that the "emotionally cold mother" group were more likely to report any psychiatric problems (OR 1.73, 95%CI 1.34 to 2.23), and to be detached from social networks (OR 2.60, 95%CI 1.68 to 4.04) compared to the "few life events" group (Table 3).

The "many life events" group experienced the highest increased risk from the factors analysed. Those with many life events were associated with 3-times increased risk of self-reporting any psychiatric problems (95%CI 2.18 to 4.17), a 2.6 times increased risk of being detached from social networks (95%CI 1.36 to 4.97) and were 2.22 times more likely to have self-reported long-standing illness (95%Cl 1.72 to 2.87) (Table 3).

Discussion:

Main Findings

We identified four groups of individuals all aged over 50 based on their experience similar of life events. The four groups include: few life events, an emotionally cold mother, experience of violence in combat and many life events. Those who formed the Violence in combat group had the highest mean age of 73 years old. This group may be likely to have fought in the second world war which was in 1939-1945 and during their younger years. All groups were significantly less likely to have a good QoL when compared with those with few life events. Only those with many life events were significantly more likely to have a reduced functional ability and to report the presence of a long-standing illness.

When we analysed other outcomes, those with an emotionally cold mother and those with many life events were significantly more likely to experience anxiety, psychiatric problems, and social detachment. Those who experienced violence in combat were more likely to have ever experienced a life-threatening illness or accident.

Current Knowledge

The results of this study are in keeping with the cross-sectional analysis by Archea C *et al,* which analysed 189 participants and found that negative life events in asthma patients were associated with a lower QoL especially in those with a lower income[22]. Whilst our study looked at significant events over the individual's life course, Archea C *et al* analysed the effect of events occurring over the last 12 months. QoL measurements were based on asthma-specific QoL and the study may be limited by possible overestimation due to the direct effect of life events on asthma exacerbations.

An Irish cohort study of 6,910 individuals using similar QoL measurements with CASP-19 for people aged 50 and older found that past stressful events had a significant negative association with QoL[23].

Further analysis found that childhood experiences had similar effects on QoL to those occurring in adulthood[23].

Krsteska and colleagues found poor socioeconomic conditions and poverty during childhood was linked to later life depression and reduced well-being[24]. Corroborating our study findings, Krsteska and colleagues also found a 3-fold increase in depression in those who had experienced emotional neglect and that negative maternal characteristics were associated with an increase in depression in later life[24]. However, it did not specify the type of negative characteristics and further the sample size was too small to claim significance[24].

Bowlby discussed the influence of secure attachment development between the child and their care giver[9]. Bowlby's attachment theory has been associated with a critical time period during the first few years of life and studies associate the disruption of such an emotional and physical bond to the subsequent disarray of emotional development[10]. A 13-year longitudinal study associated early maternal depression and offspring anxiety disorders[25]. Furthermore, a meta-analytical review exploring maternal depression showed its association with hostility towards the child and its subsequent negative impact on behavioural and emotional functioning[26]. They also found that maternal effects were more likely to be internalised in girls than boys[26]. This may explain the higher proportion of females grouped to have a characteristically emotionally cold mother in the LCA. These findings support the need for interventions supporting maternal-offspring relationships and the relationship of the wider family.

PTSD has been linked not only to mental ill health but also physical ill health[27, 28]. Husarewycz and colleagues identified that, in the analysis of a cohort of adults >20 years, those with combat-related trauma did not have an increased likelihood of physical health problems compared with other adults who had not taken part in combat[28]. This is contrary to our findings which identified increased odds of experiencing a life-threatening illness or accident. An explanation for this could be the difference in recruitment of the military in the UK and US. Husarewycz and colleagues discussed the selection

bias for this cohort whereby their health status is by nature preferable, as those in the US with physical health problems were withheld from deployment[27,28].

Implications for policy and research

This research has highlighted inequalities in exposure to life events which may affect physical and mental well-being in later life. Clinicians working with older people should consider the impact of life events and be aware of the life course perspective regarding older people's health and wellbeing as part of a patient-centred approach. Policy makers should take a long-term perspective when considering inequalities in health in later life and target life events which are amenable to change. For example, teaching and improving parenting skills may strengthen relationships in order prevent emotionally negative experiences. Gun and knife crime can be targeted through initiatives such as the Violence reduction unit introduced in 2005 by police in Glasgow which reduced morbidity[29]. The impact of adverse childhood events for children in health and social care is recognised, however adverse life events are rarely discussed for older people. Education around communicating the impact of life events to older people during consultations, particularly in people with a poor QoL or mental health diagnoses should be considered. If health inequalities in older age are going to be addressed, a life course perspective including adverse childhood events should be considered.

Strengths and limitations

ELSA is a dynamic longitudinal study designed to be directly comparable to the US Health and Retirement Study and the Survey of Health, Ageing and Retirement in Europe. The life course data was collected in wave 3 of ELSA. Data about past events were not collected at the time of the past event, and so there may be an element of recall bias. The conversion of continuous variables to categorical variables to measure latent class analysis may have skewed results. There is ongoing discussion on how to deal with membership grouping in the LCA[30-32]. To reduce the effect of this, error regression was weighted based on probability of being in a group. This was so that those with a higher probability of association with these life events had a greater weight to the regression

analysis. While the data was collected in 2006, the importance of the findings are not likely to have changed.

Conclusion

This study shows the association of life course events with long-term health outcomes. Experiencing many life events, maternal coldness or violence in combat was associated with reduced quality of life. Policies aimed at reducing inequalities in older age should consider events across the life course.

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ELSA data are available from the UK Data Service at http://discover.ukdataservice.ac.uk/catalogue?sn=5050 (11 Dec 2019, date last accessed).

Figure 1: Process for participants[17].

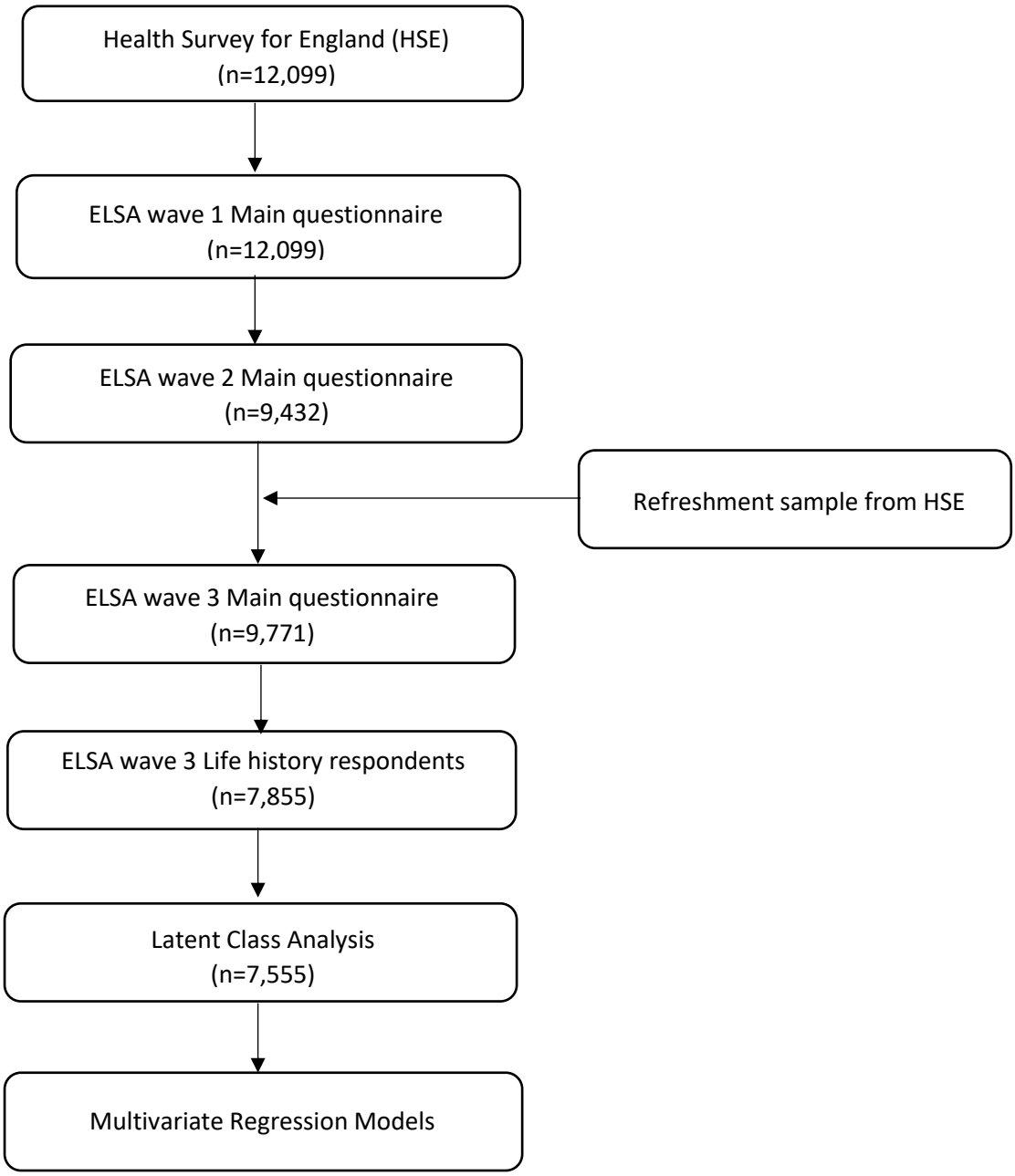

Figure 2: Eight questions from ELSA contributing to latent class analysis

1. Mother or mother figure: She seemed emotionally cold to me (Strongly agree, agree, disagree, strongly disagree)
2. Father or father figure: He seemed emotionally cold to me (Strongly agree, agree, disagree, strongly disagree)
3. Have you ever lost a very close friend in war or military service? (Yes, No)
4. Have you ever been a victim of a serious physical attack or assault? (Yes, No)
5. Have you ever fired a weapon in combat or been fired upon? (Yes, No)
6. Have you ever experienced a major fire, flood, earthquake or other natural disaster? (Yes, No)
7. Have you ever experienced severe financial hardship? (Yes, No)
8. About how many books were there in the place you lived in when you were 10? ((None or very few (0-10 books), Enough to fill one shelf (11-25 books), Enough to fill one bookcase (26-100 books), Enough to fill two bookcases (101-200 books), Enough to fill three or more bookcases (more than 200 books))

1 Table 1: Patterns of respondents across the four groups (Total=7,555)

Variable		Group A (n=6,250) "Few Life events" (n, (%))	Group B (n=724) "Emotionally cold mother" (n, (%))	Group C (n=274) Violence in combat (n, (%))	Many life events (total=307) (n, (%))
Mother cold	Agree/Strongly Agree	0 (0.0)	714(100.0)	37(14.5)	116(38.7)
	Disagree/Strongly Disagree	5,042 (100.0)	0(0.00)	218(85.5)	184(61.3)
Dad cold	Agree/Strongly Agree	471(9.6)	294(42.5)	63(24.7)	151(51.0)
	Disagree/Strongly Disagree	4,423(90.4)	398(57.5)	192(75.3)	145(49.0)
Lost someone close in war/military service	Agree/Strongly Agreed	466(9.0)	66(9.2)	190(70.1)	20(6.7)
	Disagree/Strongly Disagree	4,732(91.0)	653(90.8)	81(29.9)	280(93.3)
Victim of serious physical attack	Yes	114(2.2)	0(0.00)	56(20.9)	224(74.2)
	No	5,107(97.8)	721(100.0)	212(79.1)	78(25.8)
Ever fired weapon in combat or been fired upon	Yes	98(1.9)	10(1.4)	262(95.6)	0(0.0)
	No	5,137(98.1)	714(98.6)	12(4.4)	303(100.0)
Experienced a natural disaster	Yes	450(8.6)	49(6.8)	91(34.5)	112(37.1)
	No	4,763(91.3)	671(93.2)	173(65.5)	190(62.9)
	Yes	784(15.1)	177(24.8)	103(37.9)	242(78.8)

Experienced severe financial hardship	No	4,412(84.9)	536(75.2)	169(62.1)	65(21.2)
Number of books in home at 10 years old	0-10	1,581(25.3)	231(33.5)	95(37.9)	95(32.4)
	11-25	1,559 (24.9)	155(22.5)	66(26.3)	65(22.2)
	26-100	1,976 (31.6)	181(26.2)	62(24.7)	67(22.9)
	101-200	582(9.3)	61(8.8)	13(5.2)	45(15.4)
	>200	552 (8.8)	62(9.0)	15(6.0)	21(7.2)

1 Table 2: Baseline characteristics of participants in each group for continuous and

2 binary variables

Variable		Few Life events	Emotionally cold mother	Violence in combat	Many life events	Mean of Total
Age (mean (SD)) (mean, sd)		64(10.9)	63(10.1)	73(10.9)	60 (8.9)	64(10.9)
Socioeconomic status (mean (SD))		2(0.9)	2(0.9)	2(0.9)	2(0.9)	2(0.9)
Activities of daily living DL (median, (IQR))		0 (0,0)	0(0, 0)	0 (0, 1)	0 (0, 0)	0 (0,0)
Instrumental activities of daily living (median, (IQR)) ADL		0 (0, 0)	0 (0, 0)	0 (0, 1)	0 (0, 0)	0 (0,0)
Quality of life (mean (SD))		42(8.3)	40(9.0)	39(8.5)	37(10.3)	41(8.5)
Gender (n, (%))	Male	2780 (43.1)	218(30.0)	251 (91.6)	127 (41.5)	3376 (43.5)
	Female	3668 (56.9)	508 (70.0)	23 (8.4)	179 (58.5)	4378 (56.5)
Ethnicity (n, (%))	White	6292 (97.6)	708 (97.7)	271 (98.9)	294 (96.1)	7565 (97.6)
	Non-white	155 (2.4)	17 (2.3)	3 (1.1)	12(3.9)	187 (2.4)
Anxiety (n, (%))	No	6230 (96.3)	679 (93.4)	268 (97.8)	275(89.6)	7452 (95.8)
	Yes	238 (3.7)	48 (6.6)	6 (2.2)	32 (10.4)	324 (4.2)
Depressed or manic depression (n, (%))	No	6139 (94.9)	663 (91.2)	263 (96.0)	263 (85.7)	7328 (94.2)
	Yes	329 (5.1)	64 (8.8)	11 (4.0)	44 (14.3)	448 (5.8)
Any psychiatric problems (n, (%))	No	6018 (93.0)	639 (87.9)	260 (94.9)	251 (81.8)	7168 (92.2)
	Yes	450 (7.0)	88 (12.1)	14 (5.1)	56 (18.2)	608 (7.8)
	No	853 (79.1)	67(61.5)	29(64.4)	31 (59.6)	980 (76.3)

Detached from social network (n, (%))	Yes	225 (20.9)	42 (38.5)	16 (35.6)	21 (40.4)	304 (23.7)
Whether has any friends (n, (%))	No	233 (4.1)	41 (6.1)	23 (9.2)	25 (9.0)	322 (4.7)
	Yes	5437 (95.9)	637 (94.0)	227 (90.8)	254 (91.0)	6555 (95.3)
Self-reported long-term illness (n, (%))	No	3047 (47.3)	344 (47.5)	104 (38.0)	102 (33.3)	3597 (46.4)
	Yes	3399 (52.7)	381 (52.6)	170 (62.0)	204 (66.7)	4154 (53.6)
Self- reported general health (n, (%))	Bad/ very bad	377 (5.9)	46 (6.3)	23 (8.4)	36 (11.8)	482 (6.2)
	Very good/good/fair	6067 (94.2)	680 (93.7)	251 (91.6)	270 (88.2)	7268 (93.8)
Ever had life-threatening illness/accident (n, (%))	No	3945 (75.7)	547 (75.7)	141(53.6)	170 (57.1)	4803 (74.0)
	Yes	1264 (24.3)	176 (24.3)	122 (46.4)	128 (43.0)	1690 (26.0)
Social club member (n, (%))	No	4386 (81.1)	547 (84.2)	183 (76.6)	218 (81.3)	5334 (81.2)
	Yes	1025 (18.9)	103 (15.9)	56 (23.4)	50 (18.7)	1234 (18.8)
Long term effect of injury (n, (%))	Not mentioned	1661 (66.6)	168 (58.1)	86 (64.7)	90 (48.9)	2005 (64.7)
	Mentioned	833 (33.4)	121 (41.9)	47 (35.3)	94(51.1)	1095 (35.3)

Table 3: Regression coefficients and odds ratios for health and wellbeing factors within the 4 groups[a]

Variable	Few Life events (Reference Group)	Emotionally cold mother (95% CI)	Violence in combat (95%CI)	Many life events (95% CI)
Activities of Daily living (Coefficient)	0	0.0085 (-0.055-0.072)	0.056 (-0.063-0.17)	**0.35 (0.20-0.50)**
Instrumental Activities of Daily Living (Coefficient)	0	0.048(-0.019-0.12)	0.047 (-0.061-0.16)	**0.41 (0.27-0.56)**
Quality of life (Coefficient)	0	**-1.89 (-2.62--1.15)**	**-1.95 (-3.08- -0.82)**	**-5.33 (-6.61--4.05)**
Anxiety (OR)	0	**1.77 (1.27-2.47)**	0.94 (0.40-2.20)	**3.13 (2.08-4.70)**
Depression or manic depression (OR)	0	**1.68 (1.26-2.25)**	1.30 (0.68-2.50)	**3.19 (2.24-4.54)**
Any psychiatric problems (OR)	0	**1.73 (1.34-2.23)**	1.3 (0.71-2.25)	**3.0 (2.18-4.17)**
Whether has any friends (OR)	0	**0.59 (0.41-0.84)**	0.65 (0.41-1.05)	**0.36 (0.23-0.56)**
Social club member (OR)	0	0.85 (0.67-1.07)	1.01 (0.73-1.40)	1.09 (0.78-1.51)
Detached from social network (OR)	0	**2.60 (1.68-4.04)**	1.57 (0.79-3.13)	**2.60 (1.36-4.97)**

[a] Significance was calculated at $p<0.05$. Figure in bold represent statistically significant results.

Self-reported longstanding illness (OR)	0	1.05 (0.90-1.23)	1.11 (0.85-1.45)	**2.22 (1.72-2.87)**
Ever had a life-threatening illness/accident	0	1.07 (0.88-1.29)	**1.98 (1.52-2.60)**	**2.77 (2.16-3.57)**
Long term effect of injury e.g. ill health, difficult social life (OR)	0	**1.42 (1.10-1.84)**	1.27 (0.87-1.87)	**2.12 (1.54-2.91**)

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