Title

Depression and resilience mediate the relationship between traumatic life events and ill physical health: Results from a population study

Abbreviated Title

Traumatic life events and ill physical health

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Abstract

Resilience, depression and health behaviours have never been studied as mediators of the relationship between traumatic life events and health in a single study. We set out to investigate the mediating roles of depression, resilience, smoking, and alcohol use, in the relationship between potentially traumatic life events and objective and subjective, physical and mental health in a single study. A face-to-face, population-based survey was conducted in Hong Kong (N = 1147). Information on health conditions and traumatic life events was obtained, and participants completed measures of subjective physical and mental health, depression, and resilience. A series of mediation analyses were undertaken to determine the relationships between these variables. Smoking and drinking were not significant mediators of the relationship between life events

and both objective and subjective health. Depressive symptomatology was found to mediate the relationship between life threatening illness and subjective physical health, the relationship between abuse (physical and sexual) and subjective mental health, and the relationship between the death of a parent/partner and subjective mental health. Resilience was found to mediate the relationships between multiple traumatic life events and subjective physical and mental health. Our results indicate that psychological factors rather than biological are important mediators of the relationship between life events exposure and health. Our findings also provide evidence that depressive symptomatology and resilience have a mediating role only in the case of specific potentially traumatic life events although, resilience is only a critical factor in the face of exposure to multiple traumatic events, rather than single events.

Keywords: Trauma, life events, resilience, depression, smoking, alcohol.

Introduction

Adverse or traumatic life events such as violence, accidents and disasters are very common in the general population with the majority of adults (60.7% of men and 51.2% of women) reporting having experienced at least one event in their lifetime (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). Recent population based studies on the relationship between life events and physical health confirm a strong association and a dose-response relationship between experience of traumatic life events and physical health problems (Husarewycz, El-Gabalawy, Logsetty, &

Sareen, 2014; Karatzias, Yan & Jowett, 2015; Keyes et al, 2013; Scott et al, 2013). Previous studies have also adjusted their analyses for sociodemographics (Husarewycz, El-Gabalawy, Logsetty, & Sareen, 2014; Scott et al, 2013) and depression (Karatzias, Yan & Jowett, 2015). Furthermore, there is also evidence to suggest that there is a strong relationship between life events and subjective wellbeing and the strength of relationship strongly depends on event type (Luhmann, Hofmann, Eid, & Richard, 2012).

There has been limited research exploring the relationship between traumatic life events and objective and subjective physical health in a single study. However, this research is important because these two forms of measurement frequently do not significantly correlate with one another. For example, in combat veterans, the association between self-reported health problems and physician rated health problems has been found small to moderate in size (Beckham et al, 1998). Further evidence suggests that traumatisation affects subjective health but not necessarily objective health (Rytwinski, Avenal, Echiverri-Cohen, Zoellner, & Feeny, 2014) but such findings have never been confirmed in population based samples. Examining both subjective and objective health in a single study is important because each of these forms of measurement could provide unique information about how traumatic events can affect one's health and wellbeing.

Mediators of the relationship between traumatic life events and physical health have been predominantly investigated in non-population studies. For example, the mediating role of Posttraumatic Stress Disorder (PTSD) has been confirmed fully and partially in previous research (Taft, Vogt, Mechanic, & Resick, 2007; Spitzer et al, 2009). The chronic physiological stress that accompanies PTSD and manifests as hyperarousal symptoms has been hypothesised as responsible for increased disease risk. Depressive symptomatology has also been confirmed as mediator of the association between traumatic life events and physical health (Goméz Pérez, Abrams, López-Martínez, & Asmundson, 2012). Potential

mechanisms explaining the mediating role of depressive symptomatology in the relationship between life events and health include the glucocorticoid dysregulation hypothesis (Rohleder, Wolf, & Wolf, 2010). Furthermore, depressive symptomatology can have an indirect effect on physical health via physical inactivity, smoking or sleep disturbances (Goral, Lipsitz, Muhsen, & Gross, 2011). History of psychological trauma has also been associated with increased smoking and alcohol use resulting in poor physical health (McCarthy-Jones & McCarthy, 2014).

Resilience has also been suggested to mediate the relationship between adverse life events and mental health (Peng et al, 2012). Resilience is broadly defined as the capacity of individuals to cope flexibly with life's challenges. Resilient people are characterised by optimism, positive coping and hardiness and therefore can be more adaptive to adverse life events (Connor & Davidson, 2003). However, the mediating role of resilience in the relationship between adverse life events and physical health has never been investigated before. In addition, most previous research has investigated the mediating role of depressive symptomatology, resilience and life style factors independently and / or in relation to specific life events (e.g. McCarthy-Jones & McCarthy, 2014). We set out to investigate the mediating role of depressive symptomatology, resilience and smoking / alcohol use, in the relationship between childhood and adulthood trauma, and objective and subjective physical health, in a population based study.

Methods

Participants

Data were obtained from a household survey carried out in Hong Kong between August and December 2012 (Karatzias, Yan, & Jowett, 2015). The survey included all household members, aged 18 or above, who were of Chinese ethnicity, permanently residing in Hong Kong, able to communicate, and who consented to participate. A sample list from the Hong Kong Census & Statistics Department based on the frame of living quarters maintained by the Census and Statistics Department was obtained.

Measures

Demographics including age, gender, marital status, education, employment, and dependents (i.e. children and older adults).

Lifetime history of adverse life events

Participants were asked if they had experienced a number of adverse life events including death (parent or spouse), abuse (physical abuse by spouse, physical abuse by parent, sexual abuse, witnessed abuse), natural disaster, life threatening illness or life threatening injury, and family disruption (divorce or parent worked away).

Objective physical health

Participants were asked if they had a diagnosis of a number of conditions including hypertension, heart disease, arthritis, diabetes, eyesight degeneration, and hearing loss. The classification of physical health problems was based on the Charlson Comorbidity Index (Charlson, Pompei, Ales, & McKenzie, 1987). Further variables indicating the number of diagnoses per participant and presence of any physical health condition were created from these data.

Subjective well-being

The Short-Form 12 Health Survey was used for the assessment of subjective health (Lam, Tse, & Gandek, 2005). This 12-item measure was adapted from the original SF-36 health survey. A standard scoring algorithm has been developed in the Hong Kong Chinese population to aggregate the item scores to indicate the overall physical health (i.e., physical component score, PCS) and overall mental health (i.e., mental component score, MCS). Both PCS and MCS ranged from 0 to 100, with a higher score indicating better health status.

Depression

The shorter version of the Centre for Epidemiologic Studies Depression Scale was used for the assessment of depressive symptomatology (Boey, 1999). CES-D consists of 10 items which primarily focus on assessing affective symptoms. The response set is a 4-point Likert scale with a higher score indicating a higher level of depressive symptomatology. A cut-off score of ≥ 12 is indicative of clinical depression.

Resilience

Resilience was assessed with the Connor-Davidson Resilience Scale (CD-RISC-10; Connor & Davidson, 2003). The original CD-RISC is a 25-item scale assessing resilience during the last month, with higher scores indicating higher resilience capacity. Each item is rated on a 5-point range of responses from not true at all (0) to true nearly all time. The total score ranges from 0–100. The instrument has shown adequate internal consistency, test-retest reliability, and convergent and divergent validity. The abridged CD-RISC-10 version reflects the ability to tolerate experiences such as change, personal problems, illness, pressure, failure and painful feelings.

Alcohol/Smoking

Health behaviour measures addressing alcohol use and smoking frequencies were also assessed. Respondents reported whether they took alcohol 1) Once a day, 2) Once every other day, 3) 2-3 times per week, 4) Once a week, 5) 2-3 times per month, 6) Once a month, 7) Once every other month, 8) 2-3 times per year, and 9) Once a year. These categories were then collapsed into 'Frequently (1-4)', 'Occasionally (5-6)', and 'Rarely (7-9)'. Respondents reported whether they took cigarettes 1) Few packs per day, 2) One pack a day, 3) One pack per few days, 4) One pack a week, 5) One pack per few weeks, 6) One pack per month, 7) Few times in 6 months, and 8) Few times a year. These categories were then collapsed into 'Frequently (1-3)', 'Occasionally (4-6)', and 'Rarely (7-8)' for analysis. The categories for alcohol and smoking collapsed into slightly different frequencies; The Hong Kong Government's Centre for Health Protection (CHP) categorises "once a week" as regular drinking. In contrast, a significant number (11.8%) smoke cigarettes daily, and therefore in respect to this "occasionally" is used as a relative classification.

Statistical Analysis

Statistical descriptions and analyses were undertaken using SPSS version 22.0. To demonstrate mediation four conditions were tested (MacKinnon, Lockwood, & Hoffman, 2002). Firstly, predictors are associated with mediators; secondly, predictors are associated with outcome variables; thirdly, mediators are associated with outcome variables while controlling for predictors; and, finally, the impact of predictors is significantly less after controlling for mediators. To support these conditions, bootstrapped values for 95% confidence intervals were obtained for the proposed mediators.

Results

Demographics

Mean age was 53.2 years. A proportion of 52% were females. The majority were married (61.4%), unemployed, homemakers, or retired (53.6%) and had basic education (87.3%). A proportion of 15.3% had children under 18 years of age at home and 14% were supporting elders at home. The majority (N=737, 64.3%) reported history of at least one adverse life event. The most commonly reported life event was death of a partner or a parent (N=612, 53.4%), followed by family disruption (i.e. divorce or parent worked away from home) (N=198, 17.3%), life threatening illness or injury (N=102, 8.9%), natural disaster (N=101, 8.8%) and abuse (N=90, 7.9%). The majority reported no physical health condition (N=778, 67.8%). A proportion of 17.1% reported one condition and a percentage of 15.1% reported more than one physical condition. The most commonly reported condition was hypertension (N=268, 23.4%). SFHS-12 PCS mean score was 47.5 (Sd=9.5) and MCS was 52.7 (Sd=8.8). CES-D mean score was 0.6 (Sd=0.5).

Condition 1: Predicting variables are associated with the proposed mediators

Predictors ‘Death of parent/partner’, ‘Abuse’, ‘Natural Disaster’, ‘Life threatening illness’, ‘Family Disruption’, and ‘No. Life Events’ were regressed onto proposed mediators ‘Depressive symptomatology’, ‘Resilience’, ‘Drinking’, and ‘Smoking’ while controlling for age and gender. ‘Death of parent/partner’ was associated with ‘Depressive symptomatology’ (B=-.115, p=.003) and ‘Drinking’ (B=.138, p=.001). ‘Abuse’ was associated with ‘Depressive symptomatology’ (B=.088, p=.004). ‘Natural Disaster’ was associated with ‘Resilience’ (B=.092, p=.003). ‘Life threatening illness’ was associated with ‘Depressive symptomatology’ (B=.072, p=.023), and ‘Smoking’ (B=-.088, p=.003). ‘No. Life Events’

was associated with ‘Resilience’ (B=.126, p=.001) and ‘Smoking’ (B=-.089, p=.003). ‘Family disruption’ was not associated with any of the mediators.

Condition 2: Predicting variables are associated with the outcome variables

Predicting life event variables meeting condition 1, ‘Death of parent/partner’, ‘Abuse’, ‘Natural Disaster’, ‘Life threatening illness’ and ‘No. Life Events’, were regressed onto the health outcome variables ‘Hypertension’, ‘Heart Disease’, ‘Osteoarthritis’, ‘Diabetes’, ‘Eyesight Degeneration’, ‘Hearing loss’, ‘Subjective Physical Health’, and ‘Subjective Mental Health’, while controlling for age and gender. ‘Death of parent/partner’ was associated with ‘Subjective Mental Health’ (B=.135, p=.001). ‘Life threatening illness’ was associated with ‘Subjective Physical Health’ (B=-.179, p=.001), ‘Hypertension’ (B=.690, p=.016), ‘Heart Disease’ (B=1.495, p=.001), and ‘Eyesight Degeneration’ (B=.985, p=.006). ‘Abuse’ was associated with ‘Subjective Mental Health’ (B=-.111, p=.001). ‘No. Life Events’ was associated with ‘Heart Disease’ (B=.423, p=.003), ‘Subjective Physical Health’ (B=-.142, p=.001), and ‘Subjective Mental Health’ (B=-.572, p=.049). ‘Osteoarthritis’, ‘Diabetes’, and ‘Hearing Loss’ were not significantly associated with any life event variables.

Condition 3: Proposed mediators are associated with the outcome variables

Mediators and outcome variables meeting conditions 1-2 were then assessed for condition 3. ‘Depressive symptomatology’, ‘Resilience’, ‘Drinking’, and ‘Smoking’ were regressed onto the outcome variables ‘Subjective Physical Health’, ‘Subjective Mental Health’, ‘Hypertension’, ‘Heart Disease’, ‘Eyesight Degeneration’, and ‘Hearing loss’ while controlling for age and gender. ‘Depressive symptomatology’ was associated

with ‘Subjective Physical Health’ (B=-.199, p=.001), and ‘Subjective Mental Health’ (B=-.555, p=.001). ‘Resilience’ was associated with ‘Subjective Physical Health’ (B=.093, p=.001), and ‘Subjective Mental Health’ (B=.116, p=.001). Increased ‘Drinking’ was associated with ‘Heart Disease’ (B=1.182, p=.036). Increased ‘Smoking’ was associated with ‘Hypertension’ (B=.752, p=.010), ‘Heart Disease’ (B=1.033, p=.019), and ‘Eyesight Degeneration’ (B=.786, p=.044). The mediator ‘Drinking’ was dropped from analysis as it failed to significantly associate with both predicting and outcome variables in established relationships from condition 2.

Condition 4: The impact of the predicting variable is significantly less after controlling for the proposed mediator

Relationships meeting the preceding three conditions for mediation were assessed for strength. Life event variables were regressed onto their associated outcome variable while controlling for age and gender. The mediators previously tested for and signifying association with both predictor and outcome variables were then added into the model and the changes are observed in Table 1.

Table 1 about here

Bootstrapping

After establishing the changes in each relationship and controlling for the proposed mediators, a bootstrap analysis of the direct and indirect effects of predicting and mediating variables on the outcome variables, using PROCESS macro for SPSS (Hayes, 2013), provided clarity on the significance of these changes. Where the confidence intervals contain a .0 value, this mediator has a non-significant effect.

Inspection of confidence intervals (Table 2) revealed significant indirect effects in the following relationships:

- Depressive symptomatology mediates the relationship between 'Life threatening illness' and 'Subjective Physical Health' ($F(3, 1046) = 134.91$, $p<.001$), in that less depressive symptomatology predicts greater subjective physical health in the context of a life threatening illness.
- Depressive symptomatology mediates the relationship between 'Abuse' and 'Subjective Mental Health' ($F(3, 1041) = 6.49$, $p<.001$), in that less depressive symptomatology predicts greater subjective mental health in the context of abuse.
- Resilience mediates the relationship between 'No. Life Events' and 'Subjective Physical Health' ($F(3, 1047) = 123.40$, $p<.001$), in that higher resilience predicts greater subjective physical health in the face of multiple adverse life events.
- Resilience mediates the relationship between 'No. Life Events' and 'Subjective Mental Health' ($F(3, 1047) = 2.88$, $p.035$), in that higher resilience predicts greater subjective mental health in the face of multiple adverse life events.

Table 2 about here

Figure 1 summarises the main findings from mediation analysis.

Figure 1 about here

Discussion

We set out to investigate the mediating role of depressive symptomatology, resilience, smoking and alcohol use in the relationship between adverse life events and objective and subjective physical and mental health in a population based sample. Overall results indicate that smoking and drinking are not significant mediators of the relationship between life events and both objective and subjective health. It was found that depressive symptomatology only mediates the relationship between life threatening illness and subjective physical health and abuse and subjective mental health. Finally, it was found that resilience mediates the relationship between multiple adverse life events and subjective physical and mental health.

We were surprised by the lack of significant contribution of smoking and alcohol in the relationship between traumatic life events and health considering the proven negative effects of smoking and alcohol on physical health (McCarthy-Jones & McCarthy, 2014). However, our results indicate that psychological factors rather than biological are more important mediators of the relationship between life events exposure and health. On the other hand, these factors were rarely compared against other factors such as depressive symptomatology and resilience as mediators of this relationship, as in the present study. Our findings also provide evidence that depressive symptomatology and resilience have only a mediating role on specific events (life threatening illness and abuse) and subjective wellbeing, rather than diagnosable conditions. Again it is difficult to compare the present findings with previous literature, as objective and subjective health were rarely studied in a single study. However, there has been some previous evidence to suggest that life events affect differently objective and subjective health (Rytwinski et al, 2014).

With regard to the mediating role of depressive symptomatology, there is adequate evidence to suggest that mental health problems such as depressive symptomatology can exacerbate health conditions through a number of mechanisms including decreased adherence to recommendations, suppressed immune functioning and increased autonomic nervous system or hypothalamic-pituitary-adrenal axis activity (Husin & Triadafilopoutos, 2004). It was also quite interesting that resilience was found to be a significant mediator for multiple adverse life events and subjective physical and mental health. These results indicate that resilience is an important factor only in the face of exposure to multiple traumatic events, rather than single events. Further research is required to unravel the complex mechanisms and pathways that lead to ill physical health, particularly objective, following exposure to traumatic life events. Future research should focus on the interaction between psychological and biological factors using longitudinal designs. There are a number of limitations to our study. Firstly, our findings may be culturally biased considering that our study involved only participants from Asia. There is evidence to suggest that are cultural differences with regard to manifestation of traumatic distress as somatic symptoms (Hinton & Lewis-Fernandez, 2011). Furthermore, associations between many of the variables are bidirectional and therefore it cannot be concluded that any of the mediators we considered in the present study have a direct effect on health and wellbeing. We have also relied on retrospective account of adverse life events and in the case of historic abuse self-reports may underestimate child abuse (Hardt & Rutter, 2004). The same applies to self-report doctor diagnosed physical health conditions rather than doctor reported diagnoses. In addition, we have not examined the severity and chronicity of life events which could potentially moderate the impact on physical health (Dong, Anda, Dube, Giles, & Felitti, 2003). Furthermore, the present study lacked details on the temporal order of life events and physical health and our findings are based on an assumption that physical health followed life events. Assessment of life events were

not assessed using a validated measure, although none is available in Chinese language. Finally, we have not included a posttraumatic stress measure alongside depressive symptomatology in our tested mediational model. An integrative model has been proposed in the literature in which PTSD may be the primary pathway by which trauma leads to negative health outcomes (Schnurr & Green, 2004). Nevertheless, our study had a number of strengths including assessments of multiple types of life events and conditions, including subjective and objective physical health and multiple mediators using a population sample.

A key limitation of the study is the high number of variables investigated, as this has compromised the validity and generalisability of our findings. Conducting multiple individual analyses has increased the possibility of type I errors. Several unexpected findings have emerged, and we lack the scope to address the mechanisms for such relationships, or lack thereof, in detail. For example, smoking and drinking do not predict objective or subjective physical health, a well-documented link in previous research. This may reflect a sample bias, population characteristics, an unidentified mediator, or low statistical power. With so many variables to consider at once, it is not possible for us to confidently identify the reasons for this. This has been the cost of providing an exploration of a complicated network of variables.

Notwithstanding its limitations, our study provides evidence that the relationship between traumatic life events and physical health is far from straightforward. Our results indicate that depressive symptomatology and resilience mediate the relationship between traumatic life events and subjective, but not objective, physical and mental health.

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Table 1. The differences in relationship strength when controlling for each proposed mediator and the independent effect of each mediator in the models

Established Relationships	Initial Strength		Relationship strength when controlling for each proposed mediator						Independent effect of Depression		Independent effect of Smoking		Independent effect of Resilience	
			Controlling for 'Depression'		Controlling for 'Smoking'		Controlling for 'Resilience'							
	B	p	B	p	B	p	B	P	B	p	B	p	B	p
'Death of partner or parent' against 'Subjective Mental Health'	.106	.007*	.044	.163	-	-	-	-	-.594	.001*	-	-	-	-
'Life threatening illness' against 'Subjective Physical Health'	-.189	.001*	-.171	.001*	-.190	.001*	-	-	-.216	.001*	-.009	.744	-	-
'Life threatening illness' against 'Hypertension'	.599	.025*	.596	.026*	-.550	.041*	-	-	.044	.795	.661	.021*	-	-
'Life threatening illness' against 'Heart Disease'	1.483	.001*	-1.473	.001*	-1.424	.001*	-	-	.412	.111	1.018	.020*	-	-
'Life threatening illness' against 'Eyesight Degeneration'	.796	.015*	.802	.015*	.753	.021*	-	-	-.272	.236	.726	.059	-	-
'Abuse' against 'Subjective Mental Health'	-.118	.001*	-.069	.006*	-	-	-	-	-.592	.001*	-	-	-	-
'No. Life Events' against 'Heart Disease'	.423	.003*	-	-	.400	.005*	-	-	-	-	-.505	.019*	-	-
'No Life Events' against' Subjective Physical Health'	-.142	.001*	-	-	-	-	-.166	.001*	-	-	-	-	.183	.001*
'No. Life Events' against 'Subjective Mental Health'	-.572	.049*	-	-	-	-	-.107	.001*	-	-	-	-	.327	.001*

-: These mediators were not significantly associated with either predictor or outcome variable in relationship, and so are not applicable.

Table 2: Bootstrapping mediators

Relationship	**Mediator**	**Bootstrapping (5000)**	
		Lower 95% Confidence Interval	**Upper 95% Confidence Interval**
Death of Parent or Partner and Subjective Mental Health	Depression	.033	1.851
Life Threatening Illness and Subjective Physical Health	Depression	-1.167	-.107
	Smoking	-.071	.242
Life Threatening Illness and Hypertension	Depression	-.048	.073
	Smoking	.000	.143
Life Threatening Illness and Heart Disease	Depression	-.017	.195
	Smoking	-.001	.224
Life Threatening Illness and Eyesight Degeneration	Depression	-.151	.008
	Smoking	.000	.177
Abuse and Subjective Mental Health	Depression	-3.030	-.327
No. Life Events and Heart Disease	Smoking	.003	.075
No Life Events and Subjective Physical Health	Resilience	.116	.382
No. Life Events and Subjective Mental Health	Resilience	.212	.576

Figure 1. Mediation analysis