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Abstract

The objective of the current study was to examine whether exposure to trauma in the form of a history of physical, mental, emotional or sexual abuse or violence predicted new onset of coronary heart disease in women. In addition, this study aimed to examine the mediation effects of psychological, lifestyle and health related factors in the abuse-CHD relationship. Data from 6 surveys over 15 years, from the Australian Longitudinal Study on Women's Health, a large prospective cohort study, were used. Participants from the 1946-1951 cohort who did not self-report heart disease at surveys 1 (1996) and 2 (1998) and who had provided information on other variables were included (n=9,276). After adjusting for age, women who reported trauma exposure at baseline were 1.54 times more likely (95% confidence interval (CI), 1.29-1.83) to report new onset of CHD than those who did not report trauma exposure. The association between trauma and CHD was largely explained by psychological factors, suggesting a direct pathway between exposure to trauma and risk of CHD.

Keywords: Women, Coronary Heart Disease, Trauma exposure

Coronary heart disease (CHD) is the leading cause of death among women over the age of 60 years worldwide (WHO, 2009). In Australia, CHD was the second cause of disability-adjusted life years (DALYs) among women in 2003, just behind anxiety and depression, and the burden of the disease increased with age (Begg et al. 2007). The roles of risk factors, such as diabetes and hypertension, limited physical activity, obesity and smoking in the pathways to CHD have been well researched (Cole et al. 2011; Flint et al. 2010; Mosca et al. 2011). Menopause status was included in analyses because of the association among factors related to the development of CHD, such as hormone deprivation or replacement, and high cholesterol levels (Agrinier et al, 2010). In addition, ovarian hormones have been linked to women's responses to trauma and other stressors (Young & Korszun, 2010). Recent studies have also identified sociodemographic and psychological factors, which increase the risk of CHD (Ahto et al. 2007; Goodwin, Davidson & Keyes, 2009; Manrique-Garcia et al. 2011). There is a growing body of evidence that suggests exposure to traumatic experiences (e.g. war, assault and childhood abuse) is associated with an increased risk of CHD (Boscarino, 2008; Dong et al. 2004; Kang, Bullman & Taylor, 2006; Spitzer et al. 2009; Goodwin & Stein, 2004; Stein & Barrett-Connor, 2000). Where the traumatic event has resulted in the development of post-traumatic stress disorder (PTSD) this is independently associated with an increased risk of CHD, even after adjusting for depression and other covariates (Edmonson, Kronish, Shaffer, Falzon & Burg, 2013). However, the lifetime prevalence of PTSD is estimated to be about 7%, while the lifetime prevalence of exposure to any traumatic event is estimated to be 81% (deVries & Olf, 2009), so clearly not all exposures to trauma result in the development of PTSD. PTSD may not

be the only psychological manifestation of trauma exposure and it has been suggested that different types of trauma are associated with different forms of psychological distress, such as depression and anxiety (Harkness & Wildes, 2002; Scherrer et al, 2010). Nevertheless, few studies have examined the association between trauma and CHD in community-based samples of women, even though women are vulnerable to an array of traumatic experiences throughout their lifetime (Felitti et al. 1998; Fischer, Zink & Regan, 2011).

There are gender differences in the types of trauma experienced, responses to trauma, and in the strength of associations between trauma and CHD (Goodwin & Stein, 2004; Stein & Barrett-Connor, 2000; Pratchett, Pelcovitz & Yehuda, 2010). Women are more likely to experience adult or child sexual abuse than men, whereas men are more likely to experience non-sexual assault (Goodwin & Stein, 2004; Stein & Barrett-Connor, 2000; Pratchett, Pelcovitz & Yehuda, 2010; Tolin & Foa, 2006). In addition, the prevalence of psychological conditions, such as Post Traumatic Stress Disorder (PTSD), depression and anxiety are higher in women than men (Angst et al. 2002; Kessler, Sonnega, Bromet, Hughes, Nelson, 1995). Goodwin and Stein (2004) found that women who reported sexual abuse during childhood were 8.5 times more likely to report a cardiac outcome whereas the strength of association was only 1.7 in men. A similar pattern of results was observed in another population-based study that examined the effect of sexual abuse over the lifetime (Stein & Barrett-Connor, 2000). These differences highlight the importance of examining the association separately for men and women to avoid masking important characteristics that may be relevant in understanding the pathways to CHD.

Earlier studies on exposure to war-related trauma were based mostly on men and there is a relative paucity of studies that have focused on women. To our

knowledge, there has only been one study that examined the association between exposure to traumatic events and CHD prospectively. In that study, women who had reported five or more PTSD symptoms in response to a traumatic event experienced in the previous year had an elevated risk of experiencing subsequent adverse cardiac outcomes compared with women who did not report experiencing any PTSD symptoms (Kubzansky et al. 2009). The definition of trauma in the study was narrow, which most likely resulted in an underestimation of the association. Furthermore, PTSD may not be the only presenting symptom of traumatic exposure in women and little is understood about the effect of exposure to traumatic experiences on the risk of CHD (Chen, Dunne & Han, 2006; Chowdhary & Patel, 2008; Diaz, Simantov & Rickert, 2002; Doyle et al, 1999; Rohde et al. 2008).

Previous researchers have proposed two pathways – direct and indirect - that explain the association between exposure to traumatic events and the development of CHD (Dedert et al. 2010; Del Gaizo, Elhai & Weaver, 2011; Kibler, 2009). The direct pathway suggests that exposure to traumatic experiences induces psychological conditions, such as posttraumatic stress disorder, depression and anxiety, which have direct physiological effects that result in poorer health (Dedert et al. 2010; Kibler, 2009). This association may be accounted for by several biological mechanisms, for instance, the hypothalamic-pituitary-adrenal axis and/or the sympathetic-adrenal-medullary system (Pace & Heim, 2011). The indirect hypothesis, on the other hand, posits that exposure to traumatic experiences may lead to the development of psychological conditions which affect the risk of developing CHD through poor lifestyle behaviors, such as smoking and alcohol consumption (Kibler, 2009; Schnurr & Jankowski, 1999).

This study aims to investigate the relationship between exposure to trauma and the development of new onset CHD in women. In addition, this study will also investigate the potential mediation effect of psychological factors, lifestyle behaviors and health status in the trauma-CHD relationship.

Methods

Sample

The Australian Longitudinal Study on Women's Health (ALSWH) is a prospective study of factors affecting the health and well-being of three cohorts of women who were aged 18–23 years (1973-1978 birth cohort), 45–50 years (1946-1951 birth cohort) and 70–75 years (1921-1926 birth cohort) at the time of Survey 1 in 1996. The study sample was selected randomly from the Medicare Australia database (which covers all citizens and permanent residents of Australia), with intentional over-sampling of women living in rural and remote areas. The method of recruitment and response rates have been described elsewhere and details of the study can be found at www.alswh.org.au (Lee et al. 2005). Women participate in a postal survey every three years. The ethics committees of the University of Newcastle and the University of Queensland approved the research protocol.

Participants

Data for the current analyses were drawn from the 1946-1951 birth cohort. Women who responded 'No' to the following question: “Have you ever been told by a doctor that you have heart disease” at surveys 1 (1996) and 2 (1998) were included (N=11,919). Baseline explanatory variables were drawn from survey 2 (1998). Participants with missing data on heart disease status at any of surveys 3 (2001), 4 (2004), 5 (2007) and 6 (2010), (N=694; 6%) were excluded from the analyses. An

additional 1,991 (17%) women had missing data on one or more of the explanatory variables and their data were excluded from the analyses. The final dataset consisted of data from 9,234 women.

Measures

Outcome measure

New onset of CHD was the outcome. CHD was defined as self-reported CHD for the first time at survey 3, survey 4, survey 5 or survey 6 in response to the following question, “In the past three years, have you been diagnosed or treated for heart disease (including heart attack and angina).” Women became incident cases with their first positive response to this question.

Explanatory measures

Trauma exposure

Exposure to trauma was determined by a positive response to the following question: “Have you ever experienced any form of physical, mental, emotional or sexual abuse or violence, either as a child, in an adult relationship, or at any time?”

Psychological Factors

Depression and anxiety status were determined when women responded “Yes” to the following questions, “Have you ever been told by a doctor that you have (i) depression or (ii) anxiety”. A comorbid status variable was created by combining the depression and anxiety variables into four mutually exclusive categories based on the combinations of responses from the above questions: ‘no depression or anxiety’, ‘depression only’, ‘anxiety only’ and ‘depression and anxiety’.

Health Status

Women were asked, “Have you ever been told by a doctor that you have (i) hypertension (high blood pressure) or (ii) insulin dependent (Type 1) diabetes or non-insulin dependent (Type 2) diabetes”. Positive self-reports on either insulin-dependent or non-insulin-dependent diabetes were categorized as diabetes.

Menopausal status was determined using questions that asked whether the women had a hysterectomy and/or both ovaries removed, whether they were currently on hormone replacement therapy or taking the oral contraceptive pill, whether they had menstrual bleeding in the last 3 to 12 months and the irregularity of their bleeding. Menopausal status was categorized into 5 groups: ‘surgical menopause’ (including hysterectomy only, bilateral oophorectomy only and hysterectomy and oophorectomy), ‘hormone replacement therapy or oral contraceptive pill use’, ‘pre-menopause’, ‘peri-menopause’ and ‘post-menopause’.

Lifestyle Factors

Smoking status was categorized as ‘never-smoker’, ‘ex-smoker’ and ‘current smoker’. Never smokers included women who reported that they do not currently smoke and have smoked fewer than 100 cigarettes (or equivalent) in their lifetime. Ex-smokers included those who reported that they do not currently smoke but have smoked more than 100 cigarettes (or equivalent) in their lifetime.

Body Mass Index (BMI) was calculated based on self-reported weight (kilograms) divided by the square of reported height (meters). Categorization of BMI was based on the World Health Organization classification: Underweight/ normal range ($BMI < 25 \text{ kg/m}^2$), Overweight ($25 \text{ kg/m}^2 \leq BMI < 30 \text{ kg/m}^2$) and Obese ($BMI \geq 30 \text{ kg/m}^2$) (WHO Consultation on Obesity, 1999).

Physical activity was measured using questions that asked about frequency and duration of walking briskly (for recreation or exercise, or to get from place to

place), moderate activities (like golf, social tennis, moderate exercise classes, recreational swimming or cycling and gardening) and vigorous-intensity leisure physical activities (that make you puff and pant, like vigorous aerobics, competitive sport, vigorous cycling, running, swimming, etc.), in the past week. Women were asked to only report physical activity that lasted 10 minutes or more. A score was calculated based on the sum of products of total weekly minutes in each of the three categories of physical activity and the metabolic equivalent value (MET) assigned to each category: (walking minutes x 3.0 METs) + (moderate intensity activity minutes x 4.0 METs) + vigorous intensity activity minutes x 7.5 METs). Physical activity categories based on MET minutes per week were categorized as 'nil or sedentary' (<40 MET minutes/week) or 'active' (>=40 MET minutes/week) (Brown et al. 2008).

Sociodemographic Factors

Women were asked to provide information on their marital status, highest educational qualification, ability to manage on available income and area of residence. Marital status was categorized as: 'married or de facto', 'separated, divorced or widowed' and 'never married'. Educational level was categorized into three groups: 'no formal education', 'school or intermediate certification' and 'tertiary education'. Women's ability to manage on their available income was based on responses provided on a five-point scale. In the analyses, the responses were dichotomized: 'it is difficult some of the time', 'it is difficult all of the time', and 'it is impossible' were categorized as 'difficult'; and 'it is not too bad' and 'it is easy' were categorized as 'not difficult'. Area of residence was categorized as 'urban' or 'rural' which included areas classified as inner regional, outer regional, remote or very remote.

Statistical Analyses

All analyses were conducted using IBM SPSS software for Windows, SPSS Inc., Chicago III (version 20.0). Chi-square tests were used to examine the associations among self-reported trauma exposure and psychological factors, sociodemographic status, lifestyle behaviors and health status. Multivariate logistic regression was used to estimate the odds ratios (OR) of the relationship among psychological factors, sociodemographic factors, lifestyle behaviors and health status on trauma exposure. To evaluate whether a covariate changed the strength of association between trauma exposure and the onset of incident CHD, the percentage of change in the odds ratio for trauma exposure before and after adjustment of the potential confounder or mediator was calculated. All variables that resulted in a more than 5% change in the effect size were included in the final multivariate model. This method has been used in similar studies to determine variables which are potential confounders or mediators (Whooley et al, 2008). A likelihood ratio χ^2 test was used to assess statistical significance of the blocks. Age-adjusted ORs of the relationships between explanatory variables and new onset of CHD and 95% confidence intervals (CI) were also obtained from the regression models. A p-value of <0.05 was used to infer statistical significance.

Results

There were 3392 women (36.7%) who reported experiencing some form of physical, mental, emotional or sexual abuse or violence in their lifetime. Reports of new onset of CHD among women were 1.0% at survey 3 (N=94), 1.4% at survey 4 (N=127), 2.0% at survey 5 (N=186) and 1.8% at survey 6 (N=170). In total, there were 577 women with self-reported new onset of CHD from surveys 3 to 6. There

was no difference in the mean age of women who reported ($M=49.5$; $SD=1.4$) and did not report experiencing trauma exposure ($M=49.5$; $SD=1.5$).

The associations among trauma exposure and psychological factors, lifestyle behaviors, health status and sociodemographic factors are shown in Table 1.

Compared with women who did not report trauma exposure at baseline, women who reported trauma exposure were more likely to report depression only, anxiety only or comorbid depression and anxiety. Additionally, women who reported trauma exposure were more likely than women who did not report trauma exposure to have had a surgical menopause or be taking hormone replacement therapy or the oral contraceptive pill; be ex- or current smokers; be obese and lead a physically inactive lifestyle; have difficulty managing on income; no formal educational qualification or tertiary education; be separated/divorced/widowed or never married. There were no differences between women exposed to trauma, and those who were not, on area of residence or health conditions associated with CHD (hypertension and diabetes).

After adjustment for age, women who had experienced trauma exposure were more likely to report depression, anxiety, and comorbid depression and anxiety, to be an ex-smoker or current smoker, to have difficulty managing on their income, to be unpartnered and to live in a rural area. BMI, physical activity, diabetes and hypertension were not significantly associated with trauma exposure (Table 2).

Psychological conditions, (depression, anxiety and comorbid depression and anxiety), were the only variables that met the criterion for potential confounding or mediation with a change in effect size of -9.4% (Table 3). Diabetes, hypertension, menopause status, difficulty in managing on income, education, area of residence, smoking, BMI, exercise and marital status did not change the effect size of trauma exposure on incident CHD by more than 5%.

Table 4 illustrates the effect of trauma exposure on the development of new onset CHD. After adjusting for age, women who reported trauma exposure at baseline were 1.54 times more likely (95% confidence interval (CI), 1.29-1.83) to report new onset of CHD than those who did not report trauma exposure. After further adjustment for trauma exposure, depression only was associated with a 56% greater rate of CHD (95% CI, 1.20-2.04) and comorbid depression and anxiety was associated with a 79% greater rate of CHD (95% CI, 1.38-2.32).

Discussion

Our results indicate that exposure to trauma was associated with a higher rate of CHD in mid-aged women. This relationship was partially mediated by depression and comorbid depression and anxiety. These results add to current evidence implying possible relationships and pathways between exposure to traumatic events, such as abuse, and the development of incident CHD in non-veteran women.

The findings of this paper suggest that exposure to trauma may result in the development of depression or depression and anxiety, which directly affects the subsequent incidence of CHD. A considerable body of research has examined the relationships among depression, anxiety and heart disease, however, few of these studies has considered distal factors, such as trauma exposure, and the subsequent development of CHD. It is possible that psychological conditions may precede trauma exposure, thereby confounding the relationship between trauma and CHD.

Alternatively, psychological distress may be the result of exposure to trauma and thereby mediate the association between trauma and CHD. Regardless, comorbid depression and anxiety accounted for more than three-quarters of the association between trauma and CHD in this sample of mid-aged women. Although most previous studies examining risk factors for heart disease have investigated the effect

of either depression or anxiety, there is some evidence that co-morbid anxiety and depression better account for the risk of CHD than either disorder alone (Berecki-Gisolf et al. 2013; Goodwin, Davidson & Keyes, 2009). These findings are in contrast to those of Whooley et al (2008), who reported that the relationship between depression and cardiovascular disease was largely explained by unhealthy lifestyle behaviors (the indirect pathway).

Women who reported trauma exposure were also more likely to be smokers or ex-smokers, to have difficulty managing on their income, to be unpartnered and live in a rural area. No differences in diabetes, hypertension, BMI or physical activity were observed between women with or without trauma exposure, further strengthening the argument for a direct pathway between trauma, psychological conditions and CHD. It is possible that women who had experienced trauma under-reported these conditions, particularly since those with trauma exposure were sociodemographically disadvantaged and may not have had access to high quality preventive health care. Women who reported trauma exposure were less likely to be taking hormone replacement therapy or the oral contraceptive, or to be pre-, peri-, or post-menopausal. The association between exposure to trauma, psychological distress and smoking behavior has been consistently demonstrated across several studies (Acierno et al. 2007; Blalock et al. 2011; Leung, Gartner, Dobson, Lucke & Hall, 2011). Previous research has demonstrated mixed findings in the association between trauma and BMI (Bentley & Widom, 2009; Fuemmeler et al. 2009), with some researchers suggesting that trauma exposure may be linked to unhealthy eating behaviors as well as eating disorders, accounting for the mixed findings. Similarly, the relationship among trauma, physical activity and risk of heart disease appears to be unclear in previous studies (Kibler, 2009).

Findings from this study are consistent with the limited literature in demonstrating an association between exposure to a traumatic experience and the development of CHD in a general population of women. For example, a retrospective cohort study that examined the association between childhood trauma and physical disorders among adults in the United States found an association between sexual abuse during childhood and cardiac health in women (Goodwin & Stein, 2004). Thus, based on a nationally representative sample of mid-aged women, the current study provides further evidence supporting the association between trauma exposure and subsequent development of CHD in mid-aged women.

The main limitation of the study is that all measures were self-reported. However, previous work with this group of women has reported substantial agreement between self-report and objective measures (Burton, Brown & Dobson, 2010). Studies that have investigated the validity of self-reported health conditions have found that agreement between self-reports and medical records ranged from 53% to 94% (Bush et al. 1989; Kehoe et al. 1994). A comprehensive review of self-report and direct measures of physical activity (Prince, Adamo, Hamel, Hardt, Gorber & Tremblay, 2008) produced conflicting findings, with self-reported physical activity both higher and lower than directly measured levels of physical activity. Factors influencing the reliability and validity of reports include age, education and socioeconomic status (O'Donnell et al. 1999). Sensitivity of self-reports from women tend to be better than from men (O'Donnell et al. 1999). The prevalence of CHD observed in this study is consistent with that observed in the broader Australian population of mid-aged women (AIHW, 2011). However, we are unable to generalise our findings to women of different ages as the risk factors for CHD may differ in these groups. In particular, increasing age is associated with increased prevalence of heart disease, but the impact

of exposure to trauma in an older group remains uncertain. The use of only non-fatal CHD and the exclusion of fatal CHD for the outcome measure is another limitation of the study. Nevertheless, considering that the percentage of women who died between surveys was less than 1%, it is likely that any bias would be small.

In summary, results from this study add to the current body of evidence implicating the direct pathway from trauma exposure to the development of CHD. Future studies could utilize more sensitive measures of traumatic exposure to examine not only the impact of various types of traumatic experiences, but also the cumulative impact of trauma on the development of CHD in women, and other possible factors (i.e. social support, resilience and personality) that could moderate this relationship.

Conflict of Interest

June Lee May Ling, Deborah Loxton and Deirdre McLaughlin declare that they have no conflict of interest.

References

- Acierno, R., Lawyer, S.R., Rheingold, A., Kilpatrick, D.G., Resnick, H.S. & Saunders, B.E. (2007). Current psychopathology in previously assaulted older adults. *Journal of Interpersonal Violence*, 22(2), 250-258.
doi:10.1177/0886260506295369
- Agrinier, N., Cournot, M., Dallongeville, J., Arveiler, D., Ducimetiere, P., Ruidavets, J.B., & Ferrieres, J. (2010). Menopause and modifiable coronary heart disease risk factors: A population based study. *Maturitas*, 65, 237-243. doi: 10.1016/j.maturitas2009.11.023
- Ahto, M., Isoaho, R., Puolijoki, H., Vahlberg, T. & Kivela, S.L. (2007). Stronger symptoms of depression predict high coronary heart disease mortality in older men and women. *International Journal of Geriatric Psychiatry*, 22(8), 57-63.
doi:10.1002/gps.1735
- Angst, J., Gamma, A., Gastpar, M., Lepine, J.P., Mendlewicz, J. & Tylee, A. (2002). Gender differences in depression. Epidemiological findings from the European DEPRES I and II studies. *European Archives of Psychiatry and Clinical Neuroscience*, 252(5), 201-209. doi:10.1007/s00406-002-0381-6
- Australian Institute of Health and Welfare. (2011). Health determinants, the key to preventing chronic disease. Cat. No. PHE 157. Canberra:AIHW.
- Begg, S., Vos, T., Barker, B., Stevenson, C., Stanley, L. & Lopez, A.D. (2007). The burden of disease and injury in Australia 2003. Canberra: Australia Institute of Health and Welfare.
- Bentley, T. & Widom, C.S. (2009). A 30-year follow-up of the effects of child abuse and neglect on obesity in adulthood. *Obesity*, 17(10), 1900-1905.
doi:10.1038/oby.2009.160

- Blalock, J.A., Nayak, N., Wetter, D.W., Schreindorfer, L., Minnix, J.A., Canul, J. & Cinciripini, P.M. (2011). The relationship of childhood trauma to nicotine dependence in pregnant smokers. *Psychology of Addictive Behavior*, 25(4), 652-63. doi:10.1037/a0025529
- Boscarino, J.A. (2008). A prospective study of PTSD and early-age heart disease mortality among Vietnam veterans: implications for surveillance and prevention. *Psychosomatic Medicine*, 70(6), 668-676. doi: 10.1097/PSY.0b013e31817bccaf
- Brown, W.J., Burton, N.W., Marshall, A.L. & Miller, Y.D. (2008). Reliability and validity of a modified self-administered version of the Active Australia physical activity survey in a sample of mid-age women. *Australian and New Zealand Journal of Public Health*, 32(6), 535-41. doi:10.1111/j.1753-6405.2008.00305.x
- Burton, N.W., Brown, W.J. & Dobson, A. (2010). Accuracy of body mass index estimated from self-reported height and weight in mid-aged Australian women. *Australian and New Zealand Journal of Public Health*, 34 (6), 620-623. doi: 10.1111/j.1753-6405.2010.00618.x
- Bush, T.L., Miller, S.R., Golden, A.L. & Hale, W.E. (1989). Self-report and medical record report agreement of selected medical conditions in the elderly. *American Journal of Public Health*, 79(11), 1554-1556. doi: 10.2105/AJPH.79.11.1554
- Chen, J., Dunne, M.P. & Han, P. (2006). Child sexual abuse in Henan province, China: associations with sadness, suicidality, and risk behaviors among adolescent girls. *Journal of Adolescent Health*, 38(5), 544-549. doi.org/10.1016/j.jadohealth

- Chowdhary, N. & Patel, V. (2008). The effect of spousal violence on women's health: findings from the Stree Arogya Shodh in Goa, India. *Journal of Postgraduate Medicine*, 54(4), 306-312.
- Cole, J.A., Smith, S.M., Hart, N. & Cupples, M.E. (2011). Systematic review of the effect of diet and exercise lifestyle interventions in the secondary prevention of coronary heart disease. *Cardiology Research and Practice*, 2011, 232-351. doi.org/10.4061/2011/232351
- Dedert, E.A., Calhoun, P.S., Watkins, L.L., Sherwood, A. & Beckham, J.C. (2010). Posttraumatic stress disorder, cardiovascular, and metabolic disease: a review of the evidence. *Annals of Behavioral Medicine*, 39(1), 61-78. [10.1007/s12160-010-9165-9](https://doi.org/10.1007/s12160-010-9165-9)
- De Vries G. & Olff, M. (2009). The lifetime prevalence of traumatic events and posttraumatic stress disorder in the Netherlands. *Journal of Traumatic Stress*, 22(4), 259-267. Doi:10.1002/jts.20429
- Del Gaizo, A.L., Elhai, J.D. & Weaver, T.L. (2011). Posttraumatic stress disorder, poor physical health and substance use behaviors in a national trauma-exposed sample. *Psychiatry Research*, 188(3), 390-395. doi.org/10.1016/j.psychres.2011.03.016
- Diaz, A., Simantov, E. & Rickert, V.I. (2002). Effect of abuse on health: results of a national survey. *Archives of Pediatric and Adolescent Medicine*, 156(8), 811-817. doi:10.1001/archpedi.156.8.811.
- Dong, M., Giles, W.H., Felitti, V.J., Dube, S., Williams, J., Chapman, D. & Anda R. (2004) Insights into causal pathways for ischemic heart disease: Adverse Childhood Experiences Study. *Circulation*. 110:1761-6. doi: 10.1161/01.CIR.0000143074.54995.7F

- Doyle, J.P., Frank, E., Saltzman, L.E., McMahon, P.M. & Fielding, B.D. (1999). Domestic violence and sexual abuse in women physicians: associated medical, psychiatric, and professional difficulties. *Journal of Women's Health and Gender Based Medicine*, 8(7), 955-965. doi:10.1089/jwh.1.1999.8.955.
- Edmonson D., Kronish, I.M., Shaffer, J.A., Falzon L. & Burg, M.M. (2013). Posttraumatic stress disorder and risk for coronary heart disease: A meta-analytic review. *American Heart Journal*, 166, 806-814. Doi: 10.1016/j.ahj.2013.07.031.
- Felitti, V., Anda, R.F., Nordenberg, D., Williamson, D.F., Spitz, A.M., Edwards, V., Koss, M.P. & Marks, J.S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) study. *American Journal of Preventive Medicine*, 14, 245-258. doi.org/10.1016/S0749-3797(98)00017-8
- Fisher, B.S., Zink, T. & Regan, S.L. (2011). Abuses against older women: Prevalence and health effects. *Journal of Interpersonal Violence*, 26(2), 254-268. doi: 10.1177/0886260510362877
- Flint, A.J., Rexrode, K.M., Hu, F.B., Glynn, R.J., Caspard, H., Manson, J.E., Willett, W.C. & Rimm, E.B. (2010). Body mass index, waist circumference, and risk of coronary heart disease: a prospective study among men and women. *Obesity Research and Clinical Practice*, 4(3), e171-e181. doi:10.1016/j.orcp.2010.01.001
- Fuemmeler, B.F., Dedert, E., McClellon, F.J. & Beckham, J.C. (2009). Adverse childhood events are associated with obesity and disordered eating: results from a U.S. population-based survey of young adults. *Journal of Traumatic Stress*, 22(4), 329-333. doi:10.1002/jts.20421

- Goodwin, R.D., Davidson, K.W. & Keyes, K. (2009). Mental disorders and cardiovascular disease among adults in the United States. *Journal of Psychiatric Research*, 43, 239-246. doi.org/10.1016/j.jpsychires.2008.05.006
- Goodwin, R.D. & Stein, M.B. (2004). Association between childhood trauma and physical disorders among adults in the United States. *Psychological Medicine*, 34(3), 509-520. doi:10.1017/S003329170300134X
- Harkness, K.L. & Wildes, J.E. (2002). Childhood adversity and anxiety versus dysthymia co-morbidity in major depression. *Psychological Medicine*, 32(7), 1239-1249. doi:10.1017/s0033291702006177
- Kang, H.K., Bullman, T.A. & Taylor, J.W. (2006). Risk of selected cardiovascular diseases and posttraumatic stress disorder among former World War II prisoners of war. *Annals of Epidemiology*, 16(5), 381-386. doi: 10.1016/j.annepidem.2005.03.004
- Kehoe R, Wu SY, Leske MC, & Chylack, L.T., Jr. (1994). Comparing self-reported and physician-reported medical history. *American Journal of Epidemiology*, 139(8), 813-818.
- Kessler, R.C., Sonnega, A., Bromet, E., Hughes, M. & Nelson, C.B. (1995). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry*, 52(12), 1048-1060. doi:10.1001/archpsyc.1995.03950240066012
- Kibler, J.L. (2009). Posttraumatic stress and cardiovascular disease risk. *Journal of Traumatic Dissociation*, 10, 135-150. doi: 10.1080/15299730802624577
- Kubzansky, L.D., Koenen, K.C., Jones, C. & Eaton, W.W. (2009). A prospective study of posttraumatic stress disorder symptoms and coronary heart disease in women. *Health Psychology*, 28(1), 125-130. doi: 10.1037/0278-6133.28.1.125

- Lee, C., Dobson, A.J., Brown, W.J., Bryson, L., Byles, J., Warner-Smith, P. & Young, A.F. (2005). Cohort Profile: the Australian Longitudinal Study on Women's Health. *International Journal of Epidemiology*, 34(5), 987-991. doi: 10.1093/ije/dyi098
- Leung, J., Gartner, C., Dobson, A., Lucke, J. & Hall, W. (2011). Psychological distress is associated with tobacco smoking and quitting behaviour in the Australian population: Evidence from national cross-sectional surveys. *Australian & New Zealand Journal of Psychiatry*, 45(2), 2170-2178. doi: 10.3109/00048674.2010.534070
- Manrique-Garcia, E., Sidorchuk, A., Hallqvist, J. & Moradi, T. (2011). Socioeconomic position and incidence of acute myocardial infarction: a meta-analysis. *Journal of Epidemiology and Community Health*, 65(4), 301-309. doi:10.1136/jech.2009.104075
- Mosca, L., Benjamin, E.J., Berra, K., Bezanson, J.L., Dolor, R.J., Lloyd-Jones, D.M., ... Wenger, N.K. (2011). Effectiveness-based guidelines for the prevention of cardiovascular disease in women, - 2011 update: a guideline from the American Heart Association. *Journal of the American College of Cardiologists*, 57(12), 1404-1423. doi:10.1016/j.jacc.2011.02.005
- O'Donnell, C.J., Glynn, R.J., Field, T.S., Averbach, R., Satterfield, S., Friesenger, G.C.,.... Hennekens, C.H. (1999). Misclassification and under-reporting of acute myocardial infarction by elderly persons: implications for community-based observational studies and clinical trials. *Journal of Clinical Epidemiology*, 52(8), 745-751. doi:org/10.1016/S0895-4356(99)00054-2

- Pace, T.W. & Heim, C.M. (2011). A short review on the psychoneuroimmunology of posttraumatic stress disorder: from risk factors to medical comorbidities. *Brain, Behavior and Immunity*, 25(1), 6-13. doi.org/10.1016/j.bbi.2012.08.015
- Pratchett, L.C., Pelcovitz, M.R. & Yehuda, R. (2010). Trauma and violence: are women the weaker sex? *Psychiatric Clinics of North America*, 33(2), 465-474.
- Prince, S.A., Adamao, K.B., Hamel, M.E., Hardt, J., Gorber, S.C. & Tremblay, M. (2008). A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 5, 56. doi: 0.86/479-5868-5-56
- Rohde, P., Ichikawa, L., Simon, G.E., Ludman, E.J., Linde, J.A., Jeffery, R.W. & Operskalski, B.H. (2008). Associations of child sexual and physical abuse with obesity and depression in middle-aged women. *Child Abuse and Neglect*, 32(9), 878-887. doi:org/10.1016/j.chiabu.2007.11.004
- Scherrer, J.F., Chrusciel, T., Zeringue, A., Garfield, L.D., Hauptman, P.J., Lustman, P.J., True, W.R. (2010). Anxiety disorders increase risk for incident myocardial infarction in depressed and nondepressed Veterans Administration patients', *American Heart Journal*, 159(5), 772-779.
- Schnurr, P.P. & Jankowski, M.K. (1999). Physical health and post-traumatic stress disorder: review and synthesis. *Seminars in Clinical Neuropsychiatry*, 4(4), 295-304.
- Spitzer, C., Barnow, S., Volzke, H., John, U., Freyberger, H.J. & Grabe, H.J. (2009). Trauma, posttraumatic stress disorder, and physical illness: findings from the general population. *Psychosomatic Medicine*, 71(9), 1012-1017. doi: 10.1097/PSY.0b013e3181bc76b5

- Stein, M.B. & Barrett-Connor, E. (2000). Sexual assault and physical health: findings from a population-based study of older adults. *Psychosomatic Medicine*, 62(6), 838-843.
- Tolin, D.F. & Foa, E.B. (2006). Sex differences in trauma and posttraumatic stress disorder: a quantitative review of 25 years of research. *Psychological Bulletin*, 132(6), 959-992. doi: 10.1037/0033-2909.132.6.959
- WHO Consultation on Obesity. (1999). Obesity: Preventing and managing the global epidemic. WHO Technical Report Series 894. Geneva:World Health Organization.
- Whooley, M.A., de Jonge, P., Vittinghoff, E., Otte, C., Moos, R., Carney, R.M.....Browner, W.A. (2008). Depressive symptoms, health behaviors and risk of cardiovascular events in patients with coronary heart disease. *JAMA*, 300 (20), 2379-2388. doi:10.1001/jama.2008.711
- World Health Organization. (2009). Women and health: Today's evidence tomorrow's agenda. Geneva: World Health Organization.
- Young, E., & Korszun, A. (2010). Sex, trauma, stress hormones and depression. *Molecular Psychiatry*, 15, 23-28. doi:10.1038/mp.2009.94

Table 1. Association among trauma exposure and psychological, health status, lifestyle and sociodemographic variables

Variables	No trauma (N=5842)		Trauma (N=3392)		p-value
	N	%	N	%	
Psychological					<0.001
No depression or anxiety	4966	85.0	2286	67.4	
Depression only	374	6.4	432	12.7	
Anxiety only	240	4.1	197	5.8	
Comorbid depression and anxiety	262	4.5	477	14.1	
Diabetes	134	2.3	95	2.8	0.131
Hypertension	1007	17.2	628	18.5	0.121
Menopause Status					<0.001
Surgical menopause	1341	23.0	1036	30.5	
HRT or OCP ^a	919	15.7	549	16.2	
Pre-menopause	1466	25.1	710	20.9	
Peri-menopause	1468	25.1	766	22.6	
Post-menopause	648	11.1	331	9.8	
Smoking					<0.001
Never smoker	3617	61.9	1642	48.4	
Ex-smoker	1457	24.9	1020	30.1	
Current smoker	768	13.1	730	21.5	
BMI					0.030
Underweight/normal range	2919	50.0	1639	48.3	
Overweight	1835	31.4	1045	30.8	
Obese	1088	18.6	708	20.9	
Exercise Group					0.001
Nil/sedentary	940	16.1	638	18.8	
Active	4902	83.9	2754	81.2	
Difficulty managing income	2150	36.8	1792	52.8	<0.001
Education					<0.001
No formal education	822	14.1	601	17.7	
School certificate	1938	33.2	993	29.3	
Higher school certificate	1053	18.0	525	15.5	
Tertiary education	2029	34.7	1273	37.5	
Marital Status					<0.001
Married/ de facto	5215	89.3	2495	73.6	
Separated/divorced/widowed	472	8.1	755	22.3	
Never married	155	2.7	142	4.2	
Area of residence					0.165
Urban	1937	33.2	1077	31.8	
Rural	3905	66.8	2315	68.2	

^aHRT=Hormone replacement therapy, OCP=Oral contraceptive pill

Table 2. Adjusted odds ratios (OR) and 95% confidence interval (CI) of psychological, lifestyle and health status on trauma exposure

Variables	OR*	95%CI	p-value
Psychological			
No depression or anxiety		Reference	
Depression only	2.12	1.82-2.48	<0.001
Anxiety only	1.69	1.38-2.07	<0.001
Comorbid depression and anxiety	3.27	2.77-3.86	<0.001
Diabetes			
No		Reference	
Yes	1.06	0.80-1.42	0.673
Hypertension			
No		Reference	
Yes	0.96	0.85-1.09	0.546
Menopause Status			
Surgical menopause		Reference	
HRT or OCP ^a	0.75	0.65-0.87	<0.001
Pre-menopause	0.71	0.62-0.81	<0.001
Peri-menopause	0.73	0.64-0.83	<0.001
Post-menopause	0.69	0.58-0.81	<0.001
Smoking			
Never smoker		Reference	
Ex-smoker	1.53	1.38-1.70	<0.001
Current smoker	1.76	1.56-2.00	<0.001
BMI			
Underweight/normal range		Reference	
Overweight	1.00	0.90-1.10	0.913
Obese	1.04	0.91-1.17	0.594
Exercise Group			
Active		Reference	
Nil Sedentary	1.10	0.97-1.23	0.144
Manage on Income			
Not Difficult		Reference	
Difficult	1.56	1.42-1.71	<0.001
Education			
No formal education		Reference	
School certificate	0.81	0.70-0.93	0.003
Higher school certificate	0.79	0.68-0.93	0.004
Tertiary education	1.05	0.91-1.20	0.524
Marital Status			
Married/ de facto		Reference	
Separated/divorced/widowed	2.77	2.42-3.16	<0.001
Never married	1.69	1.32-2.16	<0.001
Area of residence			

	Urban		Reference	
	Rural	1.11	1.00-1.22	0.041

* Adjusted for age; ^aHRT=Hormone replacement therapy, OCP=Oral contraceptive pill

Table 3. Change in the strength of association between trauma exposure at baseline and new onset of CHD (expressed as the percent change in the age-adjusted odds ratio), after adjustment for potential confounders and mediators

Covariate	Change in effect size after adjustment, %
Psychological	-9.4
Diabetes	-0.6
Hypertension	-0.8
Menopause	-3.1
Smoking	-3.2
BMI	-1.5
Exercise	-0.8
Difficulty in managing income	-3.5
Education	-0.1
Marital Status	-2.5
Area of residence	-0.1

Table 4. Final model* of the association between trauma exposure at baseline and new onset of CHD

Variables		OR	95% CI	p-value
Trauma exposure	No		Reference	
	Yes	1.54	1.29-1.83	<0.001
Psychological	No depression and anxiety		Reference	
	Depression only	1.56	1.20-2.04	0.001
	Anxiety only	1.16	0.78-1.72	0.456
	Depression and anxiety	1.79	1.38-2.32	<0.001

* Adjusted for age