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Prospective study of early bereavement on psychological and behavioural cardiac risk factors

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Abstract

Background: Increasing evidence supports the role of emotional stress in the onset of cardiovascular disease. Although bereavement is a major emotional stress with both acute and more long-term features, the mechanism of its association with cardiovascular risk is not well understood, in particular because of limited studies of acute bereavement. The aim of the study was to identify psychological and behavioural changes in acute bereavement and potential modifiers of these changes.

Methods: Bereaved (n = 62) and non-bereaved individuals (n = 50) were evaluated within 2 weeks and at 6 months following loss using the Centre for Epidemiologic Studies – Depression, Spielberger State Anxiety and Anger, Social Support Questionnaire and changes in appetite, cigarette and alcohol consumption, cortisol and lipids.

Results: Compared with non-bereaved, acutely bereaved had increased symptoms of depression (26.7 ± 1.7 vs 5.9 ± 0.7, $P < 0.001$), anxiety (47.4 ± 2.0 vs 28.2 ± 1.4, $P < 0.001$) and anger (median 16.0 vs 15.0, $P < 0.001$). Greater depressive symptoms were associated with being unprepared for the death, decreased sleep duration and younger age. Acutely, bereaved slept less than non-bereaved (5.8 ± 0.2 vs 7.2 ± 0.2 h, $P < 0.001$). Reduced sleep time was associated with increased anger and depression and decreased satisfaction with social support. Compared with the non-bereaved, the acutely bereaved had higher cortisol (median 306 vs 266, $P = 0.003$), reduced appetite ($P < 0.001$) and lower total cholesterol (median 4.9 vs 5.4, $P = 0.006$) and low-density lipoprotein (median 2.4 vs 2.9, $P < 0.001$).

Conclusion: These results offer insight into the psychological, behavioural and physical changes that may contribute to cardiovascular risk in bereavement.

Introduction

Emotional stress has long been associated with myocardial infarction (MI) and sudden cardiac death. Although significant associations have primarily been observed in long-term studies of depression and anxiety, there is increased acceptance of an additional role of acute psychological factors in the onset of MI, sudden cardiac death and stroke.[1,2] In the Multicenter Investigation of the Limitation of Infarct Size, emotional upset was reported as a potential trigger of MI by 18% of the subjects, whereas lack of sleep was also reported in 8% of subjects.[3] Using the case-crossover study design, 2.4% of patients in one study reported anger in the 2-h period before MI, associated with a relative risk of 4.0 compared with the same 2-h period the day before MI.[4]

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The relationship between acute anger episodes was also confirmed in two other studies, where the relative risk was ninefold for anger as a trigger and 14-fold for anger triggering stroke in the subsequent 2 h.[5,6] Anxiety has also been associated with a transient doubling of cardiac risk[4] whereas a high-pressure work deadline with negative emotional impact has been associated with a sixfold increase in relative risk of MI.[7] Emotional stress following earthquakes, wartime missile attacks, and some sporting events, has also been linked to acute increases in cardiac risk.[8–10]

The death of a loved one is recognized as one of life's greatest stresses requiring significant psychological adjustment.[11–13] Bereavement, which is associated with both acute and more long-term features, can be particularly devastating for the surviving spouse, who is often required to deal with simultaneous disruption to living arrangements, financial security and social status.[12] Increased morbidity and mortality have been reported among bereaved, most notably in surviving spouses and parents.[14–17] Bereavement has been associated with increased physician visits,[18] poorer physical health[19] and increased cardiovascular and stroke risk.[20] Coronary heart events appear to account for a substantial amount of the increased deaths during spousal bereavement, ranging from between 20 and 53% of excess deaths.[20–23] In one study, the death of a significant other increased the relative risk of non-fatal myocardial infarction by up to 14-fold in the first day that slowly reduced to 4.8-fold at 1 month following bereavement.[24]

Across all age groups, and both sexes, the risk appears greatest in the immediate weeks following loss, but remains significantly increased during the first 6 months.[15,17,19,20,22,23,25,26] Despite the consistent findings of increased health risk, the mechanism for the increased risk in early bereavement is not fully understood, due in part to a lack of studies in the immediate weeks of bereavement and limitations of retrospective data collection.

The aim of this study was to provide insight into the mechanism of the increased cardiovascular risk early in bereavement, by prospectively evaluating psychological distress (depression, anxiety and anger), behavioural changes (sleep, appetite, smoking and alcohol consumption) and physical assessment (body mass index, waist circumference, cortisol and cholesterol) in bereaved spouses and parents.

Methods

Study design

Bereaved participants were recruited from the critical care units of five hospitals in the Sydney metropolitan area participating in the Cardiovascular Health in Bereavement study. Between February 2005 and July 2007, 62 bereaved participants (58 spouses and 4 parents) were studied within 2 weeks of bereavement and again at 6 months. Bereaved participants were compared to 50 non-bereaved relatives of patients who used the same hospitals as the bereaved. The study protocol was approved by the Institutional Human Ethic Committee for the Area Health Service and conformed to the principles outlined in the Declaration of Helsinki.

Study participants

Bereaved

All identified bereaved spouses or parents of deceased patients who met eligibility criteria at the participating institutions were contacted by a social worker or study investigator in person at the hospital or by telephone within the first 72 h following bereavement. Interested participants received a study information sheet and an appointment was made to conduct the assessment in the participant's home during the first 2 weeks of bereavement (average day 11, range 3–15). Of those who met inclusion criteria, 60% agreed to participate. Half of the refusals were from bereaved spouses, whereas the others were from family members who requested that the researchers not approach the bereaved spouse or parent.

Non-bereaved

Participants comprised family members of hospital patients, recruited from areas such as day surgery, orthopaedic or endoscopy clinics from the same hospitals as the bereaved. The initial assessment of non-bereaved participants was approximately 1 month following the hospital discharge of their family member. This non-bereaved group was recruited to represent a sample of hospital users who were less likely to be experiencing significant stress related to their family member's admission.

Exclusion criteria

Bereaved and non-bereaved participants were excluded if they had the following conditions: active malignancy, severe illness (respiratory, heart, liver and renal failure), history of coagulopathy, cognitive impairment, psychotic illness, or immunosuppressive illness, and those taking immunosuppressive drugs, residents in nursing homes or unable to speak or read English. In addition, for the non-bereaved, we excluded persons who had experienced the death of a close family member or friend in the

past 2 years. Of the bereaved, only one had experienced a second close bereavement in the 2 years before enrolment.

Study protocol

All participants lived within 60 min driving time from the hospital to allow standardization of blood collection and transport time to the laboratory. Two bereaved participants withdrew from the study before the 6-month assessment and one bereaved participant died before the final assessment from multiorgan failure following an admission for dyspnoea. One non-bereaved withdrew after the first assessment.

Participants completed a sociodemographic, medical history and lifestyle questionnaire documenting eating and sleeping patterns and a 24-h activity diary documenting physical activity, time to bed and awakening. To quantify the availability of, and satisfaction with social support, participants completed the Social Support Questionnaire (SSQ-6).[27–29] All participants completed the Centre for Epidemiological Studies-Depression (CES-D) questionnaire at both acute and 6-month assessments.[28]A score of 16 or more is considered to be indicative of clinically significant levels of depression.[30] Participants also completed the Spielberger State Anxiety and Anger scales questionnaire at both acute and 6-month assessments.[31,32]

Venous blood samples were taken from the antecubital fossa in the morning. The mean transport time from collection to laboratory delivery was 40 min (range 10–60 min). To minimize disturbance to participants, those who could not remain fasting pre-assessment were asked to have a light breakfast. A light breakfast was defined as having a cup of tea or coffee and toast only. There was no difference between bereaved and non-bereaved in those fasting before assessment (45 vs 52%, $P = 0.24$). Analyses were conducted at the study site hospital using standard laboratory techniques by staff blinded to study outcomes and participant group.

Statistical analysis

Sociodemographic data are reported as raw data and psychological scores as mean ± standard error of mean. The primary analysis involved comparison of bereaved to non-bereaved participants at the acute assessment. Differences between groups were analysed using the Student's *t*-test for interval data and χ^2-test for categorical data. Skewed data unsuccessfully transformed using log transformation were analysed using the Mann–Whitney *U*-test. Changes across time for the acute assessment to 6 months in the bereaved participants were tested using paired analysis techniques (paired *t*-test or McNemar test as appropriate). Wilcoxon test was used to compare dichotomous variables from acute to 6 months.

To determine predictors of increased risk factors, linear stepwise regression was carried out by entering the significant univariate independent variables using an *F*-value probability from inclusion of 0.05 and 0.01 for removal. Data were analysed using SPSS version 14.0 for Windows (SPSS, Chicago, IL, USA).

Results

The average age of bereaved participants was 65.2 years (range 33–84 years). Women comprised 68% of the bereaved in keeping with the fact that women live longer.[33] The vast majority (94%) were spouses or partners' of the deceased whereas four (6%) were parents. Bereaved parents were older than spouses (67.7 vs 63.4 years) and consisted of two men and women. For bereaved spouses, the number of years together as a couple ranged from 3 to 62 years (mean 37.1 years). Despite the deaths occurring in the critical care environment, 76% reported that for them, the death was 'unexpected'. The median time from diagnosis of the condition that led to the death was 13 days. The mean number of available support persons reported on the SSQ-6 was 4.5. After the death of their loved one, 55% were living alone at the time of initial assessment.

The bereaved and non-bereaved participants did not differ in sociodemographics, available support persons or satisfaction with that support as shown by responses to the SSQ-6 (Table 1). The bereaved were more likely to be living alone at the time of the first assessment than the non-bereaved ($P = 0.001$), as expected in a sample comprising mainly of bereaved spouses.

Psychological risk factor assessment

Depression, anxiety and anger symptoms were all increased acutely in the bereaved compared with non-bereaved (Table 2). Although depression and anxiety symptoms reduced over time in the bereavement group ($P < 0.001$), they remained increased at 6 months. Acutely, 84% of bereaved reported depressive symptoms higher than the recognized cut-off point for clinically significant depression (16 on the CES-D), compared with 61% at the 6-month assessment. Anxiety symptoms higher than the recognized cut-off point for clinical significance (30 on the Spielberger State Anxiety) were reported by 82% of the acutely bereaved compared with 53% at 6 months. Bereaved participants also had increased anger scores in the first 2 weeks that were reduced at 6 months ($P = 0.001$). In the non-bereaved, there were no differences in depression, anxiety or anger

Table 1 Sociodemographic characteristics and clinical history measured in participants recently bereaved compared to non-bereaved family members of hospital patients

	Bereaved ($n = 62$) Number, *n*	Non-bereaved ($n = 50$) Number, *n*	*P**
Age in years mean (range)	65.2 (33–84)	61.6 (36–87)	0.14
Female (%)	42 (68)	32 (64)	0.41
Living alone (at time of assessment) (%)	34 (55)	5 (10)	<0.001
History of myocardial infarction or angina (%)	10 (16)	4 (8)	0.42
History of diabetes (%)	4 (6)	4 (8)	0.36
History of stroke (%)	5 (8)	3 (6)	0.60
History of chronic sleep problems (snoring or sleep apnoea) (%)	9 (14)	8 (16)	0.60
Cholesterol-lowering drugs (%)	18 (29)	12 (24)	0.54
Aspirin (%)	14 (22)	10 (20)	0.46
Antidepressant drugs (%)	2 (3)	3 (6)	0.40
Social support availability mean (SE)	4.5 (0.3)	3.9 (0.21)	0.21
(SSQ-6) possible range 0–9	Range 1–9	Range 0.1–9	
Social support satisfaction mean (SE)	5.2 (0.1)	5.0 (0.2)	0.39
(SSQ-6) possible range 1–6	Range 1–6	Range1–6	

*The *t*-test for interval data and χ^2 for categorical data. SE, standard error of mean; SSQ, Social Support Questionnaire.

between the first assessment and 6 months. Multiple regression analysis showed that being less prepared for the death ($r = 0.40$, $P = 0.001$), having reduced sleep time ($r = 0.32$, $P = 0.009$) and being younger ($r = 0.28$, $P = 0.05$) were independent predictors of higher depression symptoms acutely (Table 3).

Behavioural assessment

Sleep duration

Acutely, the bereaved reported sleeping fewer hours than non-bereaved ($P < 0.001$) and 56% of bereaved reported that this sleep time was 'less than usual' (Table 2). At 6 months only 14% reported that their sleep was less than usual ($P < 0.001$). Despite the differences in duration of sleep acutely, the bereaved and non-bereaved groups did not differ in time spent in bed at night as recorded in diaries (7.5 ± 1.7 vs 8.0 ± 1.1 h, $P = 0.31$). Multiple regression analysis showed that lower satisfaction with social support ($r = 0.28$, $P = 0.01$) was an independent predictor of lower sleep time acutely (Table 3).

Appetite, alcohol consumption and smoking

Compared with non-bereaved, bereaved at the initial acute assessment were more likely to report feeling less

Table 2 Symptoms of depression, anxiety and anger and sleep behaviours

Variable	Bereaved (B)		Non-bereaved (NB)	*P*	*P*
	Acute ($n = 62$)	6 months ($n = 58$)	$n = 50$	B vs NB acute	B acute to 6 months
Depression mean (SE) (possible range 0–60)	26.7 (1.7)	16.8 (6.2)	5.9 (0.7)	<0.001	<0.001
Anxiety mean (SE) (possible range 20–80)	47.4 (2.0)	37.2 (2.1)	28.2 (1.4)	<0.001	<0.001
Anger median (IQR) (possible range 15–60)	16.0 (16.0–37.0)	15.0 (15.0–16.0)	15.0 (15.0–15.0)†	<0.001	0.001
Mean sleep hours per night in the past week mean (SE)	5.88 (0.21)	6.77 (0.16)	7.22 (0.16)	<0.001	<0.001
More then usual sleep (%)	6 (10)	5 (9)	3 (6)	0.36	0.73
Less than usual sleep (%)	35 (56)	8 (14)	3 (5)	<0.001	<0.001
Awakening or insomnia (%)	46 (74)	33 (57)	32 (64)	0.17	0.004

†Non-bereaved (88%) reported a score of 15, therefore no IQR. IQR, interquartile range; SE, standard error of mean.

Table 3 Univariate and multivariate predictors of reduced sleep and depression scores at the acute assessment

Dependent variable	Independent variable	Standardized beta	Confidence interval for B	*P**	*P***
Sleep time	SSQ-6 satisfaction	–0.305	–0.741 to –0.091	0.03	0.01
	CES-D (depression)	–0.328	–0.741 to –0.091	0.009	0.15
	Anger	–0.321	–0.171 to –0.021	0.01	0.13
CES-D	Age	–0.28	–0.51 to –0.5	0.02	0.05
	How prepared for the death	–0.40	–0.71 to –0.95	0.001	0.01
	Living alone, 1 = yes, 2 = no	0.36	2.86 to 14.43	0.004	0.27
	Sleep time (acute assessment)	–3.28	–4.16 to –0.61	0.009	0.01

**P*-values represent univariate analysis, ***P*-values represent multivariate analysis.
CES-D, Centre for Epidemiologic Studies – Depression; SSQ, Social Support Questionnaire.

Table 4 Assessment of appetite, alcohol and smoking behaviours

Variable	Response	Bereaved (B)		Non-bereaved (NB)	*P*-values	
		Acute *n* (%)	6-months *n* (%)	*n* (%)	B vs NB acute	B acute to 6 months
In the past week: have you been hungry?	Yes	12 (19)	30 (52)	29 (58)	<0.001	<0.001
In the past week: have you been eating less?	Yes	39 (63)	14 (24)	2 (4)	<0.001	<0.001
In the past week: have you been eating more	Yes	5 (8)	8 (14)	4 (8)	0.635	0.14
Do you currently drink alcohol	Yes	42 (68)	37 (64)	44 (88)	0.01	0.14
If you currently drink, in the past week: has your alcohol consumption changed	Yes	20 (48)	9 (21)	2 (5)	<0.001	0.006
Increased		12 (60)	3 (33)	1 (50)	0.003	0.03
Mean number of standard drinks per week (SE)		8.1 (1.8)	8.2 (1.8)	8.9 (1.2)	0.72	0.18
Episodes of binge drinking in the past week	Yes	4 (6%)	2 (3%)	1 (2%)	0.24	0.48
Do you currently smoke	Yes	5 (8)	5 (12)	4	0.63	0.42
If you currently smoke, in the past week: has your smoking changed	Yes	3 (60)	1 (20)	0	NA	NA
Increased		2 (67)	0 (0)	0 (0)	NA	NA
Mean number of cigarettes smoked daily (SE)		16.8 (3.8)	16.4 (3.4)	10.75 (5.2)	0.38	0.25

NA, numbers insufficient for valid analysis; SE, standard error of mean.

hungry and eating less than usual in the week before the assessment (Table 4). There was no change in the number of standard drinks consumed weekly between bereaved and non-bereaved participants acutely or in bereaved from acute to 6-month assessment (Table 4). Although fewer bereaved reported drinking alcohol at the initial assessment compared with non-bereaved (68 vs 88%), those who did drink were more likely to report a change in alcohol consumption at the initial acute assessment. For those who reported a change, there was no consistent direction, in that 60% reported an increase in consumption and 40% a decrease. However, men in the bereaved group were more likely than women to report increased alcohol intake (35% of men vs 12% of women ($P = 0.04$)). Men also reported drinking more standard drinks weekly than women (13.2 ± 4.1 vs 5.0 ± 1.2, $P = 0.02$) at the acute assessment. There was no difference in number of standard drinks consumed between men and women in the non-bereaved group.

Only five bereaved reported cigarette smoking at the acute assessment. This low number was also seen in the non-bereaved group (Table 4). There was no difference in the number of cigarettes smoked acutely compared with the non-bereaved group and this did not change over time in the bereaved participants.

Physical assessment

There were no differences between bereaved and non-bereaved in BMI and waist circumference at the initial acute assessment. BMI or waist circumference did not change in the bereaved group from the acute assessment to 6 months (BMI 26.2 ± 0.7 vs 26.6 ± 0.7, $P = 0.33$; waist circumference (cm) 92.7 ± 1.7 vs 93.9, $P = 0.52$).

Cortisol and lipid measures

The morning cortisol levels were higher in bereaved participants compared with non-bereaved participants acutely ($P = 0.006$) and had not reduced by 6 months (Table 5). Bereaved participants had lower acute levels of total cholesterol than non-bereaved ($P = 0.006$). The

Table 5 Assessment of cortisol and lipids

Variable	Bereaved (B)		Non-bereaved (NB)	*P*-values	
	Acute $n = 62$	6 months $n = 58$	$n = 50$	*P* B vs NB acute	*P* B acute to 6 months
Cortisol (mmol/L) median (IQR)	306 (247–414)	326 (236–390)	266 (220–338)	0.003	0.64
Total cholesterol mmol/L median (IQR)	4.92 (4.36–5.45)	5.16 (4.40–5.79)	5.44 (4.68–6.09)	0.006	0.01
LDL mmol/L median (IQR)	2.41 (1.8–3.89)	2.74 (2.05–3.21)	2.94 (2.52–3.77)	<0.001	0.003
HDL mmol/L mean (SE)	1.82 (0.06)	1.75 (0.06)	1.69 (0.06)	0.15	0.04
Triglycerides mmol/L median (IQR)	1.18 (0.90–2.81)	1.18 (0.95–1.84)	1.20 (0.86–1.68)	0.75	0.65

Median scores presented with IQR. HDL, high-density lipoprotein; IQR, inter quartile range; LDL, low-density lipoprotein; SE, standard error of mean.

levels increased from acute to 6 months (P = 0.01). Bereaved also had lower low-density lipoprotein (LDL) levels than non-bereaved (P < 0.001) and these levels were higher at the 6-month assessment compared with acutely (P = 0.003). There were no differences in high-density lipoprotein (HDL) or triglyceride levels between acutely bereaved and non-bereaved although HDL levels decreased from the acute assessment to 6 months in the bereaved participants (P = 0.04). Univariate analysis showed that being of the male sex (r = 0.35, P = 0.005) and having a higher consumption of alcohol (r = 0.24, P = 0.02) predicted increased cortisol acutely in the bereaved. Multiple regression analysis showed that increased alcohol was an independent predictor of increased cortisol acutely, standardized beta (95% confidence interval) being 0.55 (3.10–8.33) with P < 0.001.

Lower total cholesterol in the acutely bereaved was associated with reduced alcohol consumption (r = 0.34, P = 0.01) and taking anticholesterol medications (r = 0.29, P = 0.02). Additionally, there was a trend towards significance for both increased depression symptoms (r = 0.24, P = 0.06) and lower social support satisfaction (r = 0.22, P = 0.06) in predicting decreased cholesterol acutely. Multiple regression analysis showed that drinking less alcohol was the only independent predictor of lower cholesterol acutely (P = 0.01).

Discussion

This is the first prospective study, to our knowledge, to examine the influence of early bereavement on psychological and behavioural changes that may contribute to cardiovascular risk. Bereavement, particularly early in its course, is associated with increased risk of cardiovascular events.[10–14] Compared with non-bereaved, the acutely bereaved had increased symptoms of depression, anxiety and anger. Greater depressive symptoms were associated with being unprepared for the death, decreased sleep duration and younger age. Acutely bereaved slept less than non-bereaved, with reduced sleep time being associated with increased anger and depressive symptoms and decreased satisfaction with social support. Compared with the non-bereaved, the acutely bereaved were more likely to report reduced appetite and have lower total cholesterol and LDL cholesterol levels.

Although symptoms of depression and anxiety improved over time, they remained incompletely resolved at 6 months, consistent with previous reports of declining but unresolved psychological symptoms at 6 months.[13,34,35] Although bereaved participants had higher anger scores early in bereavement compared to non-bereaved, the levels were resolved at 6 months. Although one study suggests that anger may peak at 5 months post-loss, our results would suggest that following death in a critical care unit, anger was not a persistent psychological response to bereavement.[13] In the present study, unpreparedness for the death, reduced sleep time and younger age were the strongest predictors of increased acute depressive symptoms. Being unprepared for the death of a loved one may lead to difficulties in acknowledging and accepting the loss and may be an indicator for potential complicated bereavement.[36] Social support availability or satisfaction with support was not associated with lower depression symptoms in the acute bereavement period, as previously described; however, decreased satisfaction with support was associated with lower sleep time.[11]

Bereaved participants living alone as a consequence of bereavement had less depressive symptoms in the acute period than those not living alone. It has been suggested that when dependent children are in the home, the surviving parent must cope with both their own and the children's grief while also maintaining a functional home.[12] However, in our study, differences attributed to living alone were explained by other factors, such as age. Those living alone were older and older age was associated with lower depression scores.

Cortisol

Increased morning cortisol in the bereaved, acutely and at 6 months, suggests that a hypothalamic–pituitary–adrenal (HPA) axis stress reaction that may contribute to the increased morbidity. Whereas in one study, increased morning cortisol levels were reported several years following parental loss,[37] another study of bereaved parents found no change in the first 8 months following loss.[38] Irwin reported higher cortisol levels in a small sample of nine bereaved women assessed within 6 months of loss where the death was unexpected.[39] Breier reported increased afternoon blood cortisol in adults who experienced early parental loss with higher levels inversely associated with quality of life.[40] In our study, increased cortisol levels persisted during the first 6 months of bereavement. Although men had higher cortisol levels than women, this was accounted for by their increased alcohol intake. We did not find significant associations between cortisol level and depression symptoms or sleep time. Dysregulation of the HPA axis with high cortisol has been associated with chronic stress states, such as depression, but not consistently with episodic stress states.[41,42] Increased cortisol has been associated with effects on body mass, blood pressure, coronary stenosis and reduced quality of life.[40,43,44] Future research is needed to establish whether cortisol modifies cardiovascular risk in early bereavement.

Sleep disturbance

Although sleep disturbance can persist and become debilitating for some individuals,[45] it returns to pre-bereavement levels for most uncomplicated bereavements, as seen in this study.[46] We found that increased depression and anger symptoms were associated with decreased sleep. Disturbed sleep patterns affect more than 80% of persons experiencing depression symptoms.[47,48] Preservation of normal sleep after spousal bereavement has been previously associated with less depression in the first 2 years after loss.[47] Reduced sleep time as a result of an increased HPA axis stress reaction may exacerbate the depressive symptoms, as a strong bidirectional relationship between sleep and depression has been previously suggested.[49] Decreased satisfaction with social support associated with lower sleep time stresses the importance of perceived support in preservation of sleep. Sleep loss has been associated with inflammatory cell activation, hypertension and adverse health.[50–52]

Appetite, body mass index and cholesterol

Previous retrospective studies relying on self-reports have reported weight loss following spousal loss in elderly bereaved.[53,54] In the present study, we did not see changes to BMI or waist circumference from the acute assessment to 6 months despite the initially reduced appetite of bereaved participants returning to normal. Changes to regular alcohol consumption seen in our study are consistent with previous reports in bereavement.[12] Although the number of standard alcohol drinks consumed did not change over time, bereaved men were more likely to report drinking more alcohol than widows.[11] Furthermore investigation into the effect of alcohol consumption in bereavement is warranted in light of the complex relationship between alcohol consumption and cardiovascular risk.[55,56] Total cholesterol and LDL levels were lower acutely in the bereaved compared with non-bereaved and both levels increased over time from the acute assessment to 6 months in bereaved participants. Cholesterol levels have not been reported previously during bereavement. Previous reports of the associations between life stress and cholesterol have been inconsistent. Whereas tax time has been associated with increased cholesterol levels in accountants,[57] possibly because of increased dietary intake, prolonged work stress in nurses, accompanied by depression, has been associated with lower LDL levels.[43] Although reduced appetite and food intake could contribute to lower cholesterol, in our study decreased appetite did not predict lower cholesterol, suggesting that other mechanisms may be responsible. An inverse correlation between cortisol and cholesterol has been reported previously, particularly in subjects with higher BMI.[58] Furthermore research is needed to determine whether stress-related changes in lipids mediate cardiovascular risk.

Study limitations

As our bereaved participants were recruited from critical care areas of acute hospitals, a limitation relates to generalizability of the findings to the broader community. We choose this group of bereaved participants because of the social worker presence, which facilitated recruitment of participants. It is possible that the hospital admission itself, in the absence of bereavement, may cause a stress reaction in relatives.[59] Participating in the study may have modified responses; however, as participants responded positively to participation, it is unlikely that participants would have increased stress levels. Although we saw no difference in mean values of psychological levels between the bereaved parents and spouses, the number of parents was too small to exclude differences. Another limitation is the lack of pre-bereavement data on weight and cholesterol, although inclusion of the non-bereaved sample allows comparison to a similar sample recruited from the same hospitals as the bereaved. This paper documents measures of psychological stress and behavioural change, but presents no data directly linking the psychological findings with increased cardiovascular risk.

Conclusion

In conclusion, acute bereavement is associated with increased symptoms of depression, anxiety and anger, together with reduced sleep, which may contribute to the increased cardiovascular risk associated with bereavement. Those who were unprepared for the death of a loved one and younger individuals have the highest psychological distress in the early period. Loss of appetite acutely and reduced cholesterol levels in the first few weeks of bereavement suggest that acute changes to lipid levels may not be responsible for the increased cardiac risk in early bereavement. Higher alcohol intake associated with higher cortisol levels acutely requires further examination as a possible mediator of adverse risk.

In light of the bidirectional relationship between sleep and depressive symptoms, and prior findings that have reported health benefits from sleep preservation during bereavement, future research should consider strategies that preserve sleep during the early bereavement period.

Although focus at the time of bereavement is naturally directed on the deceased person, the health and welfare of bereaved survivors is of great concern to medical, nursing and social work professionals, as well as family

and friends. The results from this evaluation provide insight into the effect of early bereavement and potential cardiovascular risk.

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