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A Longitudinal Pilot Study of Resilience in Canadian Military Personnel

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Abstract

Research on psychological resilience is important for occupations involving routine exposure to trauma or critical events. Such research can allow for the identification of factors to target in training, education and intervention programs, as well as groups that may be at higher risk for mental health problems. Although efforts have been made to determine the individual characteristics that contribute to positive outcomes under stress, little is known about whether such characteristics are stable over time or how stressful events can impact psychological resilience in high-risk occupations such as military service. Following a review of the evidence on variations in resilience over time, results of a pilot study of Canadian Armed Forces personnel are presented in which differences in resilience characteristics were examined from military recruitment to several years after enrolment. While there was little change in resilience characteristics over time on average, there was considerable individual variation, with some individuals showing marked improvement and others showing marked deterioration in resilience characteristics. At both time points, individuals who had been deployed showed greater resilience characteristics than those who had never been deployed. Implications for the promotion of psychological resilience in military populations and personnel employed in other high-risk occupations are discussed. Copyright © 2014 John Wiley & Sons, Ltd.

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Trauma and other stressful experiences can have a negative impact on mental health and well-being. Nevertheless, not all stressful experiences have such consequences, and the symptoms and functioning of those affected vary in severity (e.g. Rundell & Ursano, 1996). The majority of past research on the link between stress and psychological well-being has focused on the role of risk or vulnerability factors (e.g. Brewin, Andrews & Valentine, 2000). Military research, specifically, has focused on factors that increase vulnerability to problems such as posttraumatic stress disorder (PTSD) and depression after combat deployments (e.g. Gallaway, Fink, Millikan, Mitchell & Bell, 2013; LeardMann, Smith, Smith, Wells & Ryan, 2009; Riviere, Kendall-Robbins, McGurk, Castro & Hoge, 2011). Like other populations, however, most military personnel do well, even after trauma-laden deployments (e.g. Sutker, Davis, Uddo & Ditta, 1995; Buckley, Blanchard &

Hickling, 1996). The focus has therefore begun to shift to the concept of psychological resilience.

Many definitions of resilience have been proposed, but all have, at their core, the concept of adapting well in the face of adversity. Some researchers focus on resilience as an outcome and measure it either by assessing outcomes after adversity and labelling those who do well as 'resilient' or by measuring perception of how the individual fared under adversity in the past. Another approach is to focus on the many behavioural, cognitive and affective components ('resilience characteristics') that underlie the capacity to do well under adversity. From this perspective, 'resilience' (adapting well in the face of adversity) is the net effect of these processes. This conceptual framework was developed by Lee, Sudom and McCreary (2011) and includes a broad range of potential resilience characteristics identified in past research (Wald, Taylor, Asmundson,

Jang & Stapleton, 2006): traits identified in the five-factor model of personality (i.e. agreeableness, conscientiousness, openness, extroversion and emotional stability), positive affect, and mastery to capture the intrapersonal dimension of resilience, and social support to capture the interpersonal dimension of resilience. More recently, a four-year longitudinal analysis of the role of these characteristics in resilience in Canadian military personnel well before and immediately after a combat deployment revealed a number of unexpected findings (Lee, Sudom & Zamorski, 2013): many resilience characteristics identified in earlier cross-sectional work were not confirmed as longitudinal predictors of post-deployment well-being. In addition, the effect sizes for significant findings were considerably smaller than those identified in cross-sectional studies. Lee et al. (2013) hypothesized that changes in resilience characteristics over time, perhaps in response to traumatic deployment experiences, might explain the failure to confirm cross-sectional findings.

Stability of psychological resilience and its relevance to high-risk professions

Research on the stability of the characteristics underlying psychological resilience, including those considered to be components of personality, can shed light on the extent to which resilience can change over time. Although various definitions exist, resilience can be viewed as a personal characteristic or set of characteristics that protects individuals from the adverse effects of stress on well-being (e.g. Connor & Davidson, 2003; Luthar, Cicchetti & Becker, 2000). Similar to a personality trait, resilience characteristics would be expected to remain relatively stable over time. Characteristics that may underlie resilience include self-esteem, mastery, self-efficacy, optimism, positive affect and hardiness—all of which have been linked to positive outcomes under stress (Agaibi &Wilson, 2005; Kobasa, 1979; Makikangas & Kinnunen, 2003; Yi, Vitaliano, Smith, Yi & Weinger, 2008). This group of characteristics or personality traits is believed to facilitate functioning despite exposure to trauma.

Although some research has suggested that personality characteristics remain relatively stable over time, as a result of their genetic basis or influence on socialization patterns that reinforce individual differences (Caspi, Bem & Elder, 1989; Caspi, Roberts & Shiner, 2005), the characteristics underlying resilience can indeed change significantly over time or in response to stressors, major life events or other factors. Particularly pronounced changes are seen in young adulthood, with continuous evolution throughout later adulthood (Ardelt, 2000; Caspi et al., 2005; McCrae & Costa, 1990; Vaidya, Gray, Haig, Mroczek & Watson, 2008). In particular, extroversion, openness, agreeableness and conscientiousness have been found to increase with age, whereas neuroticism (i.e. lack of emotional stability) has been found to decrease (McCrae & Costa, 1999). In addition, variations in trait affectivity have

been observed (Vaidya et al., 2008), with considerable variation in positive and negative affect in younger adults (Rocke, Li & Smith, 2009).

Mastery and self-esteem have been found to be more malleable than personality traits measured in the five-factor model (Aldwin, Sutton & Lachman, 1996). Research also suggests that training that is aimed at enhancing certain personal characteristics can result in personality changes. For example, increases in hardiness have been found following a hardiness training program (e.g. Maddi, Khan & Maddi, 1998). Also, increased conscientiousness and decreased neuroticism have been found following basic military training (Vickers, Hervig, Paxton, Kanfer & Ackerman, 1993).

It may be expected that the greatest changes in individual characteristics occur during or as a result of conditions of stress. Individuals exposed to extreme adversity have been found to exhibit increases in neuroticism and decreases in certain aspects of agreeableness and openness over time (Lockenhoff, Terracciano, Patriciu, Eaton & Costa, 2009). There is also evidence for a bidirectional relationship between stress reactions and hardiness (Vogt, Rizvi, Shipherd & Resick, 2008). Operational deployments and combat exposure, in particular, might thus lead to changes in the characteristics underlying resilience. When examined over a longer period, it has been found that the experience of combat stress is associated with greater mastery, self-esteem and coping skills—all of which mediate the relationship between combat exposure and PTSD (Aldwin, Levenson & Spiro, 1994). However, it is unclear whether combat exposure affects individual characteristics underlying resilience in the shorter term.

These studies generally indicate that the characteristics underlying resilience may be amenable to change. The potential for resilience to change has special significance for military populations, which typically consist of young individuals who are expected to undergo life-changing experiences, such as deployment. Understanding the factors that contribute to resilience is important in order to identify groups at high risk for developing psychological health problems and ensure adequate performance under adversity in high-stress environments. Doing so may also inform the development of strategies to reduce mental health problems as well as their potential organizational impacts (e.g. unwanted attrition). Understanding the stability of resilience characteristics will help identify those characteristics that are amenable to change and hence might be targeted in training, either to build resilience or prevent its decline in response to adversity, such as combat.

Current study

Longitudinal research on the effect of resilience characteristics on later well-being has limitations if these change significantly over time, either spontaneously

or in response to adversity. Although research is needed to improve knowledge of the stability of psychological resilience, such research has limitations. In particular, there is potential for a low response rate (e.g. see Phillips, Leardmann, Gumbs & Smith, 2010) due to the non-anonymous nature of this type of study (i.e. individual responses would have to be linked to previously collected data), possible sensitivities to disclosing mental health problems amongst those in high-risk professions or losses to follow-up (resulting from changes in address or other logistical factors). It is therefore cautious to conduct preliminary research in order to determine the potential response rate prior to conducting a full study. With this in mind, a pilot longitudinal study of psychological resilience amongst Canadian military personnel with and without combat exposure was conducted. The primary goals of this exploratory study were the following:

(1) To assess the stability of psychological resilience over time by examining (a) *group-level trends in resilience characteristics* (to determine if there are overall increases or decreases in resilience characteristics over time) and (b) *changes in resilience characteristics at the individual level* (to assess what fraction of the group experienced significant changes over time);
(2) To examine differences in resilience characteristics between military personnel who have and have not been deployed and
(3) To explore the potential response rate of a planned larger-scale study.

Methods

Procedure

Baseline data on resilience characteristics were collected using the Canadian Armed Forces (CAF) Recruit Health Questionnaire (RHQ), a voluntary paper-and-pencil survey of recruits of the CAF Regular Force during basic training. The RHQ includes validated measures of mental and physical health and a broad range of determinants of health, including resilience characteristics. A follow-up paper-and-pencil survey including the same scales was mailed to the workplace of 100 randomly selected Regular Force non-commissioned CAF members in 2012 who had been deployed on a combat mission in Afghanistan and 100 non-deployed controls (matched to the deployed group on sex and branch of service). An invitation letter and two follow-up reminders were sent by email to potential participants. Respondents were asked to consent to matching questionnaires to their earlier RHQ records. The follow-up period ranged from 5 to 9 years, with an average of 6.6 years. This study protocol was approved by the Defence Research and Development Canada Human Research Ethics Committee.

Participants

The majority of the sample was male (81.8%), of junior non-commissioned member rank (91.2%) and in the Army (78.8% Army; 15.2% Air Force; 6.1% Navy). At baseline, participants were 18–38 years of age, with a mean of 24 years. At the time of follow-up, participants were 25–47 years of age, with a mean age of 31 years.

Measures

Resilience measures

The resilience measures used in the current study were largely those included in the higher-order model of resilience developed by Lee et al. (2011). All had been validated and adapted, as necessary, for use in the CAF military population (Lee, 2008; Thompson & Smith, 2002). Mastery was assessed using a seven-item version of the Pearlin Mastery Scale (Pearlin & Schooler, 1978), which assesses sense of control over one's life circumstances. Items were rated using a five-point scale ranging from *strongly disagree* to *strongly agree*. The 11-item hardiness scale was adapted from Bartone's 15-item hardiness scale (Bartone, 1999). Items in this scale were rated using a four-point scale (1 = *not true at all*, 2 = *a little true*, 3 = *quite true* and 4 = *completely true*). Although not included in the final higher-order model of resilience, hardiness was included in the present survey since it has commonly been used as a measure of resilience in military research (e.g. Vogt et al., 2008). A modified version of the Big Five Inventory (John & Srivastava, 1999) was used to assess the Big Five personality factors (agreeableness, conscientiousness, extroversion, neuroticism and openness). Items were rated using a five-point scale ranging from *strongly agree* to *strongly disagree*. The 10-item trait affect subscale from the Positive and Negative Affect Schedule (Watson, Clark & Tellegen, 1988) was used to measure of the tendency to experience positive and negative emotions. In this measure, respondents rated the extent to which a series of adjectives describe how they feel, on average, using a five-point scale ranging from *strongly agree* to *strongly disagree*. The Social Support Survey (Sherbourne & Stewart, 1991) was used to assess perceived social support. The 19 items reflecting various types of social support were rated by respondents on a five-point scale in terms of how often each is available to them in times of need (1 = *none of the time*, 2 = *a little of the time*, 3 = *some of the time*, 4 = *most of the time* and 5 = *all of the time*). Cronbach's alpha values for these measures have been found to be adequate, ranging from 0.73 for agreeableness to 0.97 for the Social Support Survey amongst CAF members (Lee et al., 2011).

Statistical analyses

Group-level trends in resilience characteristics over time for the entire sample and separately for the deployed and control groups were explored using

paired *t*-tests. Independent sample *t*-tests explored differences between mean values in the deployed and control groups at both time periods. Group-level changes in resilience characteristics over time were also examined using Pearson correlation coefficients.

Individual-level changes over time were examined by comparing observed versus expected values of significant changes of resilience characteristics over time (defined a priori to be changes of one standard deviation or more for this exploratory analysis). To account for random error in measurement (as reflected in the test–retest reliability of each measure) and the two-stage stratified random sampling process—two sources of random variation—expected values were determined using a bootstrap approach. Regression was used to construct simulated Time 2 values for each resilience measure that have (a) the same mean and standard deviation as those observed in Time 1 for the sample frame ($N = 5267$) and (b) correlations with Time 1 values equal to published in correlations to capture random error in measurement.

The following published values for test–retest correlation coefficients were used: agreeableness = 0.76, conscientiousness = 0.76, extroversion = 0.82, neuroticism = 0.83, openness = 0.80, positive affect = 0.70, hardiness = 0.78 and social support = 0.78 (Bartone, 2007; Gosling, Rentfrom & Swann, 2003; Sherbourne & Stewart, 1991; Watson & Clark, 1994). Expected values for mastery could not be estimated as no published test–retest correlation was available. Ten thousand simple random samples of $N = 34$ (the final sample size for the study) were drawn to calculate bootstrapped expected values and their 95% confidence intervals.

Results

In total, 39 individuals responded to the survey, and 34 follow-up surveys (14 deployed and 20 controls) were successfully linked to RHQ records, for an adjusted response rate of 17%.

Paired-sample *t*-tests (Table I) indicated that the means were relatively stable from Times 1 to 2, with the exception of social support, which showed a notable decrease, $t(33) = 2.68$, $p = 0.012$; and conscientiousness, which showed a small but significant increase, $t(33) = -2.30$, $p = 0.028$. In addition to the fact that no impressive changes in resilience characteristics were seen *on average* for the sample as a whole, correlations between Times 1 and 2 values (Table II) were below those expected based on published test–retest correlations. Together, these inconsistent observations thus seemed to warrant the investigation of changes at the individual level.

As shown in Figure 1, between 4 and 18 individuals (out of a sample of 33–34, depending on the measure) had increases or decreases of one or more standard deviation. The observed number with more than one standard deviation of change was outside of the range of expected values for openness, neuroticism, hardiness, social support and, in particular, for conscientiousness, in which 18 of 34 respondents changed by that degree.

Table I. Resilience means across Times 1 and 2

| | Time 1 | | Time 2 | | |
	Mean	SD	Mean	SD	*t*-value
Hardiness	33.67	4.78	32.58	5.01	0.94
Mastery	20.63	4.64	21.55	4.43	−0.96
Agreeableness	34.50	4.49	34.90	4.61	−0.53
Conscientiousness	33.22	4.87	35.24	5.71	−2.30*
Extroversion	25.64	6.26	25.97	5.79	−0.82
Neuroticism	20.48	4.49	19.03	6.23	1.68
Openness	22.75	2.95	22.94	2.89	−0.38
Positive affect	38.50	5.29	38.59	4.99	−0.12
Social support	82.30	13.86	73.88	18.56	2.68*

SD: standard deviation
*$p < 0.05$

Table II. Pearson correlations between resilience measured at Times 1 and 2

| Time 1 | Time 2 | | | | | | | | |
	HAR2	MAS2	AGR2	CON2	EXT2	NEU2	OPE2	POS2	SS2
Hardiness	**0.38***	0.00	0.19	0.13	0.33	−0.13	0.28	0.23	0.04
Mastery	0.57***	**0.25**	0.41*	0.37*	0.33	−0.31	0.25	0.31	0.16
Agreeableness	0.44**	0.31	**0.51***	0.45**	0.21	−0.60***	0.01	0.42*	0.25
Conscientiousness	0.17	0.14	0.24	**0.54***	0.18	−0.12	0.11	0.21	0.03
Extroversion	−0.09	−0.19	−0.19	0.03	**0.76***	0.15	0.46**	0.26	0.03
Neuroticism	−0.38*	−0.18	−0.15	−0.44*	−0.45**	**0.54***	−0.26	−0.33	0.09
Openness	0.14	0.09	0.02	0.26	0.26	−0.31	**0.47***	0.18	−0.11
Positive affect	0.50**	0.51**	0.42*	0.48**	0.45**	−0.39*	0.44**	**0.63***	0.30
Social support	0.06	−0.23	−0.12	−0.09	0.59**	0.00	0.14	0.28	**0.39***

*$p < 0.05$;
**$p < 0.01$;
***$p < 0.001$
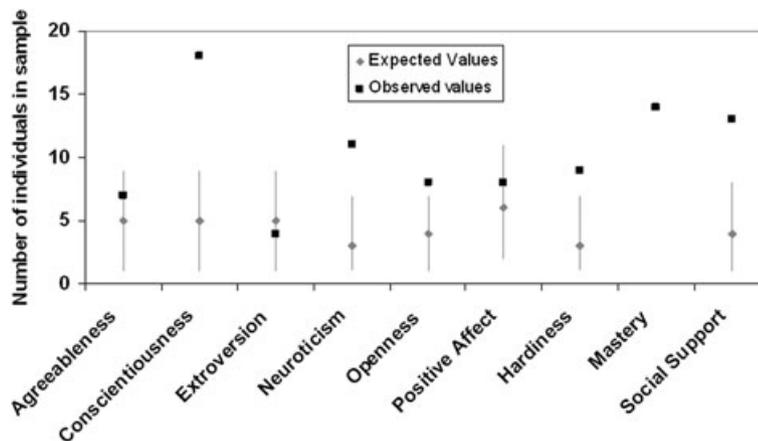
Figure 1 Number of respondents showing changes over time of one or more standard deviation in specific resilience characteristics: observed and expected values

The balance of those increasing versus those decreasing mirrored the pattern seen in the mean changes from Times 1 and 2: those seeing increases (13 in number) outnumbered those seeing decreases (5) for conscientiousness, whereas those decreasing (10) outnumbered those increasing for social support (3). For the measures showing no departure from the range of expected values (agreeableness, extroversion and positive affect), those increasing and those decreasing were roughly equal in number (2–4 individuals versus 2–5 individuals, respectively). Lack of published test–retest correlations precluded computation of expected values for mastery, though this measure had the second highest number of individuals with changes of more than one standard deviation (14, in total).

Differences between individuals with and without deployment experience are shown in Table III. At both time points, the deployed group appeared somewhat more resilient, on average. Independent samples t-tests revealed that at baseline (prior to deployment), individuals in the deployed group were higher than those in the non-deployed group in agreeableness, $t(32) = -2.92$, $p = 0.006$, and positive affect, $t(32) = -2.23$, $p = 0.033$. At follow-up, individuals who had been deployed were lower than non-deployed individuals in neuroticism, $t(32) = 2.68$, $p = 0.012$. When scores were examined across time, paired-sample t-tests revealed that social support decreased in the non-deployed group from baseline to follow-up, $t(20) = 3.07$, $p = 0.006$, although support remained unchanged in the deployed group. Also, neuroticism decreased in the deployed group over time, $t(12) = 2.78$, $p = 0.017$, whereas no change was found in the non-deployed group (Table III).

Discussion

The current study sought to assess the extent to which the characteristics underlying psychological resilience

Table III. Resilience means for deployed and non-deployed Canadian Armed Forces members

| | Deployed | | | | | Non-deployed | | | | |
| | Time 1 | | Time 2 | | | Time 1 | | Time 2 | | |
	Mean	SD	Mean	SD	t-value	Mean	SD	Mean	SD	t-value
Hardiness	34.92	3.96	33.62	5.20	0.49	32.95	5.14	31.94	4.91	0.79
Mastery	21.42	4.00	23.25	4.27	−1.44	20.13	5.03	20.57	4.32	−0.32
Agreeableness	37.08	3.72	35.77	4.09	1.61	32.90	4.23	34.36	4.93	−1.34
Conscientiousness	33.38	5.17	35.62	5.65	−1.66	33.11	4.80	35.01	5.88	−1.60
Extroversion	25.23	6.77	27.23	5.76	−1.87	25.90	6.08	25.19	5.80	0.39
Neuroticism	19.08	4.21	15.69	4.87	2.78*	21.39	4.53	21.10	6.17	0.30
Openness	22.92	3.17	22.31	3.04	0.67	22.64	2.87	23.33	2.80	−1.15
Positive affect	40.92	6.34	39.77	5.12	1.05	37.00	3.97	37.86	4.88	−0.86
Social support	82.43	11.04	78.54	15.41	0.68	82.22	15.61	71.00	20.07	3.07**

SD: standard deviation
*$p < 0.05$;
**$p < 0.01$

change over time and whether deployment to a combat zone was associated with greater degrees of change. This study was the first to examine changes in resilience at the level of the individual in military personnel over a substantial period. For most measured characteristics, the mean levels of resilience characteristics remained relatively stable over time for the study population as a whole, indicating that there was no evidence of a strong trend in most characteristics related to resilience in this sample over an average of 7 years. Two variables showed significant trends over time for the sample as a whole: the mean level of social support decreased and conscientiousness increased. With the exception of mastery, all of the correlations between the same variables measured across time were significant. However, the correlations were not as high as might be expected if resilience is considered to be stable over time.

Changes in resilience characteristics were most apparent when examined at the individual level, with the observed number of individuals changing by more than one standard deviation being greater than expected values for neuroticism, hardiness, openness, social support and conscientiousness. Examination of individual differences in resilience trajectories indicated that movement occurred in both directions: while some individuals showed improvement, others showed deterioration. A greater number of individuals increased, rather than decreased, in conscientiousness. In contrast, a greater number of individuals decreased, rather than increased, in social support.

Individuals who had been deployed to a combat zone were higher in certain aspects of resilience relative to others: at baseline, they scored higher on agreeableness and positive affect, and at follow-up, lower in neuroticism. Over time, individuals who had been deployed maintained their social support, whereas those who had not been deployed showed a decline. Despite assumed exposure to deployment-related trauma, neuroticism decreased in the deployed group but remained stable in the non-deployed group. This finding is discordant with the conservation of resources theory (Hobfoll, 1989), which proposes that stressful events can result in a loss of personal resources, increasing susceptibility to the effects of future stressors. The preservation of emotional stability in the deployed group (but not in others), on the other hand, is consistent with theories of posttraumatic growth, which highlight the potential for positive outcomes following stressors (e.g. Tedeschi & Calhoun, 1996).

These findings are consistent with the general thrust of the literature reviewed in the introduction: although resilience characteristics remain stable for many individuals, it is possible that resilience can change over time and with significant life events. Some facets of resilience are more stable than others: the variables contained in the five-factor model of personality showed some of the strongest correlations from Time 1 to Time 2, consistent with past research (e.g. Rantanen,

Metsapelto, Feldt, Pulkkinen & Kokko, 2007; Ardelt, 2000). Research on the stability of personality has shown that individual differences exist in the degree to which personality remains stable over time, and such differences are dependent upon personal and professional experiences (e.g. work and family roles; Clausen & Jones, 1998). In this vein, the observation of the substantial number of individuals who saw increases in conscientiousness reflects the high value placed on this attribute in the military and high-risk professions. That conscientiousness increased over time, as noted by other military researchers (Vickers et al., 1993), points to a powerful role of the workplace social environment in shaping personality.

Findings on resilience characteristics and deployment largely cohere with the well-documented 'healthy warrior effect': individuals selected for deployment have better mental health on average, and only those who are psychologically resilient remain eligible for combat (e.g. Larson, Highfill-McRoy & Booth-Kewley, 2008; Wilson et al., 2009). The preservation of social support may also indicate that deployment experiences facilitate the maintenance and strengthening of social ties, despite the obvious disruptions in habitual sources of support occasioned by deployment. It is possible that the sources of support reported were different at each time point, with family of origin and non-military friends as primary sources of support during basic training and military peers as primary sources of support at follow-up. Being deployed might have allowed for high social support at both time points, even though the sources of support were different. Again, these results demonstrate the potential importance of the social environment as well as life experiences, such as deployment, as influences on psychological resilience amongst military members and other individuals in high-risk occupations.

Limitations

The primary limitation of this study is its low response rate; this raises concerns regarding the possibility of self-selection bias amongst respondents. Although the response rate was in line with past research using similar follow-up methods (Phillips et al., 2010), it was low enough to cause concern about using this approach for conducting a full-scale study. This may indicate a general unwillingness to respond to non-anonymous mental health surveys, since respondents were required to provide their service number in order to match survey responses to baseline records. Self-report may also have resulted in underreporting of sensitive information because of concerns about stigma or career repercussions if respondents felt their responses could be identified.

The low response rate also meant that there was not enough data to reliably examine individual variation in the stability of resilience characteristics by deployment status. Similarly, there was not enough data to examine

the presence of possible mediating or moderating factors that could explain the relationship between resilience characteristics and mental health, such as appraisals, coping styles, social support or finding positive meaning in stressful events. Additionally, with a larger sample size, it would have been possible to control for demographic and military variables, such as age and rank, when conducting the analyses. Finally, because of the small sample size, findings should be viewed with caution, as a larger study may yield inconsistent findings.

It is difficult to ascertain whether changes in mental health over time are driving the changes in resilience characteristics reported at follow-up or whether resilience characteristics lead to changes in mental health. Changes in personality following a traumatic experience may result from mental health problems in response to the event, since some of the symptoms of mental disorders manifest as personality changes. For example, high neuroticism is associated with mental health problems such as PTSD (e.g. Cox, MacPherson, Enns & McWilliams, 2004). Accordingly, treatment of symptoms can alleviate some personality issues (Ekselius & von Knorring, 1998). There is also evidence that aspects of personality (e.g. neuroticism) can affect health and psychological outcomes through their effects on stress exposure and reactivity (Bolger & Zuckerman, 1995). Also, the relationship between resilience and stressors can be bidirectional (Vogt et al., 2008). Certainly, the experience of developing (or not developing) a mental health problem in the aftermath of trauma exposure represents powerful new information about resilience for the individual in question. Further research using larger samples and multiple time points would shed light on the nature and directionality of these relationships.

Another aspect of the study to consider is the relatively young age of the sample, during which changes in personality may be more likely. Specifically, the results may not be generalizable to older personnel. Also, the study captures a limited range of deployment experience, with combat exposure assumed to have occurred because of deployment in a combat zone. Results may thus not be applicable to personnel having gone on other types of deployments or on multiple deployments. With more data, the degree and impact of combat exposure could be examined.

Finally, the factors that enable individuals to develop and maintain psychological resilience are varied and include aspects that are beyond the scope of this study. For example, there is evidence for neurobiological mechanisms underlying resilience, in that stressors experienced early in life can alter neural responses to subsequent stressors; physical activity can modulate this response and enhance resilience to stressors (Haglund, Nestadt, Cooper, Southwick & Charney, 2007). The factors that enable individuals to be psychologically resilient can span multiple levels, and individual-level factors explain only part of the variation in resilience to stressors.

Implications

Despite the exploratory nature of this study, the results offer insights for the development of theory and future research in this area. Most notably, changes in resilience characteristics over time at the individual level suggest that these, as conceptualized and measured here, can change over time and with significant life experiences. If confirmed, these results imply that selecting personnel on the basis of assessments of resilience characteristics taken during recruitment would have limited benefits in preventing occupational mental disorders in the long term. On the other hand, further evidence that resilience characteristics can change over time would suggest that efforts to enhance it or, conversely, to prevent its decline have some promise. Since deterioration in resilience characteristics may occur in an important minority over time, it would be necessary to provide resilience-building interventions intermittently and target in the multiple facets of resilience for maximum effect.

Further study of the stability of resilience over time is clearly warranted. Such research could first and foremost confirm the preliminary findings presented in this pilot study. Future work could also serve to identify factors associated with both positive and negative changes in resilience characteristics that might be targeted in resilience-building interventions. Although longitudinal research is necessary to ensure that resilience characteristics measured at baseline preceded mental health problems measured at follow-up, observed changes in resilience characteristics over time add an element of complexity to the interpretation of findings regarding the relationship between resilience and health outcomes. For this purpose, longitudinal studies performed with varying periods of follow-up would help to establish the degree to which changes in resilience characteristics increase with longer periods of follow-up. Also, research on older individuals, in civilians and in those without life-changing events would help to confirm whether resilience is particularly flexible in young, military populations. Given the overwhelming prominence of work on resilience in military personnel, research on other high-risk professions is clearly needed. Efforts should also be made to try to tease apart whether lack of resilience is the cause or the effect of mental disorders in long-term studies. Also, additional studies using larger samples would provide greater opportunity to explore the influence of life-changing events, such as deployment in a combat zone, on the stability of resilience characteristics.

An important implication of the low response rate observed in this study is the need to identify better methods to ensure an adequate response rate for the purposes of future research in this area. The response rate is well below that reported in cross-sectional, anonymous health surveys using similar approaches

(e.g. the Health and Lifestyle Information Survey of CAF members; Whitehead & Hawes, 2010), suggesting that the requirement for respondents to provide identifying information (to allow records to be matched) was problematic. Particular reluctance to disclose mental health problems in military personnel might also conceivably be seen in other professions in which there is risk of trauma exposure (e.g. law enforcement personnel). The fact that experienced military health researchers have observed equally low response rates in similar studies suggests that this issue is not specific to the CAF (Phillips et al., 2010). Options for getting a better response rate could include the use of an anonymous unique identifier, requesting a commitment to answer follow-up surveys at the time of initial recruitment or offering incentives. Having a trusted third party engage in assertive telephone recruitment for a computer-assisted personal interview is a promising though expensive strategy: an 80% response rate in military mental health surveys was achieved using this approach (Statistics Canada, 2003).

Conclusion

This pilot study provides suggestive evidence that aspects of resilience can change over time in military personnel, at least in the early stage of their career. The observation of changes in resilience characteristics over time has important implications for the development of resilience-building interventions. Hence, these preliminary results provide compelling evidence that further research in this area is warranted to understand the factors—both positive and negative—that drive these changes. At the same time, results underscore some methodological challenges that could arise in longitudinal research in this area. Thus, future work in this area must also focus on identifying strategies to maximize response rates and, ultimately, the generalizability of findings.

Conflict of interest

The authors have declared that they have no conflict of interest.

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