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Coping profiles, perceived stress and health-related behaviors: a cluster analysis approach

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SUMMARY

Using cluster analytical procedure, this study aimed (i) to determine whether people could be differentiated on the basis of coping profiles (or unique combinations of coping strategies); and (ii) to examine the relationships between these profiles and perceived stress and health-related behaviors. A sample of 578 French students (345 females, 233 males; $M_{age}=21.78$, $SD_{age}=2.21$) completed the Perceived Stress Scale-14 (Bruchon-Schweitzer, 2002), the Brief COPE (Muller and Spitz, 2003) and a series of items measuring health-related behaviors. A two-phased cluster analytic procedure (i.e. hierarchical and non-hierarchical-k-means) was employed to derive clusters of coping strategy profiles. The results yielded four distinctive coping profiles: High Copers, Adaptive Copers, Avoidant Copers and Low Copers. The results showed that clusters differed significantly in perceived

stress and health-related behaviors. High Copers and Avoidant Copers displayed higher levels of perceived stress and engaged more in unhealthy behavior, compared with Adaptive Copers and Low Copers who reported lower levels of stress and engaged more in healthy behaviors. These findings suggested that individuals' relative reliance on some strategies and de-emphasis on others may be a more advantageous way of understanding the manner in which individuals cope with stress. Therefore, cluster analysis approach may provide an advantage over more traditional statistical techniques by identifying distinct coping profiles that might best benefit from interventions. Future research should consider coping profiles to provide a deeper understanding of the relationships between coping strategies and health outcomes and to identify risk groups.

Key words: coping; perceived stress; health-related behaviors; cluster analysis

Coping is of critical importance to physical and psychological health, specifically because stress has been associated with a range of psychological and health outcomes (Penley *et al.*, 2002; Skinner *et al.*, 2003). As outlined by Skinner *et al.*, (Skinner *et al.*, 2003), 'how people deal with stress can

reduce or amplify the effects of adverse life events and conditions not just on emotional distress and short-term functioning, but also long-term, on the development of physical and mental health or disorder' (p. 216). Therefore, it is necessary to identify risk groups that show maladaptive profile of coping for the prevention and intervention of various health problems. While the concept of coping has received a significant attention during the past decades, few researchers have considered

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that individuals may exhibit coping profiles (or unique combinations of coping strategies; Eisenbarth, 2012). In addition, the relationships between coping profiles and health outcomes have to be explored further. Therefore, a cluster analysis approach could be useful to investigate more thoroughly the relationships between coping strategies and health outcomes. Hence, the goal of this study was to (i) examine and describe the ways in which people combine several coping strategies (i.e. coping profiles), and (ii) investigate whether the coping profiles that emerge from the cluster analysis differ in perceived stress and health-related behaviors.

DEFINITION OF COPING

According to Lazarus and Folkman (Lazarus and Folkman, 1984), coping represents the cognitive and behavioral efforts of an individual to manage the internal and external demands encountered during a specific stressful situation. This definition highlights the multidimensional nature of coping. As such, researchers have tried to classify various coping strategies on the basis of their functions into meaningful dimensions. In agreement with the meta-analytic study recommendations and assumption, ‘five categories of coping are clearly core: problem solving, support seeking, avoidance, distraction, and positive cognitive restructuring’ [(Skinner et al., 2003), p. 239]. In this view, *problem solving* subsumes coping strategies such as planning and active coping; *support seeking* includes coping strategies such as instrumental support, emotional support and religion; *avoidance* comprises coping strategies such as behavioral disengagement, self-blame, denial and substance use; *distraction* includes coping strategies such as self-distraction and venting; *cognitive restructuring* subsumes coping strategies such as acceptance, humor and positive reframing (Doron et al., 2014).

In addition, Lazarus and Folkman (Lazarus and Folkman, 1984) highlighted that coping could be measured both at the trait and state levels. In this context, dispositional/trait coping represents the usual or recurrent utilization of coping strategies across contexts, situations and time. Rather than providing contradictory information to the situational/state approach, it can be argued that dispositional/trait and situational/state coping are yielding a complementary portrait of the overall ‘person × situation’ transaction residing at the core of the coping

construct (Gaudreau and Miranda, 2010). In this study, a dispositional perspective of coping was adopted.

COPING STRATEGIES AND HEALTH OUTCOMES

A reliable association has been shown between individual coping strategies and health indicators (Dunkley et al., 2000; Compas et al., 2001; Penley et al., 2002; Ottenbreit and Domson, 2004; Pritchard et al., 2007; Sasaki and Yamasaki, 2007; Wodka and Barakat, 2007). The meta-analysis of Penley et al., (Penley et al., 2002) revealed that coping strategies, such as distancing, self-control, accepting responsibility, wishful thinking, seeking social support and avoidance, demonstrated significant negative overall associations with health. That is, people who reported using these strategies also reported experiencing negative health outcomes. Conversely, people who reported using positive reappraisal and problem solving coping strategies also reported experiencing positive health outcomes.

COPING STRATEGIES AND PERCEIVED STRESS

Coping strategies are an important factor that influences people’s experienced levels of stress (Cohen et al., 2000; Muller and Spitz, 2003). Perceived stress can be conceptualized as the degree to which a situation in one’s life is appraised as stressful (Cohen et al., 1983). Thus, it can be viewed as an outcome variable (Cohen et al., 1983). For example, Muller and Spitz (Muller and Spitz, 2003) showed that active coping, planning, acceptance or positive reframing coping strategies were negatively correlated with perceived stress, while denial, behavioral disengagement, self-blame or substance use were positively correlated with perceived stress.

COPING STRATEGIES AND HEALTH-RELATED BEHAVIORS

Coping strategies are an important factor that influences people’s health-related behaviors (e.g. substance use, exercise; Penley et al., 2002). For example, people who routinely use problem-focused coping strategies are less likely to develop and more likely to overcome substance

use problems compared with the individuals who routinely use avoidance coping (Naquin and Gilbert, 1996; Wills and Hirk, 1996; Allison *et al.*, 1997; Wagner *et al.*, 1999; Simons *et al.*, 2005). Finney and Moos (Finney and Moos, 1995) found that individuals who rely more on problem-focused coping and less on avoidance coping are less likely to develop substance use problems. The results of Fromme and Rivet (Fromme and Rivet, 1994) supported the idea that coping styles are related to alcohol use. A positive association was also found between problem-focused coping and exercise (Ingledeu and McDonagh, 1998). Laybourne *et al.* reported that problem-focused coping strategies play an important role in determining physical activity (Laybourne *et al.*, 2011).

PROFILES OF COPING

Despite their respective strengths and weaknesses, the aforementioned studies viewed coping dimensions as orthogonal constructs which reflect that individuals are prone to one type of coping over another (e.g. either problem solving or support seeking or avoidance). These studies have explored, through correlational approach, the relationships between one specific coping strategy (e.g. positive reappraisal) and people's health-related behaviors (e.g. substance use, exercise). However, the statistical methods preferred by coping researchers are more appropriate for analyzing individual differences than for describing groups of individuals along multiple dimensions of coping simultaneously (Henry *et al.*, 2005). Such an approach has neglected the multidimensional nature of coping and the possibility that people may use more than one coping strategy when dealing with stressful situations (Sideridis, 2006). As outlined by Eisenbarth (Eisenbarth, 2012), 'Coping strategies likely operate in conjunction with one another and it may be valuable to consider the profile or combination of strategies endorsed by individuals rather than simply examining coping strategies discretely or in isolation of one another' (p. 485).

CLUSTER ANALYTICAL PROCEDURES

Cluster analysis is a promising method for identifying and describing subgroups of individual cases defined by similarities among multiple dimensions of interest (e.g. coping strategies;

Henry *et al.*, 2005). The process of taking a heterogeneous sample of entities and forming relatively homogeneous groups serves to organize large quantities of multivariate information. As such, this method allows to consider the multi-dimensional nature of coping and the people's combined use of coping strategies (i.e. coping profiles) in order to arrive to meaningful conclusions (Garnefski *et al.*, 2001). In addition, cluster-analytic techniques may provide an advantage over more traditional statistical techniques (e.g. regression) by assisting health professionals to identify distinct coping profiles to which individuals might belong and, subsequently, shape intervention designs to the unique dispositions and risks of the targeted group [e.g. (Kaluza, 2000)]. Therefore, some researchers have begun to examine coping strategies in terms of 'profiles' of individuals using cluster analytical procedures in different settings [e.g. (Smith and Wallston, 1996; Kaluza, 2000; Rijavec and Brdar, 2002; Gaudreau and Blondin, 2004; Wijndaele *et al.*, 2007; Steele *et al.*, 2008; Eisenbarth, 2012; Doron *et al.*, 2013)].

PROFILES OF COPING AND HEALTH OUTCOMES

Research has demonstrated that individuals can be categorized into groups based on distinctive coping profiles that differentiate people on a multitude of health indicators. For example, in a study with 2616 adults, Wijndaele *et al.* (Wijndaele *et al.*, 2007) created multivariate profiles of coping using a cluster analytical procedure. Participants were categorized into three groups, those who have (1) combined high levels of passive and avoidant coping strategies, (2) high levels of active coping strategies, and (3) intermediate levels of active coping, passive coping, and avoidant coping strategies. Group (2) had the most adaptive profile characterized by decreased depression and anxiety and increased physical activity, whereas group (1) turned out to have the most maladaptive profile associated with increased anxiety and depression and decreased physical activity. Accordingly, Doron *et al.* (Doron *et al.*, 2013) identified three cognitive coping profiles of adults and investigated their links with state-anxiety and depression. The first group labeled 'Adaptive Copers' displayed high levels of positive reappraisal, positive refocusing and perspective taking. The second group labeled 'Avoidant Copers' reported high levels of self-blame, rumination, catastrophizing and

blaming others. The third group labeled 'Low Copers' used relatively low levels of coping strategies overall. The results indicated that 'Adaptive Copers' reported better functioning in terms of displaying fewer levels of depression and state-anxiety, whereas 'Avoidant Copers' displayed higher levels of both symptoms. These studies complement the existing knowledge by showing that people combined several coping strategies differently to deal with stressful situations (e.g. profiles of coping). Moreover, these distinctive coping profiles were associated differently with psychological adjustment and health outcomes.

TARGET THE STUDENT POPULATION

Student coping with health issues and health-related behaviors deserves special attention for several reasons. First, students confront many challenges and demands in pursuit of their educational goals that can impair their psychological well-being and physical health (Hudd *et al.*, 2000; Lumley and Provenzano, 2003; Perry, 2003; Shaikh and Deschamps, 2006; Neveu *et al.*, 2012; Voltmer *et al.*, 2012; Tavoracci *et al.*, 2013). Second, many health habits are set for life during student years. Indeed, the risk of onset of substance use and related problems is heightened during the university period (Tavoracci *et al.*, 2013). Student life, therefore, offers an important developmental window to establish health habits, health risks and protective factors. As outlined by Voltmer *et al.* (Voltmer *et al.*, 2012), the quality of health decrease and the risk patterns increase during academic career. Third, this indicates a need for prevention and health promotion focusing on the student population (Voltmer *et al.*, 2012; Tavoracci *et al.*, 2013). Thus, it is necessary to identify coping profiles of students at risk of suffering from stress and engaging in unhealthy behaviors to undertake targeted prevention efforts and to offer interventions that are more appropriate. For these reasons, this study focused particularly on a student population.

PROBLEM STATEMENT AND PURPOSE

Cluster analysis seems to be a promising method for identifying subgroups of students with different coping profiles. However, few researchers have studied coping profiles of students (e.g. Rijavec and Brdar, 2002; Eisenbarth, 2012) and

explored the relationships between coping profiles, perceived stress and health-related behaviors in a student population. Thus, this study aimed (i) to determine whether college students could be differentiated based on coping profiles (or unique combinations of coping strategies) and (ii) to investigate whether the subgroups of students created by the cluster analysis also differ in perceived stress and health-related behaviors, such as physical activity and substance consumption (coffee, alcohol, tobacco, cannabis and medicine).

METHOD

Participants and procedure

Five hundred and seventy-eight French third-year college students (345 females, 233 males; $M_{age} = 21.78$, $SD_{age} = 2.21$) enrolled in Montpellier (France) during 2009–2010 academic year in one of the following programs: medicine ($n = 149$), dentistry ($n = 59$), psychology ($n = 201$) and sports sciences ($n = 175$) completed a cross-sectional survey about stress and health-related behaviors of students. The participants were given information about the survey and completed a consent form with an anonymous pen-and-paper questionnaire during a compulsory class in their respective programs. All the questionnaires were collected directly at the end of the class. The ethical committee (CPP Sud méditerranée IV) approved the protocol.

Measures

Coping

Coping was assessed using the French version (Muller and Spitz, 2003) of the Brief COPE (Carver, 1997), which contains 14 two-item subscales. Participants were asked to rate the extent to which they typically use each of the strategies described in order to manage stressful situations encountered during the previous 2 months (i.e. dispositional coping styles) on a four-point Likert scale ranging from 1 'Not at all' to 4 'Usually'. Cronbach's alpha of internal consistency ranged from 0.60 to 0.91.

Perceived stress

Perceived stress was measured using the French version (Bruchon-Schweitzer, 2002) of the Perceived Stress Scale (PSS-14; Cohen *et al.*,

1983). The measure assesses the degree to which situations in one's life are judged to be stressful. Participants reported how often they felt or thought in the way described during the previous 2 months on a 5-point Likert scale ranging from 1 'never' to 5 'very often'. A higher score indicates a higher level of perceived stress. The Cronbach's alpha coefficient was 0.99.

Health-related behaviors

A series of survey questions was used to estimate participants' levels of physical activity and substance use during the previous 2 months. Physical activity was measured with an item asking participants how often they performed a physical activity using three response categories: 'less than one hour per week', 'between one to three hours per week' or 'more than three hours per week'. These categories were determined according to the National Institute of Medical and Health Research recommendations week (INSERM, 2008). Practicing a physical activity regularly at least 3 h per week is considered a healthy behavior. In line with previous studies on people's substance use [e.g. (Allison *et al.*, 1997; Stock *et al.*, 2001; Peretti-Watel *et al.*, 2002; Lorente *et al.*, 2003)], the individual's use of (a) tobacco ('no consumption', 'between zero to ten cigarettes per day' or 'more than ten cigarettes per day'), (b) alcohol ('less than twice per week' or 'at least twice a week'), (c) cannabis ('no consumption' or 'consumption'), and (d) mood regulating medicines ('no consumption', 'consumption' or 'two and more') was rated.

Data analysis

Analyses were carried out using the SPSS 17.0 statistical software package (SPSS, Inc., Chicago, IL, USA). To identify and classify naturally occurring patterns of coping strategies, cluster analysis was used after transforming scores into standardized *z*-scores (mean of 0 and a standard deviation of 1) and identifying multivariate outliers (Hair *et al.*, 1998). As recommended by Henry *et al.* (Henry *et al.*, 2005), a two-phased cluster analytic procedure was employed to derive clusters of coping profiles from the 14 subscales of the Brief COPE. First, to provide the maximum flexibility in determining the appropriate number of clusters, the standardized data was examined using a hierarchical cluster analysis method (i.e. Ward's linkage clustering using

minimized squared Euclidean distances as the distancing metric). This process allowed identifying the number of clusters that maximizes differences between clusters or groups and minimizes within-group differences on the dependent variables (i.e. coping strategies). Then, a non-hierarchical (k-means) cluster analysis was used to confirm the number of clusters identified by the hierarchical clustering. As described by Taylor *et al.* (Taylor *et al.*, 2001), this method provides a relatively robust identification of clusters. Henry *et al.* (Henry *et al.*, 2005) noted that this combination of clustering methods 'capitalizes on the strengths of both methods and compensates for their weaknesses' (p. 124). To validate the clusters solution, a MANOVA and Tukey's HSD *post hoc* test were used with the cluster membership as an independent variable and the coping strategies as dependent variables (Aldenderfer and Blashfield, 1984).

ANOVA with Tukey's HSD *post hoc* test and Chi-square tests of association were conducted to test differences in perceived stress and health-related behaviors between clusters. In addition, since previous research reported gender differences between clusters (Rijavec and Brdar, 2002; Wijndaele *et al.*, 2007), participants' gender characteristics were analyzed to gain insights into the coping profiles.

RESULTS

Preliminary analyses

Means, standard deviations and correlation matrix for the variables studied are presented in Table 1. To check for multicollinearity, an *a priori* level of <0.70 was established to determine whether the subscales measured relatively independent constructs (Nunnally, 1994). Correlations ranged from 0.09 to 0.70, suggesting these constructs are independent measures (Table 1).

Cluster analyses

Nine multivariate outliers were identified on perceived stress and coping strategies using the critical value of Mahalanobis distance ($\chi^2_{(15)} > 39.25$, $p < 0.001$). Data from these nine participants were excluded from the subsequent analysis. First, a hierarchical cluster analysis was conducted. Based on the dendrogram, the agglomeration schedule coefficients, and the

Table 1: Variable correlations, means and standard deviations ($N = 569$)

	M	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Active Coping	4.85	1.33	—	0.63**	0.28**	0.26**	0.11**	0.04	—0.02	—0.09*	0.02	—0.19**	—0.04	0.08	0.04	0.12**	0.01
2. Planning	5.02	1.55	—	—	0.22**	0.23**	0.11**	0.05	0.04	—0.10*	0.19**	—0.12**	0.00	0.17**	0.03	0.14**	0.08
3. Acceptance	5.25	1.54	—	—	—	0.36**	0.23**	0.03	0.00	—0.06	—0.04	—0.13**	—0.11*	0.01	—0.04	0.11**	—0.04
4. Positive reframing	5.16	1.46	—	—	—	—	0.34**	0.10*	0.04	—0.03	—0.07	—0.14**	0.01	0.05	0.05	0.13**	—0.14**
5. Humor	3.84	1.61	—	—	—	—	—	—0.10*	—0.11*	0.15**	—0.10*	—0.05	0.02	—0.02	—0.01	—0.04	—0.15**
6. Instrumental support	4.95	1.71	—	—	—	—	—	—	0.70**	0.02	0.12**	0.05	0.10*	0.10*	0.16*	0.14**	—0.14**
7. Emotional support	4.94	1.63	—	—	—	—	—	—	—	0.10*	0.17**	0.11**	0.13**	0.10*	0.24**	0.68**	0.18**
8. Substance use	3.04	1.51	—	—	—	—	—	—	—	—	0.10*	0.16**	0.15**	—0.07	0.10*	0.01	0.12**
9. Self-Blame	4.71	1.46	—	—	—	—	—	—	—	—	—	0.25**	0.15**	0.15**	0.10*	0.15**	0.27**
10. Behavioral Disengagement	2.74	1.02	—	—	—	—	—	—	—	—	—	—	0.30**	0.03	0.10*	—0.01	0.19**
11. Denial	2.55	.96	—	—	—	—	—	—	—	—	—	—	—	0.04	0.05	0.06	0.20**
12. Religion	2.65	1.39	—	—	—	—	—	—	—	—	—	—	—	—	0.04	0.11**	0.12**
13. Distraction	5.10	1.24	—	—	—	—	—	—	—	—	—	—	—	—	—	0.11**	0.10*
14. Venting	4.77	1.65	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.06
15. Perceived stress	42.30	3.64	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* $p < 0.05$, ** $p < 0.01$.

interpretability of the cluster solution (Aldenderfer and Blashfield, 1984), the results suggested a four-cluster solution. Second, to confirm this four-cluster solution identified in the hierarchical cluster analysis, a non-hierarchical cluster analysis (k-mean) was performed on the data, specifying a four-cluster solution. A MANOVA revealed that the subgroups of the four-cluster solution differed significantly on all coping strategies (Wilk's $\lambda = 0.11$, $F_{(14, 554)} = 43.50$, $p < 0.0001$, partial $\eta^2 = 0.52$). After a Bonferroni correction, the results of univariate ANOVAs indicated that the subgroups of the four-cluster solution differed significantly on all coping strategies ($p < 0.003$), thus confirming its tenability (Table 2). Moreover, visual inspection of cluster centers and mean scores on the clustering variables suggested similar patterns across the two clustering methods.

The first cluster ($n = 171$) represented individuals with moderate problem solving and cognitive restructuring, high support seeking and distraction, and moderate avoidance. The second cluster ($n = 138$) consisted of participants characterized by high problem solving, moderate cognitive restructuring and low support seeking, distraction, and avoidance. The third cluster ($n = 141$) represented individuals with low problem solving, cognitive restructuring, support seeking, and distraction, and high avoidance. The fourth cluster ($n = 119$) consisted of participants characterized by low problem solving, support seeking, distraction, and avoidance, and high cognitive restructuring (Table 2).

Differences in perceived stress and health-related behaviors between clusters

Second, cluster-differences in perceived stress and health-related behaviors were examined. After a Bonferroni correction, the results of the ANOVA showed that the four clusters differed significantly in perceived stress ($F_{(3,565)} = 12.24$, $p < 0.0001$, partial $\eta^2 = 0.06$). Cluster 4 had significantly lower levels of perceived stress ($M = 40.77$) compared with Cluster 1 ($M = 43.18$), Cluster 2 ($M = 41.99$) and Cluster 3 ($M = 42.81$) ($p < 0.001$). Cluster 1 ($M = 43.18$) had significantly higher levels of perceived stress compared with Cluster 2 ($M = 41.99$) ($p < 0.003$).

The Chi-square test of association of profile (4) \times physical activity (3) indicated differences in physical activity among the clusters ($\chi^2_{(6)} = 19.32$, $p = 0.004$). Clusters 2 and 4 were more

Table 2: Cluster means, standard deviations, z scores and series of ANOVAs across the three profiles of coping ($N = 569$)

	Clus 1: High Copers ($n = 171$; 127 F, 44 M)			Clus 2: Adaptive Copers ($n = 138$; 76 F, 62 M)			Clus 3: Avoidant Copers ($n = 141$, 97 F, 44 M)			Clus 4: Low Copers ($n = 119$, 38 F, 81 M)			Tukey's HSD		
	M	SD	z	M	SD	Z	M	SD	Z	M	SD	z	F	df	η^2
Active coping	5.14	1.10	.22	6.12	0.92	0.96	3.79	0.91	-0.79	4.19	1.01	-0.50	150.50	3,565	0.44
Planning	5.47	1.28	0.29	6.33	0.98	0.84	3.99	1.22	-0.66	4.08	1.36	-0.61	118.00	3,565	0.39
Acceptance	5.58	1.35	0.22	5.83	1.49	0.38	4.21	1.32	-0.68	5.33	1.51	0.05	36.60	3,565	0.16
Positive reframing	5.64	1.27	0.33	5.50	1.30	0.23	4.03	1.25	-0.78	5.43	1.42	0.18	47.73	3,565	0.20
Humor	4.03	1.58	0.12	3.68	1.38	-0.10	2.74	1.04	-0.68	5.03	1.55	0.74	58.59	3,565	0.24
Instrumental support	6.69	1.08	1.02	4.11	1.14	-0.49	4.76	1.45	-0.11	3.66	1.20	-0.76	183.36	3,565	0.49
Emotional support	6.50	1.04	0.96	4.05	1.10	-0.55	4.96	1.40	0.02	3.69	1.19	-0.77	169.56	3,565	0.47
Religion	2.95	1.65	0.22	2.68	1.55	0.02	2.58	1.22	-0.05	2.25	.76	-0.28	6.12	3,565	0.03
Self-Distract	5.49	1.24	0.31	4.92	1.20	-0.15	5.11	1.13	0.01	4.74	1.28	-0.29	10.34	3,565	0.05
Venting	6.33	1.18	0.94	4.30	1.30	-0.29	4.44	1.36	-0.20	3.48	1.15	-0.78	140.629	3,565	0.43
Substance use	3.35	1.59	0.21	2.49	1.10	-0.36	3.26	1.63	0.15	2.95	1.51	-0.06	10.05	3,565	0.05
Self-blame	5.04	1.42	0.22	4.59	1.33	-0.09	5.06	1.53	0.23	3.98	1.31	-0.50	16.92	3,565	0.08
Behavioral disengagement	2.81	.98	0.07	2.20	0.49	-0.52	3.41	1.25	0.66	2.45	0.73	-0.28	44.98	3,565	0.19
Denial	2.77	1.13	0.22	2.31	0.70	-0.25	2.77	1.10	0.23	2.27	0.58	-0.30	12.47	3,565	0.06

*** $p < 0.003$ (Bonferroni correction). All *post hoc* results presented in this table are significant at $p > 0.003$.

F, Female; M, Male.

likely to practice at least 3 h of physical activity per week, whereas Clusters 1 and 3 were more likely to fail to attain the physical activity recommendations.

Cluster membership was also related to tobacco use ($\chi^2_{(6)} = 17.92$, $p = 0.006$), mood regulating medicines ($\chi^2_{(6)} = 12.85$, $p = 0.04$), cannabis use ($\chi^2_{(3)} = 11.62$, $p = 0.009$) and alcohol consumption ($\chi^2_{(3)} = 11.87$, $p = 0.008$). Overall, Cluster 1 and Cluster 3 were over-represented in the highest levels, while Cluster 2 and Cluster 4 were over-represented in the lowest levels of consumption, except for Cluster 4 who was over-represented in the highest levels of alcohol consumption and conversely for Cluster 1.

Consequently, the four clusters were labeled: High Copers for the Cluster 1, Adaptive Copers for the Cluster 2, Avoidant Copers for the Cluster 3 and Low Copers for the Cluster 4.

Gender in cluster composition

The results of profile (4) \times gender (2) Chi-square test of association indicated that the number of males and females was significantly different across the four coping clusters ($\chi^2_{(3)} = 59.14$, $p < 0.0001$). Women were over-represented in the Cluster 1 and Cluster 3, while men were over-represented in the Cluster 4. To complete this result, a MANOVA was conducted. As shown in Table 3, in the total sample, men and women differed significantly on coping strategies (Wilk's $\lambda = 0.81$, $F_{(14, 554)} = 9.35$, $p < 0.0001$, partial $\eta^2 = 0.19$). After a Bonferroni correction, the results of univariate ANOVAs indicated few significant differences. Men and women differed significantly on the following use of coping strategies: humor, instrumental support, emotional support, substance use and venting ($p < 0.003$) (Table 3).

DISCUSSION

The present study aimed to determine whether people could be differentiated based on coping profiles, and it assessed whether perceived stress and health-related behaviors varied as a function of these profiles in a student population. The results provided additional empirical evidence to support the proposition that students combined several coping strategies differently when dealing with stressful situations (e.g. profiles of coping). Further, they complemented existing coping literature by showing that different

Table 3: Descriptive statistics and differences between men and women for all coping strategies ($N = 578$)

	Women ($n = 338$)		Men ($n = 231$)		df	F	η^2
	M	SD	M	SD			
Active coping	4.82	1.34	4.89	1.32	1,567	0.44	0.00
Planning	5.03	1.50	5.01	1.62	1,567	0.01	0.00
Acceptance	5.19	1.55	5.33	1.53	1,567	1.11	0.00
Positive reframing	5.08	1.43	5.28	1.49	1,567	2.77	0.00
Humor	3.47	1.51	4.38	1.60	1,567	47.45***	0.08
Instrumental support	5.33	1.71	4.39	1.55	1,567	44.51***	0.07
Emotional support	5.37	1.60	4.30	1.45	1,567	66.00***	0.10
Religion	2.73	1.47	2.52	1.27	1,567	3.21	0.01
Self-distraction	5.18	1.23	4.98	1.26	1,567	3.69	0.01
Venting	5.15	1.64	4.22	1.50	1,567	47.71***	0.08
Substance use	2.88	1.36	3.27	1.69	1,567	9.59***	0.02
Self-blame	4.79	1.43	4.60	1.51	1,567	2.44	0.00
Behavioral disengagement	2.80	1.01	2.65	1.04	1,567	2.70	0.00
Denial	2.56	0.93	2.55	1.01	1,567	0.01	0.00

*** $p < 0.003$ (Bonferroni correction).

profiles of coping were associated with perceived stress and health-related behaviors differently.

Coping profiles of students

Based on participants' multivariate coping responses on the Brief COPE, cluster analysis revealed that four coping profiles existed within this sample of students (i.e. High Copers, Adaptive Copers, Avoidant Copers and Low Copers). Using a different methodology (cluster analysis), these findings complement the literature on coping by indicating that coping strategies operate in conjunction with one another (Garnefski *et al.*, 2001; Sideridis, 2006; Eisenbarth, 2012). Therefore, these results strengthen the previous cluster-analytic studies that have examined coping strategies in terms of 'profiles' (Smith and Wallston, 1996; Kaluza, 2000; Rijavec and Brdar, 2002; Gaudreau and Blondin, 2004; Wijndaele *et al.*, 2007; Steele *et al.*, 2008; Eisenbarth, 2012; Doron *et al.*, 2013). Specifically, they support and share common threads with the four-cluster solution found in the previous research (Smith and Wallston, 1996; Rijavec and Brdar, 2002; Gaudreau and Blondin, 2004; Steele *et al.*, 2008). This may indicate a potential generalization of the patterns of coping profiles associated with the four-cluster solution across different settings and different populations. Moreover, the findings of this study illustrate the potential importance of taking into account multivariate students' coping responses. Better describing meaningful subgroups of students based on their coping responses

and linking these subgroups to development, risk and intervention requires a method more attuned to this multidimensional perspective (Henry *et al.*, 2005).

Students' coping profiles and perceived stress

Beyond identifying coping profiles, the present study aimed to investigate whether these subgroups of students differ in perceived stress. The results revealed that Low Copers and Adaptive Copers displayed lower levels of perceived stress compared with High Copers and Avoidant Copers. Particularly, students with the lowest levels of perceived stress in this study endorsed a coping profile of Low Copers, whereas students with the highest levels of perceived stress endorsed a coping profile of High Copers. First, these findings add insight to the previous studies who have simply examined the association between isolated coping strategies with perceived stress using correlational methods. For example, acceptance has been found to be negatively correlated with perceived stress, while self-blame has been found to be positively correlated with perceived stress (Muler and Spitz, 2003). However, it seems more valuable to consider the profile or combination of strategies that individuals endorsed in relationships with perceived stress. Indeed, the results indicated that students who combined moderate problem solving and cognitive restructuring, high support seeking and distraction, and moderate avoidance (i.e. High Copers) or high avoidance

and low problem solving, cognitive restructuring, support seeking, and distraction (i.e. Avoidant Copers) tend to report greater perceived stress compared with students who combined high problem solving, moderate cognitive restructuring, and low support seeking, distraction, and avoidance (i.e. Adaptive Copers) or high cognitive restructuring with low problem solving, support seeking, distraction, and avoidance (i.e. Low Copers). Therefore, the coping profiles of Low Copers and Adaptive Copers appear more effective in reducing perceived stress than the coping profiles of High Copers and Avoidant Copers. Second, these results provided further explanation and completed existing literature regarding the coping profile of Low Copers. As in previous cluster-analytic studies [e.g. (Smith and Wallston, 1996; Rijavec and Brdar, 2002; Gaudreau and Blondin, 2004; Steele *et al.*, 2008; Doron *et al.*, 2013)], the group of Low Copers, who used relatively low levels of all coping strategies, is a noteworthy finding. In the study of Smith and Wallston (Smith and Wallston, 1996), the group of 'Low Copers' experienced lower level of pain than other patients, which may indicate that they have used coping strategies to a lesser extent because they perceived less pain to cope with. In the present study, Low Copers reported the lowest levels of perceived stress, which indicated that they have coped less intensively because of less negative stress. As such, the results provided meaningful conclusions regarding the coping profile of Lower Copers regarding association with perceived stress. Consequently, students may be able to protect themselves against stress even if they use very few coping strategies when their resources exceed the demands of stressful situations (Lazarus and Folkman, 1984).

Students' coping profiles and health-related behaviors

The present study is the first to investigate the relationships among coping profiles and health-related behaviors such as physical activity and substance consumption (coffee, alcohol, tobacco, cannabis and medicine). The findings complete previous studies who have simply examined the association between isolated coping strategies with physical activity or substance consumption (Naquin and Gilbert, 1996; Wills and Hirky, 1996; Allison *et al.*, 1997; Ingledew and McDonagh, 1998; Wagner *et al.*, 1999; Simons *et al.*, 2005; Laybourne *et al.*, 2011). They revealed that students who endorsed a

coping profile of Adaptive Copers and Low Copers were less likely to use substance (except alcohol for Low Copers) and more likely to practice physical activity. Conversely, students who endorsed a coping profile of High Copers and Avoidant Copers were more likely to use substance (except alcohol for High Copers) and more likely to fail to attain the physical activity recommendations. These results supported Wijndaele *et al.*'s (Wijndaele *et al.*, 2007) findings regarding association between coping profiles and physical activity. As such, the present study highlighted that not only certain coping strategies related to unhealthy behaviors, but also the profile of coping as a whole. Thus, it seems more valuable to consider the profile or combination of strategies that individuals endorsed in relationships with health-related behaviors. In addition, research has consistently demonstrated that students use substance for coping reasons (e.g. Allison *et al.*, 1997; see Armeli *et al.*, 2010, for a review; Naquin and Gilbert, 1996; Wagner *et al.*, 1999), but Low Copers might reported social drinking, not only escape drinking (Williams and Clark, 1998). Overall, the results of the present study are consistent with previous research in the nascent coping literature that employed cluster analysis (e.g. Smith and Wallston, 1996; Kaluza, 2000; Rijavec and Brdar, 2002; Gaudreau and Blondin, 2004; Wijndaele *et al.*, 2007; Steele *et al.*, 2008; Eisenbarth, 2012; Doron *et al.*, 2013). People who have a relative reliance on avoidance, distraction, as well as support seeking coping and de-emphasize problem solving and cognitive restructuring coping tend to report greater psychological distress and negatives health outcomes. In this line, the coping profile of Adaptive Copers may act as a buffer against unhealthy behaviors (Thompson *et al.*, 2010).

Gender differences in coping profiles

In the present study, group membership was significantly related to gender. In addition, gender was distributed unequally particularly in Low Copers, Avoidant Copers and High Copers groups. Most women were in High Copers group and most men were in Low Copers group. Similar gender differences in coping profiles have been reported previously [e.g. (Rijavec and Brdar, 2002; Wijndaele *et al.*, 2007)]. As highlighted by Rijavec and Brdar (Rijavec and Brdar, 2002), a coping pattern with high scores on all strategies is very frequent for women (High Copers), but not

for men. Conversely, a coping pattern with low scores on all strategies (Low Copers) is more frequent for men than for women. Further, past research has found that college women, unlike men, reported feeling more stress (Abouserie, 1994; Hudd *et al.*, 2000; Pierceall and Keim, 2007; Brougham *et al.*, 2009), expressed feelings more, sought emotional support and utilized denial, acceptance and positive reframing (Eaton and Bradley, 2008). They also used more social support compared with college men (Dwyer and Cummings, 2001). Therefore, the results of the present study were consistent with the coping literature. The High Copers group reported also the highest levels of perceived stress and engaged in unhealthy behaviors, such as not exercising and smoking [e.g. (Rijavec and Brdar, 2002; Wijndaele *et al.*, 2007)]. In contrast, the Low Copers group reported the lowest levels of perceived stress, and the adoption of healthy behavior such as exercising (Rijavec and Brdar, 2002; Wijndaele *et al.*, 2007). However, Low Copers reported also alcohol consumption. Gender also appeared to influence motivations for alcohol consumption [e.g. (Cooper *et al.*, 1992; Frone *et al.*, 1994)]. Finally, the Active Copers group tends to include an equal number of men and women. Research has not found a clear pattern of gender differences in college students' use of problem-solving strategies to cope with stress [e.g. (Brougham *et al.*, 2009)].

Implications

The present study exhibited a number of conceptual, methodological and practical strengths that improve the usefulness of coping data. This study contributed to the increased interest of researchers to investigate coping profiles simultaneously rather than in isolation. As outlined by Eisenbarth (Eisenbarth, 2012) 'individuals' relative reliance on some strategies and de-emphasis on others may be a more advantageous way of understanding the manner in which individuals cope with stress' (p. 486). As such, researchers may gain a deeper understanding of coping by identifying subgroups of individuals based on their coping profiles. Students at risk of suffering from stress and engaging in unhealthy behaviors to cope with stressful situations should be identified based on their coping profiles (i.e. High Copers and Avoidant Copers). This result implies that teaching of additional or effective use of coping skills and expanding individuals' coping repertoires may be

of greater use than simply trying to limit avoidance coping (Kaluza, 2000). Identifying these high-risk groups of students enables interventions to be developed and targeted appropriately in a cost-effective manner in large population undergoing a critical time in their development (Musselman and Rutledge, 2010). Accordingly, cluster analysis has the potential to make a major contribution to applied health psychology research, as it can identify groups that might best benefit from interventions (Clatworthy *et al.*, 2005). In addition, cluster analysis approach may have an advantage over more traditional statistical techniques (e.g. correlation, regression) by assisting health professionals in identifying distinct coping profiles to which individuals might belong and subsequently in shaping intervention designs to the unique dispositions and risks of the targeted group. For example, Kaluza (Kaluza, 2000), who identified distinct coping clusters and tailored stress-management training according to cluster-specific needs, has demonstrated this strategy successfully. Benefits were found by balancing or broadening one-sided coping profiles of individuals who were initially low in particular coping strategies. Clearly, the present study provided new knowledge that may help scholars develop prevention and intervention university programs.

Limitations and future directions

In spite of its contributions, the present study is not exempt from certain limitations. First, the use of self-reported measures might lead to a possible social desirability bias. Disclosing substance consumption may be a sensitive issue for students, even when anonymity is guaranteed. In order to facilitate the students' response to the survey, short measures of consumption have been used. Therefore, the results of the present study have to be replicated with validated measures of consumption. Second, a one-dimensional perspective of perceived stress was adopted, whereas Lazarus (Lazarus, 1999) highlighted the usefulness to adopt a multidimensional perspective of perceived stress (i.e. threat, harm, challenge). Future research needs to consider this multidimensional perspective to better examine the relationships between coping profiles and stress appraisals. Third, the cross-sectional design of this study prohibits statements of causality. In order to deal with these problems, prospective design using cluster analysis procedure and coping profiles is needed to elucidate causal relationships. This is

particularly important regarding the bounds between coping strategies and stress levels in order to give more credit to the idea that certain coping profiles are actually more adaptive compared with others in a given context. Fourth, a dispositional perspective was used to examine students' coping profiles while situation-based factors, such as specific environmental demands, were not considered. As such, longitudinal studies are necessary to determine the stability of identified coping clusters over time and capture the variability in coping that likely exists between and within situations. A final limitation concerns the almost exclusive reliance on French undergraduates as the population of participants in the current study. To be able to generalize these findings, this study should be replicated with a more comprehensive sample of students (e.g. students from multiple institutions, greater ethnic or racial diversity, a variety of academic majors, non-traditional aged students).

CONCLUSION

Using cluster analysis approach, this study adds to a growing literature on coping by identifying students' coping profiles and their associations with perceived stress and health-related behaviors. Clearly, the coping profiles of Avoidant Copers and High Copers comprised students at risk for experiencing stress and engaging in unhealthy behaviors. The identification of coping profiles in relation to health outcomes represents an important step in developing preventive interventions. Health professionals, by acknowledging group coping profiles, may be better able to predict those who are at an increased risk for suffering from stress and engaging in unhealthy behaviors and subsequently tailor prevention and intervention efforts to match coping tendencies of the target population. Overall, these findings suggested that future research should focus on coping profiles in order to provide a deeper understanding of how different individuals cope with stress and identify targeted groups most likely to benefit from specific health promotion and prevention campaigns.

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