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## Perceived stress, internal resources, and social support as determinants of mental health among young adults

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### Abstract

**Background:** Mental health is a central determinant of quality of life. While psychiatric morbidity of populations has been studied extensively, the role of perceived stress, social support, and internal resources as determinant of health is still poorly understood. **Methods:** We surveyed 2000 randomly selected university students. Perceived stress was measured by the Brief Encounter Psychosocial Instrument, social support by the Duke-UNC Functional Social Support Questionnaire, internal resources (mastery and self-esteem) by a brief version of the Pearlin coping questionnaire. Linear regression models were used to explore the relationships between these variables and mental health, based on the SF-12 health survey. **Results:** After two reminders, 1257 students answered the questionnaire. In bivariate analysis, mental health was negatively associated with stress and positively associated with internal resources and social support (all  $p$ -values < 0.001). In multiple regression analysis, internal resources were positively associated with mental health, and buffered the negative impact of stress on mental health. Internal resources and stress mediated the positive impact of social support on mental health. **Conclusions:** Our data confirm that perceived stress is an important risk factor for low mental health and suggest that mastery and self-esteem are important protective factors of mental health among young adults.

**Key words:** Mastery, Mental health, Self-esteem, Social support, Stress, Young adults

### Introduction

Mental health is a central determinant of quality of life. In western countries, particularly in younger population groups [1, 2], mental health disorders account for a large part of the overall burden of disease [3, 4], as well as for a considerable share of health care utilization [5]. While psychiatric morbidity of populations has been studied extensively, how most people maintain their emotional balance in every day life is still poorly understood. In particular, how internal resources, i.e., self-esteem and mastery, and external resources, i.e., social support, help people to deal with stressful aspects of their lives is an important issue that deserves further attention [6, 7].

The term 'stress' has been used to describe different constructs: (a) external stressors; (b) demand from the environment as perceived by the individual; and (c) a physiological response to threatening situations [8]. The negative effect of the two first constructs on mental health has been documented by several authors [8, 9].

Three main mechanisms have been proposed to explain how social support may affect mental health (Figure 1): (a) a significant beneficial effect of social support on mental health, after controlling for other predictors of mental health (direct effect) [10, 11]; (b) an indirect effect on mental health, where the effects of social support are mediated through the promotion of internal resources and coping abilities [12, 13], and (c) a

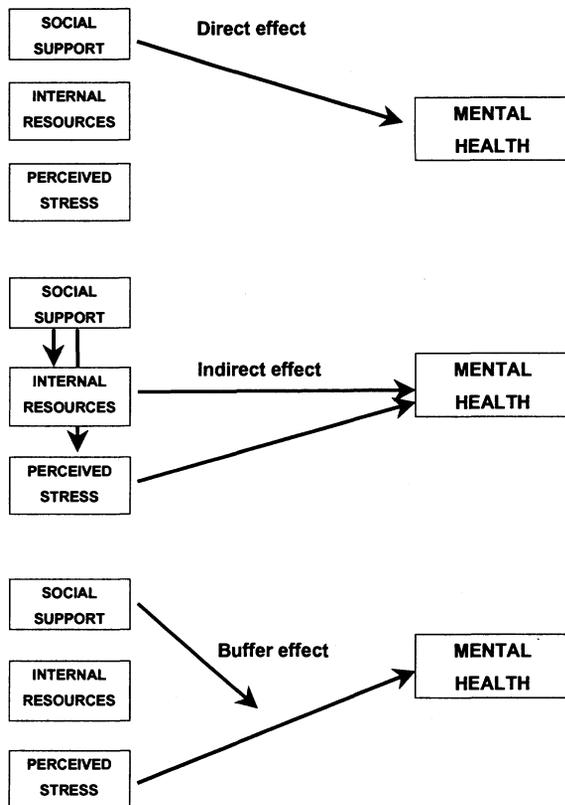


Figure 1. Proposed models for the effects of social support on mental health.

buffer or moderator effect, variation in the magnitude of the effect of social support on mental health across levels of stress, by reducing the negative impact of external stressors on mental health [9, 14–16]. By analogy, internal resources may also have a direct, indirect or buffer effect on mental health [17].

The respective contributions of these pathways are not fully understood, and all three mechanisms have been reported in the literature. In this study, we explored the respective contributions of perceived stress, social support, and internal resources as determinants of mental health status in a sample of young adults.

## Methods

The study was mandated by the Rector's office of the University of Geneva, Switzerland. Its primary purpose was to assess health care needs in the

students' population, and assist planning of student health services. Participants received a letter describing the study objectives and were informed that their response would be treated confidentially. The main results have been included in a report for the Rector's office [18]. The results reported herein are a secondary analysis of the data.

## Study design

We conducted a cross-sectional survey of a random sample of 2000 students enrolled in October 1997 at the University. After deletion of incorrect or foreign addresses, 1954 persons remained eligible. Questionnaires were sent by mail in November 1997, followed by up to two reminders over the next 2 months.

## Study variables and instruments

Mental health was measured by the SF-12 health survey (version 2) (<http://www.sf-36.com/general/sf12.html>) [19, 20]. This instrument allows computation of a physical health and a mental health summary score. Because algorithms to compute the scores were not available for the French SF-12 version 2 at the time of analysis, we performed a factor analysis of the 12 items, followed by varimax rotation. As expected, this analysis yielded a 2-factor solution, clearly interpretable as representing physical and mental health constructs. We used the resulting loadings to compute two orthogonal mental and physical health summary scores, each being a distinct linear combination of the 12 items (Table 1). Consistent with predictions, the general health item loaded moderately on both dimensions, while the other items loaded predominantly on the dimension they were designed to represent. Because we used a locally developed scoring algorithm, the physical and mental health scores are not literally SF-12 scores.

Stress was measured with the Brief Encounter Psychosocial Instrument (BEPI) [21, 22]. The instrument was slightly modified to allow self-administration: the first open-ended sensitisation item was removed, and the five closed-ended items were integrated in a table with corresponding 1–10 response scales. BEPI includes the following items: (1) extrinsic demand, or individual's perception of the balance between external demand and capa-

**Table 1.** Loadings from factor analysis (principal component analysis, varimax rotation) of the SF-12 items, among 1257 University adults, Geneva, Switzerland, 1997

SF-12 items	Mental health component	Physical health component
General health	0.44	0.42
Difficulty with moderate activities	-0.08	0.63
Difficulty climbing several flights of stairs	0.03	0.60
Accomplished less than would like due to physical problems	0.29	0.73
Limited in the kind of activities due to physical problems	0.35	0.72
Accomplished less than would like due to emotional problems	0.81	0.14
Did not do activities as carefully as usual due to emotional problems	0.78	0.13
Felt calm and peaceful	0.71	0.14
Felt downhearted and blue	0.81	0.05
Had a lot of energy	0.69	0.12
Pain interfered with normal work	0.17	0.67
Health interfered with social activities	0.74	0.16

bility; (2) intrinsic demand, or the importance of the individual's expectations as demands one places on oneself; (3) attributional demand, or expectations and demands that the individual places on his physical or interpersonal environment; (4) demand uncertainty, or the fact that uncontrollable events elicit a greater stress response than demands over which the individual has control; (5) demand perspective, or the ability to maintain perspective in the face of stressful demand. A stress score was constructed by adding scores of the five items. A low score corresponded to a low level of stress. The internal consistency of the scale was high (Cronbach's  $\alpha$ : 0.84), and a factor analysis confirmed that the items represented a single dimension.

Internal resources were measured with an 8-item instrument, adapted from Pearlin [23]. This instrument included two sub-scales, mastery and self-esteem. Both had good internal consistency (Cronbach's  $\alpha$ : 0.81 for self-esteem and 0.72 for mastery), and factor analysis showed that they were two distinct constructs.

A 6-item instrument adapted from the Duke-UNC Functional Social Support Questionnaire measured social support [24]. This instrument was composed of two sub-scales, confident support and affective support, with satisfactory internal consistency (Cronbach's  $\alpha$ : 0.70 for affective support and 0.79 for confident support). Factor analysis also confirmed these two constructs.

An official French translation of the SF-12 health survey version 2 was available. We produced three independent French translations of

each other instruments; two were obtained from the authors (PAB and TVP) and one from a multilingual secretary. A final version was obtained by consensus during a review session by an expert panel. We did not make a backtranslation. The resulting questionnaire was pre-tested for acceptability and clarity during face-to-face interviews with 20 University students. Description of the items and detailed validation of the instruments are reported elsewhere [25, 26].

#### *Data analysis*

Summary scales for physical and mental health were constructed using the resulting loadings from the factor analysis and standardized to mean 50 and standard deviation 10. Student *t*-test and analysis of variance were used to test for difference in mean health scores across levels of socio-demographic categorical variables; tests for linear trend were performed when the categorical variable was measured on an ordinal scale. Relationships between physical and mental health scores and internal resources and social support scores were assessed using Pearson correlation coefficients.

To test the hypotheses of direct, indirect and buffer effect of social support on mental health (Figure 1), we estimated the following regression models:

(1) Mental health =  $\beta_0 + (\beta_1 \times \text{stress}) + (\beta_2 \times \text{social support})$ ;

(2) Mental health =  $\beta'_0 + (\beta'_1 \times \text{stress}) + (\beta'_2 \times \text{social support}) + (\beta'_3 \times \text{internal resources})$ ;

(3) Mental health =  $\beta_0'' + (\beta_1'' \times \text{stress}) + (\beta_2'' \times \text{social support}) + (\beta_4'' \times \text{stress} \times \text{social support})$  where social support was either confident or affective support.

These models were interpreted as follows [27, 28]:

1. A direct effect was considered to be present if the coefficient ( $\beta_2$ ) of social support was statistically significant and remained significant after adjustment for other relevant predictors ( $\beta_2'$  and  $\beta_2''$  significant) [29].
2. An indirect effect was considered to be present if  $\beta_2$  was statistically significant and the difference  $\beta_2' - \beta_2$  was large as compared to  $\beta_2$ ; a 10% difference is generally regarded as reflecting confounding [30].
3. A buffer effect was considered to be present if the interaction term between stress and social support ( $\beta_4'$ ) was statistically significant [29].

Similar models were constructed for mastery and self-esteem. All scores were standardised to mean 0 and standard deviation 1, so that differences in mental health scores will be associated with a 1 standard deviation difference in social support, internal resources and stress. All regression models were adjusted for significant socio-demographic determinants of mental health.

Non-parametric regression (LOWESS) was used to analyse trends in scatter-plots across different levels of internal resources and social support [31]. All statistical tests were two-tailed, with a significance level of 0.05.

## Results

Overall, 1257 students answered the questionnaire (response rate 64%). The mean age of the respondents was 26 years (SD 5.6) and 58% were women. The majority were Swiss (73%), single (89%), had been living in Geneva for 10 years or more (60%), and 55% reported a monthly income between 1000 and 3999 SFr (approximately \$600–2500) (Table 2). Only a minority were living alone (20%). Sixty percent were enrolled in a license, 26% in a diploma and 14% in a PhD program. Non-respondents were more likely to be men and non-Swiss, but these differences were not statistically significant.

Male respondents, students younger than 34 years and Swiss citizens had better physical health, but the differences were small (Table 1). Male respondents, married students, those not living alone, students living in Geneva since 10 years or more, and students reporting higher monthly income had better mental health.

### *Correlation between the health measures, stress, internal resources, social support*

Completion rates were high for all instruments ( $\geq 98\%$  for all instruments). Strong correlations were observed between mental health summary score and stress, internal resources, and, to a lesser degree, social support (Table 3). Stress scores were also strongly correlated with self-esteem and mastery. Subscales reflecting internal resources and social support were correlated. The physical summary score showed weak but statistically significant relationships with the other scales.

### *Direct and indirect effect*

In simple linear regression analysis, the mental health summary score was significantly associated with all scores reflecting stress, social support, and internal resources (Table 4). The stress scale was the strongest predictor of mental health, as it explained 49% of its total variance (cf. Simple models). Stress remained the strongest correlate of mental health in all linear regression models, which suggests a strong direct effect of perceived stress on mental health. The direct effect hypothesis for social support was rejected based on near-zero and/or non-significant regression coefficients after adjustment for either internal resources (cf. Model 1) or stress (cf. Model 2). These results support the hypothesis that internal resources and/or stress mediate the effect of social support on mental health (indirect effect).

In contrast, a direct effect of internal resources on mental health was supported as strong associations were found between these variables after adjustment for social support and stress (cf. Models 3 and 4). Analyses also supported the hypothesis that social support and/or stress may be intervening variables in the relationship between internal resources and mental health.

**Table 2.** Socio-demographic determinants of physical and mental health among 1257 University students, Geneva, Switzerland, 1997

	N	%	Physical health		Mental health	
				p-Value		p-Value
Sex <sup>a</sup>				0.006		<0.001
Male	522	42	50.9		51.3	
Female	735	58	49.3		49.1	
Age (1 missing value) <sup>b</sup>				0.04		0.09
<25 years	611	49	50.2		49.6	
25–29 years	400	32	50.3		50.3	
30–34 years	144	11	50.2		50.3	
>34 years	101	8	47.2		51.2	
Citizenship <sup>a</sup>				0.04		0.37
Swiss	916	73	50.3		50.2	
Other	341	27	49.1		49.6	
Marital status (13 missing values) <sup>a</sup>				0.19		0.05
Single	1119	90	50.1		49.8	
Married	125	10	48.9		51.7	
Living alone (14 missing values) <sup>a</sup>				0.97		0.01
Yes	244	20	49.9		48.6	
No	999	80	50.0		50.4	
Number of years in Geneva (177 missing values) <sup>b</sup>				0.80		0.04
0–3	221	20	50.7		48.9	
>3–10	214	20	48.6		49.9	
>10	645	60	50.1		50.6	
Self-reported monthly income (46 missing values) <sup>b</sup>				0.93		<0.001
<1000 SFr	429	35	49.9		48.8	
1000–3999 SFr	667	55	50.2		50.0	
>3999 SFr	115	10	49.5		54.3	

Physical and mental health scores were standardized to mean 50 and standard deviation 10.

<sup>a</sup> Student *t*-test.

<sup>b</sup> ANOVA, test for linearity.

**Table 3.** Correlation (Pearson correlation coefficients) between physical and mental health scores and internal resources, social support and stress scales among 1257 University students, Geneva, Switzerland, 1997

	Physical health	Mental health	Self-esteem/ denigration	Mastery	Affective support	Confident support
Internal resources sub-scales						
Self-esteem/denigration	0.08*	0.53**				
Mastery	0.14**	0.54**	0.58**			
Social support sub-scales						
Affective support	0.11**	0.29**	0.27**	0.35**		
Confident support	0.11**	0.26**	0.27**	0.34**	0.57**	
Stress scale	–0.16**	–0.69**	–0.52**	–0.59**	–0.35**	–0.32**

\*  $p < 0.05$  level (two-tailed).

\*\*  $p \leq 0.001$  (two-tailed).

### Buffer effects

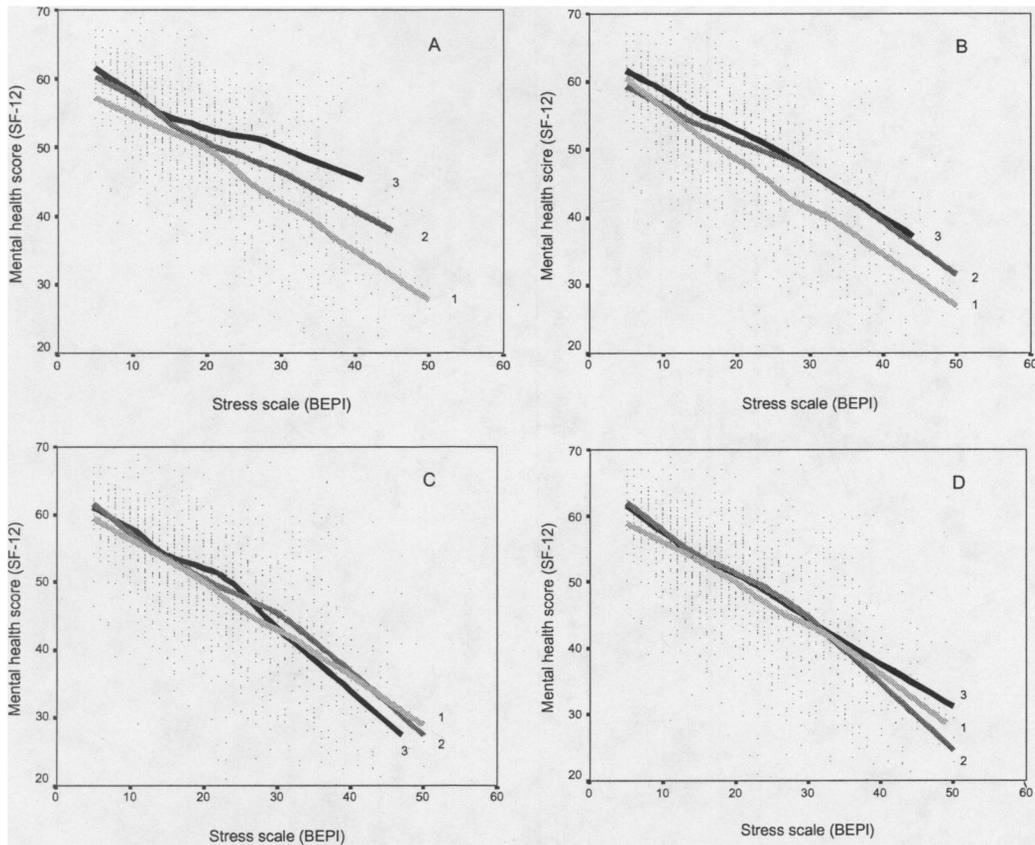
We further examined the association between stress and mental health graphically, stratifying on tertiles of internal resources. A nearly linear as-

sociation was observed between stress and mental health at all levels of mastery, and at any level of stress respondents who had high mastery reported higher mental health scores than those who had lower mastery scores (Figure 2A and B).

**Table 4.** Direct and indirect effect of stress, social support and internal resources on mental health scores among 1257 University students, Geneva, Switzerland

	Variables in the model												Model <i>F</i> ( <i>R</i> <sup>2</sup> )
	Stress		Social support sub-scales				Internal resources sub-scales				Mastery		
			Affective support		Confident support		Self-esteem/denigration		β	<i>p</i> -Value			
	β	<i>p</i> -Value	β	<i>p</i> -Value	β	<i>p</i> -Value	β	<i>p</i> -Value					
Simple models													
Stress	-0.68	<0.001	-	-	-	-	-	-	-	-	-	-	138.1 (0.49)
Affective support	-	-	0.29	<0.001	-	-	-	-	-	-	-	-	21.4 (0.13)
Confident support	-	-	-	-	0.30	<0.001	-	-	-	-	-	-	22.3 (0.13)
Self-esteem/denigration	-	-	-	-	-	-	0.51	<0.001	-	-	-	-	62.1 (0.30)
Mastery	-	-	-	-	-	-	-	-	0.52	<0.001	-	-	65.8 (0.31)
Model 1													
Social support and internal resources	-	-	0.06	0.05	0.08	0.01	0.30	<0.001	0.31	<0.001	-	-	64.3 (0.39)
Model 2													
Social support and stress	-0.65	<0.001	0.03	0.29	0.07	0.01	-	-	-	-	-	-	110.2 (0.49)
Model 3													
Internal resources and stress	-0.52	<0.001	-	-	-	-	0.18	<0.001	0.12	<0.001	-	-	126.1 (0.53)
Model 4													
Social support, internal resources and stress	-0.51	<0.001	0.009	0.74	0.10	0.08	0.17	<0.001	0.11	<0.001	-	-	103.9 (0.53)

Differences in mental health scores were obtained by linear regression and associated with a one standard deviation difference in social support, internal resources, and stress; all models were adjusted for sex, age, marital status, living alone, numbers of year in Geneva and self-reported monthly income.



**Figure 2.** (A) Relationship between mental health and stress scores, for three different levels (tertiles) of internal resources (A: mastery; B: self-esteem) and social support (C: affective support; D: confident support) scores, among 1257 young adults. Lines represent non-parametric regression estimates (LOWESS).

Furthermore, the slope of the association between stress and mental health appeared slightly steeper for lower levels of mastery. We tested this impression in a linear regression model including stress, mastery, and an interaction term between stress and mastery, as predictors of mental health (Table 5). Consistent with the graphical analysis, the interaction term between stress and mastery was statistically significant (cf. Model 4a). This result indicates that the protective effect of mastery is stronger at high than at low level of stress, a finding that supports the buffer hypothesis. A similar buffer effect was also observed for self-esteem, as a significant interaction term was also found between stress and self-esteem (cf. Model 4b).

By contrast, stratifying on tertiles of social support scales showed no such buffer effect (Fig-

ure 2C and D), and the interaction terms between stress and confident or affective support subscales were both non-significant (results not shown).

## Discussion

We found that stress and internal resources (i.e. mastery and self-esteem) were strong correlates of mental health in a sample of young adults. These two variables explained more than half of the total variance in mental health. Stress was consistently the strongest correlate of mental health, regardless of adjustment. The negative effect of stress on mental health was gradual, without evidence of a threshold. We measured perceived stress rather than external stressors, as reported by several other authors [8, 9, 17, 32]. As opposed to external

**Table 5.** Protective effect of mastery and self-esteem on mental health scores at higher level of stress among 1257 University students, Geneva, Switzerland

	Variables in the model												Model <i>R</i> <sup>2</sup>
	Stress		Social support sub-scales			Internal resources sub-scales			Stress ×				
	$\beta$	<i>p</i> -Value	Affective support	Confident support	Self-esteem/denigration	Mastery	Stress × mastery	Stress × self-esteem	$\beta$	<i>p</i> -Value	$\beta$	<i>p</i> -Value	
<b>Model 4a</b>													
Interaction between stress and mastery	-0.54	<0.001	0.01	0.69	0.06	0.05	-	0.16	<0.001	0.05	0.009	-	0.51
<b>Model 4b</b>													
Interaction between stress and self-esteem	-0.54	<0.001	0.02	0.49	0.05	0.05	0.19	<0.001	-	-	-	0.05	0.53

Differences in mental health scores were obtained by linear regression and associated with a one standard deviation difference in social support, internal resources, and stress; all models were adjusted for sex, age, marital status, living alone, numbers of year in Geneva and self-reported monthly income.

stressors, perceived stress results from the assessment of the potential impact of external stressors on the likelihood of reaching one's goal. Therefore, perceived stress captures these aspects of external stressors that are relevant to the individual. On the other hand, early coping mechanisms may also play a role in this process. Nevertheless, although perceived stress was not independent of internal resources, the association of stress with mental health remained strong even after adjustment for internal resources and social support.

The observed relationships between social support, internal resources and mental health supported some, but not all of the postulated mechanisms (Table 6). Internal resources, especially mastery, displayed a direct beneficial effect on mental health, and buffered the negative impact of stress on mental health. Having appropriate personal resources and performance abilities may enable the individual to respond more successfully to external stressors [33]. Inversely, the belief that one's resources are poor can lead to the appraisal that an event is unmanageable and thus stressful. Self-esteem also had direct beneficial effect on mental health, but whether self-esteem buffered the relationship between stress and mental health was less clear than for mastery. When people feel good about themselves, they cope with stress better [8].

Social support was positively related to mental health in bivariable analysis, but this relationship disappeared after adjusting for internal resources and stress. Neither social support subscale was independently associated with mental health, nor did they buffer the impact of stress on mental health. This observation suggests that social support exerts its beneficial effect by strengthening internal resources and/or diminishing perceived stress (indirect effect). There are three alternative explanations. The first is confounding: people with

higher social support happen to be subjected to less stress, and therefore have better mental health. This type of relationship finds little support in the literature [13]. The second is that the unadjusted significant association between social support and mental health was caused by response set bias, whereby some people tend to give favorable answers on any item in the survey. Third, the operational definition of social support that we used may have been inadequate. Because our study could not assess the causality of the observed associations, we cannot formally distinguish between these scenarios.

The main weakness of our study is its cross-sectional nature, which precludes an evaluation of temporal precedence and causality of the observed associations. Another limitation is our exclusive reliance on self-reported rating scales, which raises the issue of systematic positive or negative response tendencies. Furthermore, as no scale is perfectly reliable, random misclassification causes the relationships we have observed to appear weaker than they are in reality.

On the positive side, our results were obtained among a sample of healthy young adults and are more broadly generalizable than research conducted among selected groups of patients, such as mental health services users. Education level was similar for all participants. The sample was sufficiently large to allow exploration of even fairly weak associations. The participation rate was acceptable, and the scales we used were previously validated instruments that retained their psychometric properties in our sample.

In summary, having sufficient internal resources, such as mastery and self-esteem, may be an important prerequisite of mental health in young adults, especially when social support is low. These results have implications in orienting future research dealing with quality of care in mental health

**Table 6.** Summary of the respective contributions of social support and internal resources as determinants of mental health

	Social support		Internal resources	
	Affective support	Confident support	Mastery	Self-esteem
Direct effect on mental health	No	No	Yes	Yes
Indirect effect on mental health	Yes	Yes	Yes	Yes
Buffer effect on mental health	No	No	Yes	Yes

care, and for social services and career counseling dealing with young adults.

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