# Effects of life satisfaction and psychache on risk for suicidal behavior: a study based on data from Chinese undergraduates

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# Effects of life satisfaction and psychache on risk for suicidal behavior: a study based on data from Chinese undergraduates

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**Key words:** Suicidal ideation, suicide attempt, life satisfaction, psychache, Chinese undergraduates

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## ABSTRACT

**Objectives:** To examine the predicting effect of psychache and life satisfaction on risks of suicidal ideation and suicide attempt among young people.

**Design:** A cross-sectional study.

**Setting**: Data were collected from an online survey in Wuhan, China.

**Participants:** 5988 college students from 6 universities were selected by a stratified cluster sampling method.

**Primary and secondary outcome measures:** participant who reported have ever considered seriously about killing himself/ herself (in the past year or in him/her life) was define as suicide ideation. And who reported have ever tried or attempt to kill himself/herself (in the past year or in him/her life) and have suicide action was define as suicide attempt.

**Results:** Students with suicidal ideation or attempt more often reported low level of life satisfaction and high degree of psychache than counterparts without suicidal ideation or attempt. Regression analyses indicated that life satisfaction and psychache were significantly associated with the risk of suicidal ideation and the risk of suicidal attempt. Though psychache showed a relatively stronger effect than did life satisfaction, the effects of the two factors remained significant when they were individually adjusted for personal demographic characteristics. However, when the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt. Life satisfaction contributed unique variance in the statistical prediction of suicidal ideation.

**Conclusions：** Psychache and life satisfaction both have a significant effect on risk for suicidal behavior, and life satisfaction could relieve the effect of psychache when suicidal behavior is in the beginning. The results suggest that Shneidman's theory that psychache is the pre-eminent psychological cause of suicide, is perhaps applicable only to a more serious form of suicidal behavior.

## ARTICLE SUMMARY

### Research focus

Most of available studies about the pre-eminence of psychache in suicidality have only involved negative psychological variables, and little research attention has delved into positive factors, such as life satisfaction. The study aims to examine the predicting effect of psychache and life satisfaction on risks of suicidal ideation and suicide attempt among young people.

### Key messages

Life satisfaction and psychache were significantly associated with the risk of suicidal ideation and the risk of suicidal attempt.

However, when the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt.

The results suggest that Shneidman's theory that psychache is the pre-eminent psychological cause of suicide, is perhaps applicable only to a more serious form of suicidal behavior.

### Strengths and limitations of this study

The participants were selected from 6 universities in Wuhan China by stratified cluster sampling method, and the results are adjusted for important personal demographic characteristics.

It is uncertain to us if they are representative to undergraduates studying in other places of China such as the more developed coasts in China or the less developed western China.

## Introduction

Suicidal behaviour in young people has become an increasing social and public health problem in the contemporary China as well as in many parts of the world.[1-3] The behavior is complex and determined by many factors including personal socio-demographics,[4] life stressors,[5] biological features,[6] psychological traits,[7] psychiatric problems,[8] coping skills,[9] etc. Psychological pain is thought to be of great importance, playing an indispensable role in the process of becoming suicidal.[10]

Psychache, according to Shneidman, is defined as an acute state of intense and intolerable psychological pain that encompasses shame, guilt, humiliation, loneliness, fear, angst, dread, anguish, etc.[11] It is associated with many psychological suicideogenic factors such as depression and hopelessness, but is also conceptually distinct from these factors.[12 13] Evidence has shown that psychache is a significant and unique predictor for various suicide criteria, including suicidal ideation and suicide attempt, even after controlled for effects of depression and hopelessness.[12 14 15]According to Shneidman's theory, psychache is fundamentally linked with suicide in its own, whereas other psychological factors and affective states (e.g., depression, hopelessness) are relevant to suicide only insofar as they lead to psychache.[11] In other words, if the psychache is controlled, the single effect of many factors would be largely attenuated or become insignificant.[16] Thus, the psychache is the switch as whether a suicide happen or not. In concrete terms, if psychache is too heavy to tolerant for a person, the person will become suicidal -- thinking of dying as the best solution to relief from the intolerable psychache.[11] If psychache can be relieved or mollified, the lethality of method chosen for suicide would be reduced, and the individuals will continue to live.[17]

Some studies have suggested that completion of suicide is a balanced consequence, depending upon both the presence of risk factors and the absence of protective factors against suicide.[18] However, most of available studies about the pre-eminence of psychache in suicidality have only involved negative psychological variables, such as hopelessness,[12] depression[15] and alexithymia.[19] Little research attention has delved into positive factors, such as life satisfaction which is reported to be strongly and negatively correlated with suicidal ideation and suicide attempt[20 21] and to have a long-term effect on the risk of suicidal behavior.[22] To better understand the role of psychache in

mechanism of suicidality, we believe, studies taking into account effects of positive factors such as life satisfaction would provide interesting insights.

The primary purpose of the present study is to test Shneidman's theory of suicide by evaluating the contributions of life satisfaction and psychache to the statistical prediction of suicidality in a large sample of Chinese college students. Our specific aims include: (1) to examine the prevalence and characteristic of suicidal ideation and suicide attempt among Chinese college students by demographic variables, (2) to assess the effects of life satisfaction and psychache on risk of suicidal behavior, and (3) to explore the role of psychache in suicide theory.

## Method

### Participants

Of 8 universities attached directly to the ministries of the P. R.China in Wuhan city, 6 universities agreed to join the survey for this study. A stratified cluster sampling method was used to draw study subjects from all undergraduate students in these universities. A 10% sample of undergraduate students was assigned to each university, and then randomly selected in classes -- the cluster unites that are organized according to specialty and school year with usually 30-80 students. In case a selected class has more than 100 students, 100 students were further drawn randomly from this class. Otherwise, all students in the drawn classes were enrolled into the study. With this sampling procedure, a total of 7220 college students were sampled and 6096 students finally attended questionnaire survey for data collection in this study. Most students who did not attend the survey were out of the university campus for their internship during the period when the survey for this study was conducted. Each subject was assigned with a unique encrypted code to their student identification to be used for the survey.

The survey was conducted online. Students enrolled into the survey were informed about the purpose of the study, the confidentiality of the personal information and the principle of voluntarily. Of 6096 students who attended the online survey, 5988 completed all questionnaires designed for this study (response rate of 98.23%).

### Measurements

***Demographic variables*** Data on personal general information and demographic status such as gender, age, place of family residence, school year and specialty of study were collected.

***Life satisfaction*** Life satisfaction was assessed with the Satisfaction with Life Scale[23] which is a self-report questionnaire comprising 5 items [ i.e. (1) 'In most ways my life is close to my ideal'; (2) 'My life condition is very good'; (3) 'I am satisfied with my life', (4) 'I have got the important things which I want in the life'; (5) 'If I had new life, I would enjoy it just as I do now' ]. All items are answered on a 7-point Likert rating (1= 'strongly disagree'; 2= 'disagree'; 3= 'incomplete disagree'; 4= 'not sure'; 5= 'incomplete agree'; 6= 'agree'; and 7= 'strongly agree'). The averages score of the 5 items was calculated as the score of life satisfaction (scores range 1-7). The Satisfaction with Life Scale has strong psychometric properties with alpha reliability coefficients was 0.89[24] and 0.86.[25] In present study, the Alpha reliability coefficient was 0.85.

***Psychache*** Psychache was measured with the Psychache Scale[16] which is a 13-item (e.g., ''My soul aches") self-report questionnaire designed to assess Shneidman's conceptualization of psychache. All items are answered on a 5-point Likert rating (1= 'never', 2= 'sometimes', 3= 'often'; 4= 'very many', and 5= 'almost') and the total scores range from 13 to 65 (High score indicates high psychache level). In order to precisely capture the level of psychache, we constructed a continuous variable to categorize the score into 5 levels defined after taking into account the frequency distribution and score value as 1=13-15, 2=16-19, 3=20-22, 4=23-26, 5=27-65. Alpha reliability coefficients of this scale were general exceeding 0.90,[16 26] and the scale could distinguish between suicide attempters and non-attempters.[16] In present study, the Alpha reliability coefficient was 0.92.

***Suicidal ideation and attempt*** The dependent variable in the present study included both suicidal ideation and suicide attempt. Suicidal ideation was assessed with two items: (1) ''have you ever considered seriously about killing yourself in the past year? '', and (2) "have you ever seriously considered about killing yourself in your life?" These two items were answered on a 3-point rating (0 = 'never', 1 = 'sometimes', 2 = 'very often'). Participants who answered with '0' for the both items were regarded as ''without suicidal ideation'', and otherwise regarded as ''with suicidal ideation''.

Suicide attempt was assessed with three questions: (1) "have you ever tried or attempted to kill yourself in the past year?", (2) "have you ever tried or attempt to kill yourself in your life?" and (3)"have you ever had any suicidal action?". The first two items were answered on a 3-point rating

(0 = never, 1 = sometimes, 2 = very often) and the last item was answered with 'yes' or 'no'. Participants who answered with '0' for both of the first two items and 'no' for the last item were regarded as "without suicide attempt", and otherwise regarded as "with suicide attempt".

**Statistical analysis**

Chi-square test was used to examine the distribution difference of suicidal behavior (suicidal ideation and suicidal attempt) by demographic variables. T-test was conducted to explore the relations between life satisfaction, psychache and suicidal behaviour. Logistic regression models were conducted to evaluate the relative importance of statistical predict effect and the mechanism of psychache and life satisfaction on risk of suicidal behaviour. In the model I, five logistic regressions were manipulated to explore the separate predict effect of the demographic variables (gender, grade and age), life satisfaction and psychache. In model II, two logistic regressions were conducted to investigate the predict effect of life satisfaction and psychache, after controlling for effects of demographic variables. In model III, one logistic regression was used to exam the adjusted predict effects of life satisfaction and psychache while considering simultaneously life satisfaction and psychache as well as demographic factors in the model.

## Results

**General description**

The age of study subjects ranged from 14-26 years (Mean=19.94; SD=1.38). The total sample of 5988 students comprised 3171 male and 2770 female students (47 students did not report gender). Table 1 shows the distribution of general information and demographic status of the study subjects.

Table1 Demographic distribution of students in the study

| | Number (%) | | |
|---|---|---|---|
| **Demographic variables** | **Total** | **Male** | **Female** |
| Residence place of family | | | |
| Provincial capital or municipality directly under the Central Government | 921 (15.5) | 413 (44.8) | 508 (55.2) |

| | | | |
|---|---|---|---|
| County-level city | 1343 (22.6) | 660 (49.1) | 683 (50.9) |
| County | 795 (13.4) | 411 (51.7) | 384 (48.3) |
| Township | 855 (14.4) | 460 (53.8) | 395 (46.2) |
| Suburban countryside | 917 (15.4) | 500 (54.5) | 417 (45.5) |
| Remote countryside | 1107 (18.6) | 727 (65.7) | 380 (34.3) |
| Specialty of study | | | |
| Engineering | 2035 (34.3) | 1568 (77.1) | 467 (22.9) |
| Science | 2269 (38.2) | 1078 (47.5) | 1191 (52.5) |
| Liberal arts | 1637 (27.6) | 525 (32.1) | 1112 (67.9) |
| Grade | | | |
| Freshman | 2725 (45.9) | 1319 (48.4) | 1406 (51.6) |
| Sophomore | 1747 (29.4) | 1025 (58.7) | 722 (41.3) |
| Junior | 1133 (19.1) | 589 (52.0) | 544 (48.0) |
| Senior | 336 (5.7) | 238 (70.8) | 97 (29.2) |
| Age | | | |
| 14-18 years old | 823 (13.9) | 349 (42.4) | 474 (57.6) |
| 19-21 years old | 4348 (73.2) | 2320 (53.4) | 2028 (46.6) |
| 22-26 years old | 769 (12.9) | 501 (65.1) | 268 (34.9) |

**Characteristics of students with suicidal ideation and attempt**

Of the total students, 16.4% (982) participants had suicidal ideation and 1.9% (114) participants reported the presence of suicide attempt. Chi-square tests indicated significant group differences in prevalence of suicidal ideation and of suicide attempt with regards to most demographic variables. As shown in table 2, the prevalence in female students were significant higher than that of male students for both suicidal ideation ($X^2$=58.97, $p$<0.01) and suicide attempt ($X^2$=13.52, $p$<0.01). There were also significant differences in prevalence of suicidal ideation by specialty ($X^2$=32.72, $p$<0.01), school year ($X^2$=21.22, $p$<0.01) and age group ($X^2$=8.60, $p$<0.05). In concrete terms, suicidal ideation was more common among students studying Liberal Arts than college peers with specialty in Engineering ($X^2$=28.33, p<0.01) and Science ($X^2$=19.99, p<0.01). Senior students reported less suicidal ideation than did juniors ($X^2$=14.81, p<0.01), sophomores ($X^2$=11.64, p<0.01) and freshmen ($X^2$=19.23, p<0.01), and freshmen reported the highest rate of

suicidal ideation. Consistent with this, the proportion of students with suicidal ideation decreased with increasing age. Students aged 14 to 20 reported significantly more suicidal ideation than peers students at higher ages (compared with students of 22-26 years old: $X^2$=8.01, p<0.01).

Table 2 Prevalence of suicidal ideation and suicide attempt by demographic variables

| | Number | Suicidal ideation | | Test of difference | Suicidal attempt | | Test of difference |
|---|---|---|---|---|---|---|---|
| | N | N | % | | N | % | |
| Total | 5988 | 982 | 16.4 | | 114 | 1.9 | |
| Gender | | | | | | | |
| Males | 3171 | 413 | 13.0 | $\chi^2$=58.97** | 41 | 1.3 | $\chi^2$=13.52** |
| Females | 2770 | 566 | 20.4 | df=1 | 72 | 2.6 | df=1 |
| Residence place of family | | | | | | | |
| Provincial capital or municipality directly under the Central Government | 921 | 175 | 18.9 | $\chi^2$=6.26 df=5 | 26 | 2.8 | $\chi^2$=8.92 df=5 |
| County-level city | 1343 | 218 | 16.1 | | 27 | 2.0 | |
| County | 795 | 124 | 15.4 | | 19 | 2.4 | |
| Township | 855 | 129 | 15.0 | | 15 | 1.7 | |
| Suburban countryside | 917 | 151 | 16.2 | | 12 | 1.3 | |
| Remote countryside | 1107 | 184 | 16.5 | | 15 | 1.3 | |
| Specialty of study | | | | | | | |
| Engineering | 2035 | 289 | 14.2 | $\chi^2$=32.72** | 30 | 1.5 | $\chi^2$=4.54 |
| Science | 2269 | 348 | 15.3 | df=2 | 43 | 1.9 | df=2 |
| Liberal arts | 1637 | 342 | 20.9 | | 40 | 2.4 | |
| School year | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Freshman | 2725 | 493 | 17.8 | $\chi^2$=21.22** | 58 | 2.1 | $\chi^2$=5.61 |
| Sophomore | 1747 | 270 | 15.4 | df=3 | 31 | 1.8 | df=3 |
| Junior | 1133 | 191 | 16.8 | | 24 | 2.1 | |
| Senior | 336 | 28 | 8.3 | | 1 | 0.3 | |
| Age | | | | | | | |
| 14-18 | 823 | 150 | 18.1 | $\chi^2$=8.60* | 15 | 1.8 | $\chi^2$=3.79 |
| 19-21 | 4348 | 732 | 16.7 | df=2 | 91 | 2.1 | df=2 |
| 22-26 | 769 | 982 | 13.0 | | 8 | 1.0 | |

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

**Distribution of life satisfaction and psychache according to presence of suicidal behaviour**

Figure 1 presents the frequency distribution of students according to the level of life satisfaction and psychache. For life satisfaction, the scores exhibited a normal distribution, ranging from 1 to 7. However, the scores of psychache exhibited a partial normal distribution with the majority having a low score and a few at the high end. According to the Shneidman's theory, psychache is an intense and intolerable extreme state involving heavy psychological pain. [11] It is therefore reasonable that most of people experienced a mild psychological pain whilst intense psychological pain was present in the minority.

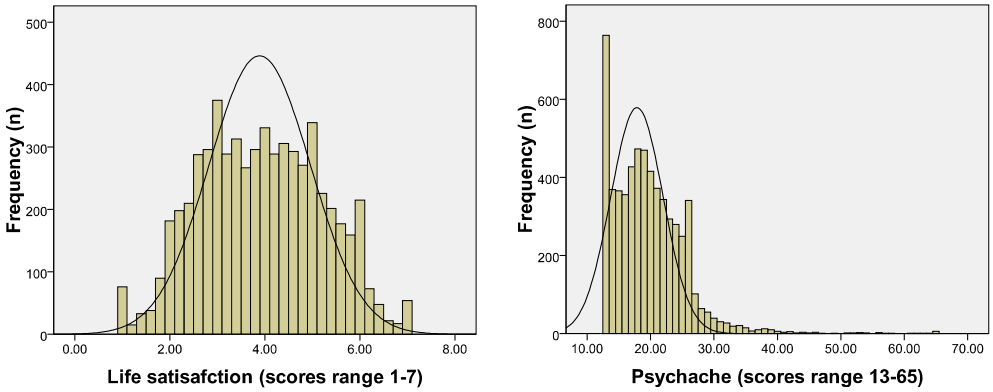


Figure 1 Distribution of life satisfaction and psychache scores in the study subjects

Table 3 present the means and standard deviations of life satisfaction and psychache scores according to the presence of suicidal ideation and suicide attempt. The results from t tests indicate that students with suicidal ideation or suicide attempt reported significantly lower score of life satisfaction and significantly higher score of psychache, which, in another word, means that high level of life satisfaction and low degree of psychache are proactive against suicidal behavior in this group of population.

Table 3 Scores of life satisfaction and psychache by presence of on suicidal ideation and suicide attempt

| | | Number of subjects | Mean (Standard deviation) | |
|---|---|---|---|---|
| | | | Life satisfaction | Psychache |
| Total | | | 3.93（1.29） | 1.56 (1.27) |
| Suicidal ideation | Yes | 982 | 3.50（1.22） | 2.44 (1.21) |
| | No | 5006 | 4.02（1.28） | 1.39 (1.20) |
| *t-test* | | | -11.97** | 24.95** |
| Suicide attempt | Yes | 114 | 3.48（1.44） | 2.55 (1.36) |
| | No | 5874 | 3.94（1.28） | 1.54 (1.26) |
| *t-test* | | | -3.81** | 8.49** |

*Note.* *$p$<0.05, **$p$<0.01；Life satisfaction scores range 1-7； Psychache scores range 0-4.

**Effect of life satisfaction and psychache on risk for suicidal ideation and suicide attempt**

Logistic regressions were further manipulated to evaluate the relative importance of statistical predict effects of psychache and life satisfaction on suicidal ideation and suicide attempt, as shown in table 4.

Table 4 Predictive effect of life satisfaction and psychache on risk of suicidal ideation and of suicide attempt

| **Suicidal ideation** | **Model I** | | | | **Model II** | | | | **Model III** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable of study** | **B** | **Wald** | **OR** | **CI (95%)** | **B** | **Wald** | **OR** | **CI (95%)** | **B** | **Wald** | **OR** | **CI (95%)** |
| Gender | -0.54 | 58.14** | 0.58 | 0.51-0.67 | | | | | -0.63 | 67.28** | 0.54 | 0.46-0.62 |
| Grade | -0.13 | 11.04** | 0.88 | 0.81-0.95 | | | | | 0.01 | 0.04 | 1.01 | 0.91-1.13 |
| Ages | -0.10 | 14.77** | 0.91 | 0.86-0.95 | | | | | -0.08 | 4.98* | 0.92 | 0.86-0.99 |
| Life satisfaction | -0.32 | 127.81** | 0.73 | 0.69-0.77 | -0.37 | 154.14** | 0.69 | 0.66-0.74 | -0.15 | 20.61** | 0.86 | 0.81-0.92 |
| Psychache | 0.67 | 497.41** | 1.96 | 1.85-2.08 | -0.69 | 500.01** | 1.98 | 1.87-2.11 | 0.63 | 380.03** | 1.88 | 1.77-2.01 |
| **Suicide attempt** | **Model I** | | | | **Model II** | | | | **Model III** | | | |
| **Variables of study** | **B** | **Wald** | **OR** | **CI (95%)** | **B** | **Wald** | **OR** | **CI (95%)** | **B** | **Wald** | **OR** | **CI (95%)** |
| Gender | -0.71 | 13.00** | 0.49 | 0.33-0.72 | | | | | -0.75 | 13.92** | 0.47 | 0.32-0.70 |
| Grade | -0.15 | 1.95 | 0.86 | 0.70-1.06 | | | | | -0.09 | 0.38 | 0.92 | 0.69-1.21 |
| Ages | -0.06 | 0.86 | 0.94 | 0.82-1.08 | | | | | 0.02 | 0.03 | 1.02 | 0.85-1.22 |
| Life satisfaction | -0.29 | 14.27** | 0.75 | 0.65-0.87 | -0.33 | 17.62** | 0.72 | 0.62-0.84 | -0.11 | 1.63 | 0.90 | 0.76-1.06 |
| Psychache | 0.62 | 63.12** | 1.86 | 1.60-2.17 | 0.61 | 60.70** | 1.85 | 1.58-2.16 | 0.57 | 45.14** | 1.77 | 1.50-2.09 |

Note：*P<0.05, **p<0.01；Life satisfaction scores range 1-7；Psychache scores range 1-5；Gender male=1 and female=0；Grade scores range 1-4.

Model I: crude analyses without any adjustment; Model II: only adjusted for gender, grade and age; Model III: adjusted for all variables listed in the table.

The results of model I and model II both indicated that life satisfaction and psychache were significant predictors of suicidal ideation and suicide attempt, and that a higher level of life

satisfaction was associated with a reduced risk while a higher level of psychache was associated with an increased risk for suicidal ideation and for suicide attempt. In the model III, psychache remained to have a significant effect on the risk for both suicidal ideation and suicide attempt. The effect was generally stronger for risk of suicidal ideation than that for suicide attempt as demonstrated consistently in all three models. However, the effect of life satisfaction on suicidal behaviour differed somehow in the model III. Its effect remained highly significant for the risk of suicidal ideation; but for suicide attempt, the effect attenuated into insignificant. This means that when the effects of demographic variables and psychache were controlled, life satisfaction did not have a significant predictive effect on suicide attempt, it was relevant to suicide attempt only insofar as they lead to psychache.

## Discussion

### Differences in suicidal ideation and attempt by gender, grade and specialty

The present study demonstrates that both suicidal ideation and suicide attempt were prevalent in female students than in the males. This mostly aligns with previous studies from China and many other places reporting higher prevalence of suicidal behaviors in young females than males.[27-30] As for the effect of specialty of study, there is no significant difference in suicidal attempt but a highly significant difference in suicidal ideations with a higher prevalence found in students studying Liberal Arts than those studying Engineering and Science. One possible reason for this could be that relative more female students study Literal Arts than other subjects as Engineering or Science. It may also reflect a selection of personality traits that Liberal Arts students react more sensitively and emotionally to events and stressors than counterpart students studying other subjects. In addition, the study indicates that students at lower grade or younger age reported more suicidal ideation than higher grade or older peers. These results are somehow expected and might be explained by limited experiences and ability to cope with stressors at the beginning of college life. With the increase of age and experience, the ability of coping is developing and the individuals become better in coping with stressors that they would not be able to handle at younger ages.

### Psychache, life satisfaction and suicidal behavior

The results of the study indicate that psychache and life satisfaction were both significant

predictors for suicidal ideation and suicide attempt in the study population. Psychache could better predict suicidal ideation and suicide attempt than did life satisfaction, as evidenced by its larger standardized regression coefficients. Similar findings have also been documented in other studies testing Shneidman's theory with samples of general population [31] and special groups as offenders, [26 32] homeless people[14] or patients with mental illness.[33] The result supports Shneidman's view that psychache is a fundamentally important predictor for suicidal behavior.

Further regression analyses of our data indicate that the mediating role of psychache on the occurrence of suicidal behavior differed slightly between suicidal ideation and suicide attempt. In prediction of suicide attempt, psychache accounted for a greater proportion of variance than did life satisfaction. The association between life satisfaction and suicidal attempt were completely residualized by psychache as Shneidman had predicted. Life satisfaction was relevant to suicide attempt only when it was associated with psychache. However, life satisfaction, independent of psychache, remained to have an additional significant contribution to suicidal ideation. In other words, psychache was not inevitable to suicidal ideation and played a partial role mediating the link between life satisfaction and suicidal ideation. This observation is in line with findings in a number of published studies. For instance, a study of a large scale college students showed that psychache did not fully mediate the association of suicidal ideation with hopelessness and the change in hopelessness over following-up remained to be a significant predictor.[34] One possible explanation to this result is that psychache may be associated with the more serious forms of suicidal behavior. Suicide is known as a continuous process with suicide attempt being more severe form than suicidal ideation.[11] Many factors influence suicidal attempt only insofar they are related to psychache, so psychache is the inevitable channel to suicidal attempt. A study conducted by Mendonca and Holden on population-based psychiatric inpatients also demonstrated that psychache exhibited a stronger influence in persons who had actually formulated a plan for suicide than those who had general suicidal desires.[35] That is to say that, psychache represents a more distal vulnerability in a chain culminating in suicidality.

In addition, our results show that psychache independently and positively predicted suicidal ideation and suicide attempt, and that the odds ratios associated with psychache were eliminated when adjusted for effects of life satisfaction and demographic variables simultaneously. These

results suggest that life satisfaction may be opposed and relieve psychache, and thus verify Shneidman's theory that if the psychache surpasses the threshold of tolerance and is subjectively judged to be unbearable, intolerable or unacceptable , the individuals would then die from suicide in order to escape from the suffer. [11] However, if psychache is relieved, e.g., via effect of protective factors as life satisfaction, then the originally unbearable psychological pain become acceptable and the individual would stay to live on.[17]

## Limitations

There are several limitations in the present study. Firstly, like most of reports published in this area, the present study is a cross-sectional investigation. This makes it impossible to document any causal relationship between life satisfaction, psychache and suicide. While the present study has provided some suggestive evidence, Shneidman's view that psychache is preeminence and prior the suicide needs to be further tested by studies with a cohort design.[17] Another limitation is about the generalizability of the findings from the present study. The study students were sampled strictly by a stratified cluster sampling method and from 6 of 8 universities in a major city in Central China. Yet we are confident that our subjects could well represent undergraduate college students in the area of Central China, it is uncertain to us if they are representative to undergraduates studying in other places of China such as the more developed coasts in China or the less developed western China. It is therefore preferable that more studies should be carried out to test the present findings and evaluate their generalizability. Thirdly, to our awareness, no protective variables such as life satisfaction have been encompassed in the Shneidman's model so far. Some postulates, for example, life satisfaction could relieve psychache and thus prevent suicide, need to be further verified by studies from various social settings.

## Conclusions

The present study sought to test the Shneidman's theory among Chinese college and to extend existing research by including a protective variable of life satisfaction. The results indicate that psychache and life satisfaction both contribute to risks for suicidal ideation and suicide attempt, and that psychache plays a mediating role on the link between life satisfaction and suicidal behavior. More specifically, psychache could fully mediate the relationship of life satisfaction with suicidal attempt, but acts as partial mediator linking life satisfaction with suicidal ideation,

suggesting that Shneidman's theory is probably more applicable to severe forms of suicidality.

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**Contributors** ZZ, PQ and ZY conceived the idea of the study; ZZ, PQ, ZY and CW designed the study. ZY, SY and MC undertook the data analysis; SY produced the tables and graphs; MC, ZY and SY prepared the initial draft of the manuscript. ZZ, PQ provided critical comments on the revised draft of the manuscript and contributed to the interpretation of the results. All authors read and approved the final manuscript.

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**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1, 2 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 4, 5 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 4, 5 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5, 6, 7 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 6, 7 |
| Bias | 9 | Describe any efforts to address potential sources of bias | *5, 6* |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 7 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 7 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 7 |
| | | (*c*) Explain how missing data were addressed | 5 |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | 5 |
| | | (*e*) Describe any sensitivity analyses | |
| **Results** | | | |

| | | | |
|---|---|---|---|
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 7, 8, 9, 10 |
| | | (b) Give reasons for non-participation at each stage | 5, 6, 7 |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 7, 8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | 7, 8, 9, 10, 11 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 7, 8, 9, 10, 11 |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 12 |
| | | (*b*) Report category boundaries when continuous variables were categorized | 5, 6, 7 |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 13, 14, 15 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 15 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 13, 14,15 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 15, 16 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 16 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

# Effects of life satisfaction and psychache on risk for suicidal behavior: a study based on data from Chinese undergraduates

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# Effects of life satisfaction and psychache on risk for suicidal behavior: a study based on data from Chinese undergraduates

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**Running Title:** LIFE SATISFACTION, PSYCHACHE AND SUICIDE BEHAVIOR

**Key words:** Suicidal ideation, suicide attempt, life satisfaction, psychache, Chinese undergraduates

**Word count: 3291**

**ABSTRACT**

**Objectives:** To examine the predicting power of psychache and life satisfaction on risks for suicidal ideation and suicide attempt among young people.

**Design:** A cross-sectional study.

**Setting**: Data were collected from an online survey in Wuhan, China.

**Participants:** 5988 university students from 6 universities were selected by a stratified cluster sampling method.

**Primary and secondary outcome measures:** Suicidal ideation and suicide attempt at some point of the students' life time were the outcomes of interest.

**Results:** Students with suicidal ideation or attempt more often reported low level of life satisfaction and high degree of psychache than counterparts without suicidal ideation or attempt. Regression analyses indicated that life satisfaction and psychache were significantly associated with the risk of suicidal ideation and the risk of suicidal attempt. Though psychache showed a relatively stronger predictive power than did life satisfaction, the effect of the two factors remained significant when they were individually adjusted for personal demographic characteristics. However, when the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt. Life satisfaction remained to contribute unique variance in the statistical prediction of suicidal ideation.

**Conclusions:** Psychache and life satisfaction both have a significant predict power on risk for suicidal behavior, and life satisfaction could relieve the predict power of psychache when suicidal behavior is in the beginning. Shneidman's theory that psychache is the pre-eminent psychological cause of suicide is perhaps applicable only to a more serious form of suicidal behavior.

## ARTICLE SUMMARY

### Research focus

Most studies testing Shneidman's theory on the pre-eminence of psychache in suicidality have been predominantly from North America and only involved negative psychological variables. The present study extends Shneidman's theory to another culture and includes the positive factor of life satisfaction into the model. Our purpose is to examine the predicting power of psychache and life satisfaction on risks for suicidal ideation and suicide attempt among university students in China.

### Key messages

- Life satisfaction and psychache were individually significantly associated with the risk for suicidal ideation and the risk for suicidal attempt. When the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt, but not the relationship of life satisfaction with suicidal ideation.
- The results suggest that Shneidman's theory that psychache is the pre-eminent psychological cause of suicide, is perhaps applicable only to a more serious form of suicidal behavior.

### Strengths and limitations of this study

- It is a cross-section study.
- Study subjects comprise a large sample of students randomly selected from 6 universities in a city of central China but it is uncertain if they could represent all university students in China.
- Self-reported suicide attempts may have limited validity or reliability.

## Introduction

Suicidal behaviour in young people has become an increasing social and public health problem in the contemporary China as well as in many other parts of the world. [1-3]With around 287.000 casualties in the total population of China each year, [4] suicide is the first leading cause of death for young people of 15 to 34 years old and the mortality among Chinese aged 15-24 years stands in the second highest place among the 39 countries that provide the data on suicide to the World Health Organization. [5] Suicide in China is known for its high odds ratio of the rates in rural versus urban areas, and in women versus men particularly in young age groups, [6 7] but the problem in other forms as suicidal ideation and suicide attempt in young Chinese is generally less known and warrants thorough investigation.

Suicidal behavior is a complicated phenomenon. It is associated with social and environmental factors and particularly with a variety of traits and disadvantages on a personal level. A great number of studies have demonstrated significant relationships of suicide with personal socio-demographics, [8] life stressors, [9] biological features, [10] psychological traits, [11] psychiatric problems, [12] coping skills, [13] etc. Psychological pain is thought to be of great importance, playing an indispensable role in the process of becoming suicidal. [14 15]

Psychache, according to Shneidman, is defined as an acute state of intense and intolerable psychological pain that encompasses shame, guilt, humiliation, loneliness, fear, angst, dread, anguish, etc. [16 17] It is associated with many psychological suicideogenic factors such as depression and hopelessness, but is also conceptually distinct from these factors. [18 19] Evidence has shown that psychache is a significant and unique predictor for various suicide criteria, including suicidal ideation and suicide attempt, even after controlled for effects of depression and hopelessness. [18 20 21] According to Shneidman, psychache is fundamentally linked with suicide in its own, whereas other psychological factors and affective states (e.g., depression, hopelessness) are relevant to suicide only insofar as they lead to psychache. [16 17] In other words, if psychache is controlled, the single effect of many factors would be largely attenuated or become insignificant. [22] Thus, psychache is the switch deciding whether a suicide happens or not. In concrete terms, if psychache is too heavy to tolerant for a person, the person will become suicidal -- thinking of dying as the best solution to relief from the intolerable psychache. [16 23] In contrast, if psychache can be relieved or mollified, the lethality of method chosen for suicide would be reduced, and the individuals will continue to live on. [24]

It is suggested that completion of suicide is a balanced consequence, depending upon both the presence of risk factors and the absence of protective factors against suicide. [25] However, most of available studies about the pre-eminence of psychache in suicidality have only involved negative psychological variables, such as hopelessness, [18] depression [21] and alexithymia. [26] Little research attention has delved into positive factors, such as life satisfaction – a measure that is reported to be strongly and negatively correlated with suicidal ideation and suicide attempt [27 28] and to have a long-term effect on the risk of suicidal behavior. [29] At the same time, suicide

studies testing Shneidman's model have been predominantly from North America, sparse study, to our awareness, has tested Shneidman's theory with a large sample from another culture. To better understand the role of psychache in mechanism of suicidality, we believe, studies that take into account effects of positive factors such as life satisfaction and that use data from diverse cultural backgrounds would provide interesting insights.

We therefore conducted the present study with the primary purpose to test Shneidman's theory of suicide by assessing the predictive power of life satisfaction and psychache on risk of suicidal behavior in a large sample of Chinese college students. Our specific aims include: (1) to examine the prevalence of suicidal ideation and suicide attempt among Chinese college students, (2) to assess the predictive power of life satisfaction and psychache on risk for suicidal behavior, and (3) to explore the role of psychache in the mechanism of suicidality.

## Method

### Participants

Of 8 universities that are attached directly to the ministries of the P. R.China and located in the city of Wuhan, 6 universities agreed to join the survey for this study. A stratified cluster sampling method was used to draw study subjects from all undergraduate students in these universities. A 10% sample of undergraduate students was assigned to each university, and then randomly selected in classes -- the cluster unite that is organized according to specialty and school year with usually 30-80 students. In case a selected class has more than 100 students, 100 students were drawn randomly from this class. Otherwise, all students in the drawn classes were enrolled into the study. With this sampling procedure, a total of 7220 college students were sampled and 6096 students finally attended questionnaire survey for the data collection, corresponding to a response rate of 84.44%. Most students who did not attend the survey were out of the university campus for their internship during the period when the survey was conducted.

The survey was conducted online. Each selected student was assigned with an encrypted code unique to their student identification to be used as personal password for online access to the website designed for the survey. Students enrolled into the survey were informed about the purpose of the study, the confidentiality of personal information and the principle of voluntarily. Of 6096 students who attended the online survey, 5988 completed all question items designed for this study and were therefore included in the final dataset for analyses.

### Measurements

For each participant, we collected data on personal general information and demographic status such as gender, age, place of family residence, school year and specialty of study alongside data on life satisfaction, psychache and suicidal behavior as described below.

***Life satisfaction***

Life satisfaction was assessed with the Satisfaction with Life Scale [30] which is a self-report questionnaire comprising 5 items [ i.e. (1) 'In most ways my life is close to my ideal'; (2) 'My life condition is very good'; (3) 'I am satisfied with my life', (4) 'I have got the important things which I want in the life'; (5) 'If I had new life, I would enjoy it just as I do now' ]. All items are answered on a 7-point Likert scale (1= 'strongly disagree'; 2= 'disagree'; 3= 'incomplete disagree'; 4= 'not sure'; 5= 'incomplete agree'; 6= 'agree'; and 7= 'strongly agree'). The averages score of the 5 items was calculated as the score of life satisfaction (scores range 1-7). The Satisfaction with Life Scale has strong psychometric properties with alpha reliability coefficients was 0.89 [31] and 0.86. [32]In present study, the Alpha reliability coefficient was 0.85.

***Psychache***

Psychache was measured with the Psychache Scale [22] which is a 13-item (e.g., ''My soul aches") self-report questionnaire designed to assess Shneidman's conceptualization of psychache. All items are answered on a 5-point Likert scale and the total scores range from 13 to 65 (High score indicates high psychache level). In order to precisely capture the level of psychache, we constructed a continuous variable to categorize the score into 5 levels defined after taking into account the frequency distribution and score value as 1=13-15, 2=16-19, 3=20-22, 4=23-26, 5=27-65. Alpha reliability coefficients of this scale were generally exceeding 0.90, [22 33] and the scale could distinguish between suicide attempters and non-attempters. [22] In present study, the Alpha reliability coefficient was 0.92.

***Suicidal ideation and suicide attempt***

Suicidal ideation was defined as thoughts or wishes to be dead or to kill oneself according to Schneidman and Silverman et al.[14 34 35] It was assessed through the following two question items: (1) ''have you seriously considered about killing yourself in the past one year", and (2) "have you ever seriously considered about killing yourself in your life". These two items were answered on a 3-point Likert rating (0 = 'never', 1 = 'sometimes', 2 = 'very often'). Participants who answered with '0' for the both items were regarded as ''without suicidal ideation'', all others were regarded as ''with suicidal ideation''.

Suicide attempt was defined as a self-inflicted behavior with a nonfatal outcome for which there is evidence of intent to die. [34] It was assessed with three questions: (1) "have you ever tried or attempted to kill yourself in the past year", (2) "have you ever tried or attempted to kill yourself in your life" and (3) "have you ever taken any non-fatal suicidal action". The first two items were answered on a 3-point Likert rating (0 = never, 1 = sometimes, 2 = very often) and the third item had a binary answer of 'yes' or 'no'. Participants who answered with '0' for both of the first two items and 'no' for the third item were regarded as "without suicide attempt", and otherwise regarded as "with suicide attempt".

**Statistical analysis**

Chi-square test was used to examine the distribution difference of suicidal behavior (suicidal

ideation and suicidal attempt) by demographic variables. T-test was conducted to test the variation of scores on life satisfaction and psychache according to the presence of suicidal behaviour. Logistic regression was used to assess the predictive power of psychache and life satisfaction on risk of suicidal behavior and also to evaluate the relative importance of these two factors via three models. Model I estimated the crude effect of each variable of interest; model II estimated the individual effect of life satisfaction and of psychache in the adjustment of demographic variables; and model III the adjusted effect when all variables were included in the model.

## Results

### General description

The total sample of 5988 students comprised 3203 male and 2785 female students, with the age ranging from 14 to 26 years (Mean=19.94; SD=1.38). Table 1 shows the demographic distribution of the study participants in details.

Table1 Demographic distribution of students in the study

| Demographic variables | Number (%) | | |
|---|---|---|---|
| | Total | Male | Female |
| Residence place of family | | | |
| Provincial capital or direct-controlled municipality | 924 (15.4) | 413 (44.7) | 511 (55.3) |
| County-level city | 1353 (22.6) | 665 (49.2) | 688 (50.8) |
| County | 803 (13.4) | 417 (51.9) | 386 (48.1) |
| Township | 861 (14.4) | 465 (54.0) | 396 (46.0) |
| Suburban countryside | 930 (15.5) | 510 (54.8) | 420 (45.2) |
| Remote countryside | 1114 (18.6) | 733 (65.8) | 381 (34.2) |
| Specialty of study | | | |
| Engineering | 2036 (34.0) | 1568 (77.0) | 468 (23.0) |
| Science | 2310 (38.6) | 1107 (47.9) | 1203 (52.1) |
| Liberal arts | 1642 (27.4) | 528 (32.2) | 1114 (67.8) |
| Grade | | | |
| Freshman | 2770 (46.3) | 1351 (48.8) | 1419 (51.2) |
| Sophomore | 1748 (29.2) | 1025 (58.6) | 723 (41.4) |
| Junior | 1134 (18.9) | 589 (51.9) | 545 (48.1) |
| Senior | 336 (5.6) | 238 (70.8) | 98 (29.2) |
| Age | | | |

| | | | |
|---|---|---|---|
| 14-18 years old | 828 (13.8) | 352 (42.5) | 476 (57.5) |
| 19-21 years old | 4390 (73.3) | 2349 (53.5) | 2041 (46.5) |
| 22-26 years old | 770 (12.9) | 502 (65.2) | 268 (34.8) |

Note. In the study population, 3 students did not report the region of permanent family residence.

Of the total students, 16.4% (982) participants reported the presence of suicidal ideation and 1.9% (114) reported a history of suicide attempt at some point of their life time. The prevalence differed significantly with regards to most demographic variables as shown in Table 2. Suicidal ideation was more prevalent in female than male students (20.4% vs 12.9%), in students coming from large cities as provincial capitals or direct-controlled municipalities (18.9%), and in students studying liberal arts (20.8%), in freshman students (17.8%), and consistent with this, in students at relatively younger age groups. These observed patterns remained very similar when looking at the self-reported presence of suicide attempt, although the differences by most demographic factors did not reach a statistical significance. Still, it is evident that female students reported a significantly higher rate of suicide attempt (2.6%) than their male counterparts studying in the universities (2.6% vs 1.3%).

Table 2Prevalence of suicidal ideation and suicide attempt by demographic variables

| | **Number** | **Suicidal ideation** | **Test of difference** | **Suicidal attempt** | **Test of difference** |
|---|---|---|---|---|---|
| | **N** | **N (%)** | | **N (%)** | |
| *Total* | 5988 | 982(16.4) | | 114(1.9) | |
| *Gender* | | | $\chi^2$=60.63 | | $\chi^2$=12.95 |
| Males | 3203 | 414(12.9) | df=1 | 42(1.3) | df=1 |
| Females | 2785 | 568(20.4) | p=0.0000 | 72(2.6) | p=0.0002 |
| *Residence place of family* | | | $\chi^2$=6.26 | | $\chi^2$=8.92 |
| Provincial capital or direct-controlled municipality | 924 | 175(18.9) | df=5 p=0.2819 | 26(2.8) | df=5 p=0.1123 |
| County-level city | 1353 | 218(16.1) | | 27(2.0) | |
| County | 803 | 124(15.4) | | 19(2.4) | |
| Township | 861 | 129(15.0) | | 15(1.7) | |
| Suburban countryside | 930 | 151(16.2) | | 12(1.3) | |
| Remote countryside | 1114 | 184(16.5) | | 15(1.3) | |
| *Specialty of study* | | | $\chi^2$=33.16 | | $\chi^2$=4.51 |

| | | | | | |
|---|---|---|---|---|---|
| Engineering | 2036 | 289(14.2) | df=2 | 30(1.5) | df=2, |
| Science | 2310 | 351(15.2) | p=0.0000 | 44(1.9) | p=0.105 |
| Liberal arts | 1642 | 342(20.8) | | 40(2.4) | |
| *School year* | | | $\chi^2$=21.22 | | $\chi^2$=5.61 |
| Freshman | 2770 | 493(17.8) | df=3 | 58(2.1) | df=3 |
| Sophomore | 1748 | 270(15.4) | p=0.0001 | 31(1.8) | p=0.1322 |
| Junior | 1134 | 191(16.8) | | 24(2.1) | |
| Senior | 336 | 28(8.3) | | 1(0.3) | |
| *Age* | | | $\chi^2$=8.56 | | $\chi^2$=3.79 |
| 14-18 | 828 | 150(18.1) | df=2 | 15(1.8) | df=2 |
| 19-21 | 4390 | 732(16.7) | p=0.0138 | 91(2.1) | p=0.1500 |
| 22-26 | 770 | 100(13.0) | | 8(1.0) | |

Note. In the study population, 3 students did not report the region of permanent family residence.

**Distribution of life satisfaction and psychache according to presence of suicidal behaviour**

Figure 1 shows the frequency distribution of students according to the level of life satisfaction and the raw score of psychache. For life satisfaction, the scores exhibited a normal distribution, ranging from 1 to 7. However, the scores of psychache exhibited a partial normal distribution with the majority having a low score and a few at the high end. According to the Shneidman's theory, psychache is an intense and intolerable extreme state involving heavy psychological pain. It is therefore reasonable that most of people experienced a mild psychological pain whilst intense psychological pain was present in the minority.

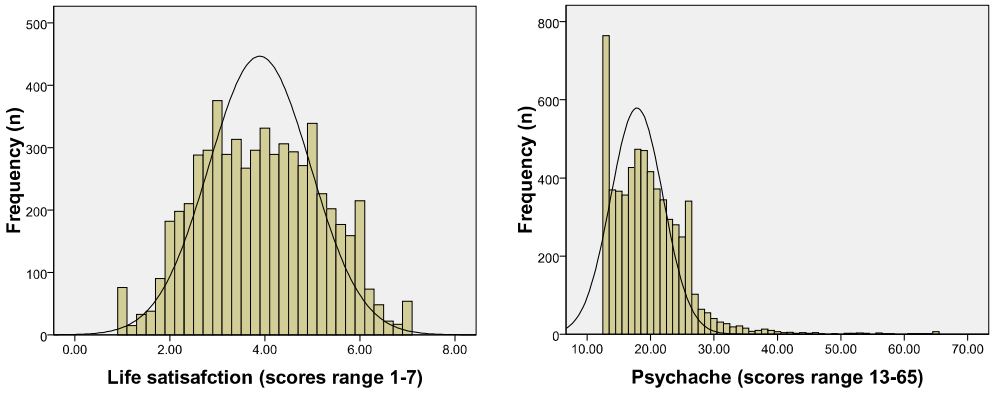


Figure 1 Distribution of life satisfaction and psychache scores in the study subjects

Table 3 presents the means and standard deviations of the scores on life satisfaction and psychache according to the presence of suicidal ideation and suicide attempt. The results from t

tests indicate that students with suicidal ideation or suicide attempt reported a significantly lower score of life satisfaction and a significantly higher score of psychache. This, in other words, means that high level of life satisfaction and low degree of psychache are proactive against suicidal behavior within this population.

Table 3 Scores of life satisfaction and psychache by presence of suicidal ideation and suicide attempt

| | | Number of subjects | Mean (Standard deviation) | |
|---|---|---|---|---|
| | | | Life satisfaction | Psychache |
| Total | | | 3.93（1.29） | 1.56 (1.27) |
| Suicidal ideation | Yes | 982 | 3.50（1.22） | 2.44 (1.21) |
| | No | 5006 | 4.02（1.28） | 1.39 (1.20) |
| t-test | | | -11.97 | 24.95 |
| df | | | 5986 | 5986 |
| p | | | 0.0000 | 0.0000 |
| Suicide attempt | Yes | 114 | 3.48（1.44） | 2.55 (1.36) |
| | No | 5874 | 3.94（1.28） | 1.54 (1.26) |
| t-test | | | -3.81 | 8.49 |
| df | | | 5986 | 5986 |
| p | | | 0.0001 | 0.0000 |

*Note.* Life satisfaction score ranges from 1 to 7 ; Psychache score ranges from 1 to 5.

**Effect of life satisfaction and psychache on risk for suicidal ideation and suicide attempt**

Table 4 displays the results from modelling the data with logistic regression in order to assess the statistical predictive power of psychache and life satisfaction on risk for suicidal ideation and suicide attempt.

Table 4 Predictive power of life satisfaction and psychache on risk of suicidal ideation and of suicide attempt

| Suicidal ideation | Model I | | | | | Model II | | | | | Model III | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable of study** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** |
| Gender | -0.55 | 59.75 | 0.0000 | 0.58 | 0.51-0.67 | | | | | | -0.64 | 71.53 | 0.0000 | 0.53 | 0.45-0.61 |
| Grade | -0.13 | 11.04 | 0.0009 | 0.88 | 0.81-0.95 | | | | | | 0.04 | 0.69 | 0.4049 | 0.96 | 0.87-1.06 |
| Ages | -0.19 | 7.48 | 0.0062 | 0.83 | 0.73-0.95 | | | | | | -0.07 | 0.78 | 0.3785 | 0.93 | 0.79-1.10 |
| Life satisfaction | -0.32 | 127.81 | 0.0000 | 0.73 | 0.69-0.77 | -0.36 | 151.82 | 0.0000 | 0.70 | 0.66-0.74 | -0.15 | 19.89 | 0.0000 | 0.81 | 0.81-0.92 |
| Psychache | 0.67 | 497.41 | 0.0000 | 1.96 | 1.85-2.08 | -0.68 | 498.28 | 0.0000 | 1.98 | 1.86-2.10 | 0.63 | 379.54 | 0.0000 | 1.76 | 1.76-2.00 |

| Suicide attempt | Model I | | | | | Model II | | | | | Model III | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables of study** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** |
| Gender | -0.69 | 12.47 | 0.0004 | 0.50 | 0.34-0.74 | | | | | | -0.73 | 13.18 | 0.0003 | 0.48 | 0.33-0.72 |
| Grade | -0.15 | 1.95 | 0.1626 | 0.86 | 0.70-1.06 | | | | | | -0.06 | 0.25 | 0.6164 | 0.94 | 0.73-1.20 |
| Ages | -0.20 | 1.17 | 0.2802 | 0.82 | 0.57-1.17 | | | | | | -0.04 | 0.04 | 0.5810 | 0.96 | 0.63-1.46 |
| Life satisfaction | -0.29 | 14.27 | 0.0002 | 0.75 | 0.65-0.87 | -0.33 | 17.85 | 0.0000 | 0.72 | 0.62-0.84 | -0.11 | 1.56 | 0.2123 | 0.90 | 0.76-1.06 |
| Psychache | 0.62 | 63.12 | 0.0000 | 1.86 | 1.60-2.17 | 0.62 | 62.90 | 0.0000 | 1.87 | 1.60-2.18 | 0.58 | 47.10 | 0.0000 | 1.79 | 1.52-2.11 |

Value of variables: Gender 0(female) – 1 (male); Grade 1 – 4; Age group 1 (14-18 years old) – 3 (22-16 years old); Life satisfaction score 1 – 7; Psychache score 1 – 5.

Model I: crude analyses without any adjustment; Model II: only adjusted for gender, grade and age; Model III: adjusted for all variables listed in the table.

The results from model I and model II both indicated that life satisfaction and psychache had a significant power in predicting suicidal ideation and suicide attempt, and that a higher level of life satisfaction was associated with a reduced risk while a higher level of psychache was associated with an increased risk for suicidal ideation and for suicide attempt. In model III, psychache remained to have a significant effect on the risk for both suicidal ideation and suicide attempt. The effect of life satisfaction, however, differed somehow in model III; its predictive power remained highly significant for the risk of suicidal ideation but attenuated into insignificant for suicide attempt. This means that when the effects of demographic variables and psychache were controlled, life satisfaction did not have a significant predictive effect on suicide attempt, it was relevant to suicide attempt only insofar as it led to psychache.

**Discussion**

In this study, we have investigated the role of life satisfaction and psychache on suicidal ideation and suicide attempt among university students in China using a large random sample from 6 universities. It is, to our awareness, the first study to examine Schneidman's theory on psychache and suicidology in a Chinese culture, and also the first to assess the role of psychache on suicidality in the context of the positive psychological factor of life satisfaction.

**Differences in suicidal ideation and attempt by gender, grade and specialty**

The present study demonstrates that both suicidal ideation and suicide attempt were more prevalent in female students than in the males. This mostly aligns with previous studies from China and many other places reporting higher prevalence of suicidal behaviors in young females than young males. [36-39] One explanation of the higher female versus male suicidal behavior in our study population perhaps lies in the Chinese culture, especially, the deep-rooted Confucianism produced in a patriarchy which trended to denigrate women. [39 40] On the other hand, since the observed phenomenon exists worldwide regardless of culture, we believe that, the gender specific personality traits may to a large extend contribute to our observation. [36-39]

Our finding that students studying Literal Arts reported a significantly higher occurrence of suicidal ideation and also modestly higher suicide attempt than their peers studying Engineering and Science is interesting. Of course, the fact that relative more female students choose to study Literal Arts than other subjects may contribute to the result. It may also reflect a selection of personality traits that Liberal Arts students may react more sensitively and emotionally to events and stressors than counterpart students studying other subjects.

In addition, we note that students in the early school years or at a younger age reported more suicidal ideation than their higher grade or elder peers. These results are somehow as expected and could well be explained by the hardship to adapt to the college life and limited experience in handling stressors at the beginning of college life. With the increase of age and experience, the students become better in coping with and handling stressors that they would not be able to handle at younger ages.

**Psychache, life satisfaction and suicidal behavior**

The present study indicates that psychache and life satisfaction were both significant predictors for suicidal ideation and suicide attempt in the study population. Psychache had stronger power in predicting suicidal ideation and suicide attempt than had life satisfaction, as evidenced by its larger standardized regression coefficients. This result is in line with the finding from other studies testing Shneidman's theory with samples of general population [41] and special groups as offenders, [33 42] homeless people [20] and patients with mental illness. [43] The result supports Shneidman's view that psychache is a fundamentally important predictor for suicidal behavior.

Moreover, our analyses further indicate that the mediating role of psychache on the occurrence of suicidal behavior differed slightly between suicidal ideation and suicide attempt. In prediction of suicide attempt, psychache accounted for a greater proportion of variance than did life satisfaction. The association between life satisfaction and suicidal attempt were completely residualized by psychache as Shneidman had predicted. Life satisfaction was relevant to suicide attempt only when it was associated with psychache. However, for suicidal ideation, life satisfaction, independent of psychache, remained to have an additional significant contribution. In other words, psychache was not inevitable to suicidal ideation and played a partial role mediating the link between life satisfaction and suicidal ideation. This observation is in line with findings in a number of published studies. For instance, a study of a large scale college students showed that psychache did not fully mediate the association of suicidal ideation with hopelessness and the change in hopelessness during the follow-up period remained to be a significant predictor. [44] One possible explanation to this result is that psychache may be associated with more serious forms of suicidal behavior. Suicide is known as a continuous process with suicide attempt being more severe form than suicidal ideation. [16] Many factors influence suicidal attempt only insofar they are related to psychache, so psychache is the inevitable channel to suicidal attempt. A study conducted by Mendonca and Holden on population-based psychiatric inpatients also demonstrated that psychache exhibited a stronger influence in persons who had actually formulated a plan for suicide than those who had general suicidal desires. [45] That is to say that, psychache represents a more distal vulnerability in a chain culminating in suicidality.

In addition, our results show that psychache is independently and positively associated with suicidal ideation and suicide attempt, and that the odds ratios associated with psychache were eliminated when adjusted for effects of life satisfaction and demographic variables simultaneously. These results suggest that life satisfaction may be opposed and relieve psychache, and thus verify Shneidman's theory that if the psychache surpasses the threshold of tolerance and is subjectively judged to be unbearable, intolerable or unacceptable , the individuals would then die from suicide in order to escape from the suffering. [16] However, if psychache is relieved, e.g., via effect of protective factors such as life satisfaction, then the originally unbearable psychological pain become acceptable and the individual would stay to live on. [24]

From a clinical poin of view, the phenomenology of suicide refers to the inner world of individuals and focuses on what the individual feels as well as understanding from the inside whenever a clinician encounters a patient. [46] Shneidman considers psychache to be the main ingredient of suicide, [17] and regards suicide not as a movement toward death but rather as a remedy to escape from intolerable emotion, unendurable or unacceptable anguish. [24] Suicidal individuals experience dichotomous thinking, wishing for either some specific (almost magical) total solution for their psychache or cessation (suicide), and suicide is the result of an interior dialogue during which the mind scans its options. [23] The present study indicates that life satisfaction may relieve the psychache and therefore reduces the risk for suicidal ideation and suicide attempt. Treatment for psychache, e.g., using anodyne psychotherapy [47] to mollify unbearable psychological pain, may well have an effect on reducing the risk for suicidal behavior.

**Limitations of the study**

There are several limitations of the present study. Firstly, like most research in this area, the present study is a cross-sectional investigation. This makes it impossible to document any causal relationship of life satisfaction and psychache with suicidal ideation or suicide attempt. While the present study is supportive to Shneidman's view concerning the preeminent role of psychache on suicidal behavior, further studies with a cohort design are needed to verity the possible causal pathways. Secondly, self-reported suicide attempts have limited validity or reliability due to recall bias, [35] we are unable to verify if the reported suicide attempt truly happened in the students' real life. Another concern is related to the generalizability of the findings from the present study. The study students were sampled strictly by a stratified cluster sampling method and from 6 universities in a major city in Central China. Yet we are confident that these students could well represent all undergraduate college students in the area of Central China, we are uncertain whether they are representative to undergraduates studying in other places of China such as the more developed coasts and the less developed western China. This calls for more research to test the model using samples from other parts of China as well from areas with different cultures. Moreover, to our awareness, no protective variable such as life satisfaction have been encompassed in the Shneidman's model so far. Some postulates, for example, that life satisfaction could relieve psychache and thus prevent suicide, need to be further verified by studies from various social settings.

**Conclusions**

The present study sought to test the Shneidman's theory of suicide as psychache using a large sample of university students in China, and to extend existing research by including the protective variable of life satisfaction. The results indicate that psychache and life satisfaction both contribute to the risk for suicidal ideation and suicide attempt, and that psychache plays a mediating role on the link between life satisfaction and suicidal behavior. More specifically, psychache could fully mediate the relationship of life satisfaction with suicidal attempt, but acts as

partial mediator linking life satisfaction with suicidal ideation, suggesting that Shneidman's theory is probably more applicable to severe forms of suicidality.

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**Contributors** ZZ, PQ and ZY conceived the idea of the study; ZZ, PQ, ZY and CW designed the study. ZY and SJ undertook the data analysis and produced the tables and graphs; ZY and SJ prepared the initial draft of the manuscript. ZZ and PQ contributed to the interpretation of the results and made the critical revision of the manuscript. All authors read and approved the final manuscript.

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**Competing interests** None.

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# Effects of life satisfaction and psychache on risk for suicidal behavior: a study based on data from Chinese undergraduates

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**Running Title:** LIFE SATISFACTION, PSYCHACHE AND SUICIDE BEHAVIOR

**Key words:** Suicidal ideation, suicide attempt, life satisfaction, psychache, Chinese undergraduates

**Word count: 3291**

**ABSTRACT**

**Objectives:** To examine the predicting ~~effect of~~power of psychache and life satisfaction on risks ~~of~~ for suicidal ideation and suicide attempt among young people.

**Design:** A cross-sectional study.

**Setting**: Data were collected from an online survey in Wuhan, China.

**Participants:** 5988 university ~~college~~ students from 6 universities were selected by a stratified ~~cluster~~ cluster sampling method.

**Primary and secondary outcome measures:** Suicidal ideation and suicide attempt at some point of the students' life time were the outcomes of interest. ~~participantswho reported have ever considered seriously about killing himself/ herself (in the past year or in him/her life) was weredefined as with suicide ideation. And suicide attempt is defined as a self-inflicted, potentially injurious behavior with a nonfatal outcome for which there is evidence(either explicit or implicit) of intent to die.~~

~~And who reportedhave ever tried or attempt to kill himself/herself (in the past year or in him/her life) and have suicide action was define as suicide attempt.~~

**Results:** Students with suicidal ideation or attempt more often reported low level of life satisfaction and high degree of psychache than counterparts without suicidal ideation or attempt. Regression analyses indicated that life satisfaction and psychache were significantly associated with the risk of suicidal ideation and the risk of suicidal attempt. Though psychache showed a relatively stronger ~~effect~~ predictive power than did life satisfaction, the effects of the two factors remained significant when they were individually adjusted for personal demographic characteristics. However, when the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt. Life satisfaction remained to contribute~~d~~ unique variance in the statistical prediction of suicidal ideation.

**Conclusions:** Psychache and life satisfaction both have a significant ~~effect~~ predict power son risk for suicidal behavior, and life satisfaction could relieve the ~~effect~~ predict power of psychache when suicidal behavior is in the beginning. ~~The results suggest that~~ Shneidman's theory that psychache is the pre-eminent psychological cause of suicide~~,~~ is perhaps applicable only to a more serious form of suicidal behavior.

## ARTICLE SUMMARY

### Research focus

Most ~~of available~~ studies testing Shneidman's theory on ~~about~~ the pre-eminence of psychache in suicidality have been predominantly from North America and only involved negative psychological variables. The present study extends Shneidman's theory to another culture and includes the positive factor of life satisfaction into the model. Our purpose is ~~, andlittle research attention has delved into positive factors, such as life satisfaction.The study aims~~to examine the predicting ~~effect~~ power of psychache and life satisfaction on risks ~~of~~ for suicidal ideation and suicide attempt among university student s in China~~young people~~.

### Key messages

- Life satisfaction and psychache were individually significantly associated with the risk ~~of~~ for suicidal ideation and the risk ~~of~~ for suicidal attempt.
- ~~However, w~~When the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt, but not the relationship of life satisfaction with suicidal ideation.
- The results suggest that Shneidman's theory that psychache is the pre-eminent psychological cause of suicide, is perhaps applicable only to a more serious form of suicidal behavior.

### Strengths and limitations of this study

- It is a cross-section study.
- Study subjects comprise a large sample of students randomly ~~The participants were~~ selected from 6 universities in a city of central China~~Wuhan China by stratified cluster sampling method~~, but it is uncertain if they could represent all university students in China.
- ~~, and the results are adjusted for important personal demographic characteristics. It is uncertain to us if they are representative to undergraduates studying in other places of China such as the more developed coasts in China or the less developed western China.~~
- Self-reported suicide attempts may have limited validity or reliability ~~due to recall bias~~.

**Introduction**

Suicidal behaviour in young people has become an increasing social and public health problem in the contemporary China as well as in many other parts of the world. [1-3]With around 287.000 casualties in the total population of China each year, [4]~~,~~ suicide is the first leading cause of death for young people of 15 to 34~~. Suicide is the first cause of death for the young~~ years old and the mortality among Chinese aged 15-24 years stands in the second highest place among the 39 countries that provide the data on suicide to the World Health Organization, ~~adult (15-34) in China, while in western countries suicide is the third or fourth death cause for the same age group [5]. China has the second highest rate of suicide in young adults aged 15-24 among the 39 countries that provide data on suicides to the WHO (World Health Organization~~[5]~~)~~ Suicide in China is known for its high odds ratio of the rates in rural versus urban areas, and in women versus men particularly in young age groups.

~~The pattern of suicides in China is different from that in most other countries:rates in the elderly are extremely high, rural rates are three-fold urban rates, andthere are more successful suicides in females than in males, specially, rates are particularly high in young rural females 15–24~~[6 7]~~.Furthermore, among the countries that provide suicide data to the WHO, China is the only country that reports higher rates in women than in men, but most Asian countries report much smaller differences between male rates and female rates than Western countries (where the male: female ratio is often 3:1 or higher~~ , but the problem in other forms as suicidal ideation and suicide attempt in young Chinese is generally less known and warrants thorough investigation.

Suicidal ~~), and some local studies in Asian countries also find higher rates in women (e.g., Regional studies in India find higher rates in women than in men~~[5]~~).~~

~~Silverman et alsuggested suicide-related ideations, suicide-related communications (suicide threats and suicide plans), and suicide-related behaviors (self-harm, suicide attempts and suicide) were three key terms of suicide research. Specially, *Suicidal ideation* can be defined as thoughts or wishes to be dead or to kill oneself [10]. And suicide attempt is defined as a self-inflicted, potentially injurious behavior with a nonfatal outcome for which there is evidence (either explicit or implicit) of intent to die. A suicide attempt may result in no injuries, injuries, or death, and regardless of the degree of injury or lethality of method~~[8]~~.~~[1-3] ~~The suicidal~~behavior is a complicated phenomenon. It is associated with social and environmental factors and particularly with a variety of traits and disadvantages on a personal level. A great number of studies have demonstrated significant relationships of suicide with ~~ex and determined by many factors including~~ personal socio-demographics, [8],[4] life stressors, [9],[5] biological features, [10],[6] psychological traits, [11],[7] psychiatric problems, [12],[8] coping skills, [13],[9] ~~-~~etc. Psychological pain is thought to be of great importance, playing an indispensable role in the process of becoming suicidal. [14 15].[10]

Psychache, according to Shneidman, is defined as an acute state of intense and intolerable psychological pain that encompasses shame, guilt, humiliation, loneliness, fear, angst, dread,

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anguish, etc. [16 17].[11] It is associated with many psychological suicideogenic factors such as depression and hopelessness, but is also conceptually distinct from these factors. [18 19].[12 13] Evidence has shown that psychache is a significant and unique predictor for various suicide criteria, including suicidal ideation and suicide attempt, even after controlled for effects of depression and hopelessness. [18 20 21].[12 14 15] According to Shneidman's theory, psychache is fundamentally linked with suicide in its own, whereas other psychological factors and affective states (e.g., depression, hopelessness) are relevant to suicide only insofar as they lead to psychache. [16 17][11] In other words, if the psychache is controlled, the single effect of many factors would be largely attenuated or become insignificant. [22][16] Thus, the psychache is the switch deciding as whether a suicide happens or not. In concrete terms, if psychache is too heavy to tolerant for a person, the person will become suicidal -- thinking of dying as the best solution to relief from the intolerable psychache. [16 23] In contrast, [11]If psychache can be relieved or mollified, the lethality of method chosen for suicide would be reduced, and the individuals will continue to live on. [24].[17]

It is Some studies have suggested that completion of suicide is a balanced consequence, depending upon both the presence of risk factors and the absence of protective factors against suicide. [25].[18] However, most of available studies about the pre-eminence of psychache in suicidality have only involved negative psychological variables, such as hopelessness, [18].[12] – ddepression [21].[15] and alexithymia. [26][19] Little research attention has delved into positive factors, such as life satisfaction – a measure that which is reported to be strongly and negatively correlated with suicidal ideation and suicide attempt [27 28][20 21] and to have a long-term effect on the risk of suicidal behavior. [29].[22] At the same time, suicide studies testing Shneidman's model have been predominantly from North America, sparse study, to our awareness, has tested Shneidman's theory with a large sample from another culture. To better understand the role of psychache in mechanism of suicidality, we believe, studies that take ing into account effects of positive factors such as life satisfaction and that use data from diverse cultural backgrounds would provide interesting insights.

We therefore conducted The primary purpose of the present study with the primary purpose is to test Shneidman's theory of suicide by assessing the predictive power evaluating the contributions of life satisfaction and psychache on risk to the statistical prediction of suicidal behavior ity in a large sample of Chinese college students. Our specific aims include: (1) to examine the prevalence and characteristic of suicidal ideation and suicide attempt among Chinese college students by demographic variables, (2) to assess the effects predictive power of life satisfaction and psychache on risk of for suicidal behavior, and (3) to explore the role of psychache in the mechanism of suicidalitysuicide theory.

## Method

### Participants

Of 8 universities that are attached directly to the ministries of the P. R.China and located in the city of ~~in~~ Wuhan ~~city~~, 6 universities agreed to join the survey for this study. A stratified cluster sampling method was used to draw study subjects from all undergraduate students in these universities. A 10% sample of undergraduate students was assigned to each university, and then randomly selected in classes -- the cluster unite~~s~~ that is ~~are~~ organized according to specialty and school year with usually 30-80 students. In case a selected class has more than 100 students, 100 students were ~~further~~ drawn randomly from this class. Otherwise, all students in the drawn classes were enrolled into the study. With this sampling procedure, a total of 7220 college students were sampled and 6096 students finally attended questionnaire survey for the data collection ~~in this study~~, corresponding to a response rate of 84.44%. Most students who did not attend the survey were out of the university campus for their internship during the period when the survey ~~for this study~~ was conducted. ~~Each subject was assigned with a unique encrypted code to their student identification to be used for the survey.~~

The survey was conducted online. Each selected student was assigned with an encrypted code unique to their student identification to be used as personal password for online access to the website designed for the survey. Students enrolled into the survey were informed about the purpose of the study, the confidentiality of ~~the~~ personal information and the principle of voluntarily. Of 6096 students who attended the online survey, 5988 completed all question items ~~naires~~ designed for this study and were therefore included in the final dataset for analyses ~~(response rate of 98.2382.94%)~~.

**Measurements**

***~~Demographic variables~~*** For each participant, we collected d~~D~~ata on personal general information and demographic status such as gender, age, place of family residence, school year and specialty of study alongside data on life satisfaction, psychache and suicidal behavior as described below ~~were collected~~.

***Life satisfaction***

Life satisfaction was assessed with the Satisfaction with Life Scale [30] which is a self-report questionnaire comprising 5 items [ i.e. (1) ‘In most ways my life is close to my ideal’; (2) ‘My life condition is very good’; (3) ‘I am satisfied with my life’, (4) ‘I have got the important things which I want in the life’; (5) ‘If I had new life, I would enjoy it just as I do now’ ]. All items are answered on a 7-point Likert scale~~rating~~ (1= ‘strongly disagree’; 2= ‘disagree’; 3= ‘incomplete disagree’; 4= ‘not sure’; 5= ‘incomplete agree’; 6= ‘agree’; and 7= ‘strongly agree’). The averages score of the 5 items was calculated as the score of life satisfaction (scores range 1-7). The Satisfaction with Life Scale has strong psychometric properties with alpha reliability coefficients was 0.89 [24][31] and 0.86. [32]In present study, the Alpha reliability coefficient was 0.85.

***Psychache***

Psychache was measured with the Psychache Scale [22][16] which is a 13-item (e.g., ‘‘My soul aches”) self-report questionnaire designed to assess Shneidman’s conceptualization of psychache. All items are answered on a 5-point Likert scalerating (1= ‘never’, 2= ‘sometimes’, 3= ‘often’; 4= ‘very oftenmany’, and 5= ‘alwaysalmost’) and the total scores range from 13 to 65 (High score indicates high psychache level). In order to precisely capture the level of psychache, we constructed a continuous variable to categorize the score into 5 levels defined after taking into account the frequency distribution and score value as 1=13-15, 2=16-19, 3=20-22, 4=23-26, 5=27-65. Alpha reliability coefficients of this scale were generally exceeding 0.90, [22 33][16 26] and the scale could distinguish between suicide attempters and non-attempters. [22][16] In present study, the Alpha reliability coefficient was 0.92.

***Suicidal ideation and suicide attempt****The dependent variable in the present study included both suicidal ideation and suicide attempt.*

Suicidal ideation was defined as thoughts or wishes to be dead or to kill oneself according to Schneidman and Silverman et al.[14 34 35]. It was assessed through the following two question with two items: (1) ‘‘have you seriously ever considered seriously about killing yourself in the past one year? ”, and (2) “have you ever seriously considered about killing yourself in your life?”. These two items were answered on a 3-point Likert rating (0 = ‘never’, 1 = ‘sometimes’, 2 = ‘very often’). Participants who answered with ‘0’ for the both items were regarded as ‘‘without suicidal ideation’’, all others were and otherwise regarded as ‘‘with suicidal ideation’’.

Suicide attempt was defined as a self-inflicted behavior with a nonfatal outcome for which there is evidence of intent to die. [34] It was assessed with three questions: (1) “have you ever tried or attempted to kill yourself in the past year?”, (2) “have you ever tried or attempted to kill yourself in your life?” and (3) “have you ever takenhad any non-fatal suicidal action?”. The first two items were answered on a 3-point lLikert rating (0 = never, 1 = sometimes, 2 = very often) and the third last item had a binary answer of was answered with ‘yes’ or ‘no’. Participants who answered with ‘0’ for both of the first two items and ‘no’ for the thirdlast item were regarded as “without suicide attempt”, and otherwise regarded as “with suicide attempt”.

**Statistical analysis**

Firstly, Chi-square test was used to examine the distribution difference of suicidal behavior (suicidal ideation and suicidal attempt) by demographic variables. TSecondary, aTt-test was conducted to test the variation of scores on explore the relations between life satisfaction and psychache according to the presence of and suicidal behaviour. Logistic regression was used to assess themodels were conducted to evaluate the relative importance of statistical predictive power effect and the mechanism of psychache and life satisfaction on risk of suicidal behaviourbehavior and also to evaluate the relative importance of these two factors via three models. Model I estimated the crude effect of each variable of interest; model II estimated the

individual effect of ~~In the model I, five logistic regressions were manipulated to explore the separate predict effect of the demographic variables (gender, grade and age),~~ life satisfaction and of psychache in the adjustment of ~~. In model II, two logistic regressions were conducted to investigate the predict effect of life satisfaction and psychache, after controlling for effects of~~ demographic variables; and ~~. In~~ model III the adjusted effect when all variables were included ~~, one logistic regression was used to exam the adjusted predict effects of life satisfaction and psychache while considering simultaneously life satisfaction and psychache as well as demographic factors~~ in the model.

## Results

### General description

~~The age of study subjects ranged from 14 26 years (Mean=19.94; SD=1.38).~~ The total sample of 5988 students comprised ~~3171~~ 3203 male and ~~2770~~ 2785 female students ~~(47 students did not report gender)~~, with the age ranging from 14 to 26 years (Mean=19.94; SD=1.38). Table 1 shows the demographic distribution of ~~general information and demographic status of~~ the study participants in details~~subjects~~.

Table1 Demographic distribution of students in the study

| Demographic variables | Number (%) | | |
|---|---|---|---|
| | Total | Male | Female |
| Residence place of family | | | |
| Provincial capital or direct-controlled municipality | 924 (15.4) | 413 (44.7) | 511 (55.3) |
| County-level city | 1353 (22.6) | 665 (49.2) | 688 (50.8) |
| County | 803 (13.4) | 417 (51.9) | 386 (48.1) |
| Township | 861 (14.4) | 465 (54.0) | 396 (46.0) |
| Suburban countryside | 930 (15.5) | 510 (54.8) | 420 (45.2) |
| Remote countryside | 1114 (18.6) | 733 (65.8) | 381 (34.2) |
| Specialty of study | | | |
| Engineering | 2036 (34.0) | 1568 (77.0) | 468 (23.0) |
| Science | 2310 (38.6) | 1107 (47.9) | 1203 (52.1) |
| Liberal arts | 1642 (27.4) | 528 (32.2) | 1114 (67.8) |
| Grade | | | |
| Freshman | 2770 (46.3) | 1351 (48.8) | 1419 (51.2) |
| Sophomore | 1748 (29.2) | 1025 (58.6) | 723 (41.4) |

| | | | |
|---|---|---|---|
| Junior | 1134 (18.9) | 589 (51.9) | 545 (48.1) |
| Senior | 336 (5.6) | 238 (70.8) | 98 (29.2) |
| Age | | | |
| 14-18 years old | 828 (13.8) | 352 (42.5) | 476 (57.5) |
| 19-21 years old | 4390 (73.3) | 2349 (53.5) | 2041 (46.5) |
| 22-26 years old | 770 (12.9) | 502 (65.2) | 268 (34.8) |

Note. In the study population, 3 students did not report the region of permanent family residence.

**~~Characteristics of students with suicidal ideation and attempt~~**

Of the total students, 16.4% (982) participants reported the presence of ~~had~~ suicidal ideation and 1.9% (114) ~~participants~~ reported a history ~~the presence~~ of suicide attempt at some point of their life time. The ~~Chi-square tests indicated significant group differences in~~ prevalence differed significantly ~~of suicidal ideation and of suicide attempt~~ with regards to most demographic variables a~~.~~ As shown in Ttable 2, Suicidal ideation was more prevalent in female than male students (20.4% vs 1~~3~~2.0~~9~~%), ~~–~~ in students coming from large cities as provincial capitals or direct-controlled municipalities (18.9%), and in students studying liberal arts (20.~~9~~8%), in freshman students (17.8%), and consistent with this, in students at relatively younger age groups. These observed patterns remained very similar when looking at the self-reported presence of suicide attempt, although the differences by most demographic factors did not reach a statistical significance. Still, it is evident that female students reported a significantly higher rate of suicide attempt (2.6%) than their male counterparts studying in the universities (2.6% vs 1.3%).

~~, the prevalence in female students were significant higher than that of male students for both suicidal ideation ($\chi^2X^2$=58.97, $p$=0.0000<0.01) and suicide attempt ($\chi^2X^2$=13.52, $p$=0.0002<0.01). There were also significant differences in prevalence of suicidal ideation by specialty ($\chi^2X^2$=32.72, $p$=0.0000<0.01), school year ($\chi^2X^2$=21.22, $p$=0.0001<0.01) and age group ($\chi^2X^2$=8.60, $p$=0.0135<0.05). In concrete terms, suicidal ideation was more common among students studying Liberal Arts than college peers with specialty in Engineering ($\chi^2X^2$=28.33, p=0.0000<0.01) and Science ($\chi^2X^2$=19.99, p=0.0000<0.01). Senior students reported less suicidal ideation than did juniors ($\chi^2X^2$=14.81, p=0.0001<0.01), sophomores ($\chi^2X^2$=11.64, p=0.0006<0.01) and freshmen ($\chi^2X^2$=19.23, p=0.0000<0.01), and freshmen reported the highest rate of suicidal ideation. Consistent with this, the proportion of students with suicidal ideation decreased with increasing age. Students aged 14 to 20 reported significantly more suicidal ideation than peers students at higher ages (compared with students of 22-26 years old: $\chi^2X^2$=8.01, p=0.0046<0.01).~~

Table 2Prevalence of suicidal ideation and suicide attempt by demographic variables

10

| | Number | Suicidal ideation | Test of difference | Suicidal attempt | Test of difference |
|---|---|---|---|---|---|
| | N | N (%) | | N (%) | |
| *Total* | 5988 | 982(16.4) | | 114(1.9) | |
| *Gender* | | | $\chi^2$=60.63 | | $\chi^2$=12.95 |
| Males | 3203 | 414(12.9) | df=1 | 42(1.3) | df=1 |
| Females | 2785 | 568(20.4) | p=0.0000 | 72(2.6) | p=0.0002 |
| *Residence place of family* | | | $\chi^2$=6.26 | | $\chi^2$=8.92 |
| Provincial capital or direct-controlled municipality | 924 | 175(18.9) | df=5 p=0.2819 | 26(2.8) | df=5 p=0.1123 |
| County-level city | 1353 | 218(16.1) | | 27(2.0) | |
| County | 803 | 124(15.4) | | 19(2.4) | |
| Township | 861 | 129(15.0) | | 15(1.7) | |
| Suburban countryside | 930 | 151(16.2) | | 12(1.3) | |
| Remote countryside | 1114 | 184(16.5) | | 15(1.3) | |
| *Specialty of study* | | | $\chi^2$=33.16 | | $\chi^2$=4.51 |
| Engineering | 2036 | 289(14.2) | df=2 | 30(1.5) | df=2, |
| Science | 2310 | 351(15.2) | p=0.0000 | 44(1.9) | p=0.105 |
| Liberal arts | 1642 | 342(20.8) | | 40(2.4) | |
| *School year* | | | $\chi^2$=21.22 | | $\chi^2$=5.61 |
| Freshman | 2770 | 493(17.8) | df=3 | 58(2.1) | df=3 |
| Sophomore | 1748 | 270(15.4) | p=0.0001 | 31(1.8) | p=0.1322 |
| Junior | 1134 | 191(16.8) | | 24(2.1) | |
| Senior | 336 | 28(8.3) | | 1(0.3) | |
| *Age* | | | $\chi^2$=8.56 | | $\chi^2$=3.79 |
| 14-18 | 828 | 150(18.1) | df=2 | 15(1.8) | df=2 |
| 19-21 | 4390 | 732(16.7) | p=0.0138 | 91(2.1) | p=0.1500 |
| 22-26 | 770 | 100(13.0) | | 8(1.0) | |

Note. In the study population, 3 students did not report the region of permanent family residence.

~~direct-controlled~~

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

**Distribution of life satisfaction and psychache according to presence of suicidal behaviour**

Figure 1 shows ~~presents~~ the frequency distribution of students according to the level of life satisfaction and the raw score of psychache. For life satisfaction, the scores exhibited a normal distribution, ranging from 1 to 7. However, the scores of psychache exhibited a partial normal distribution with the majority having a low score and a few at the high end. According to the Shneidman's theory, psychache is an intense and intolerable extreme state involving heavy psychological pain.[11] It is therefore reasonable that most of people experienced a mild psychological pain whilst intense psychological pain was present in the minority.

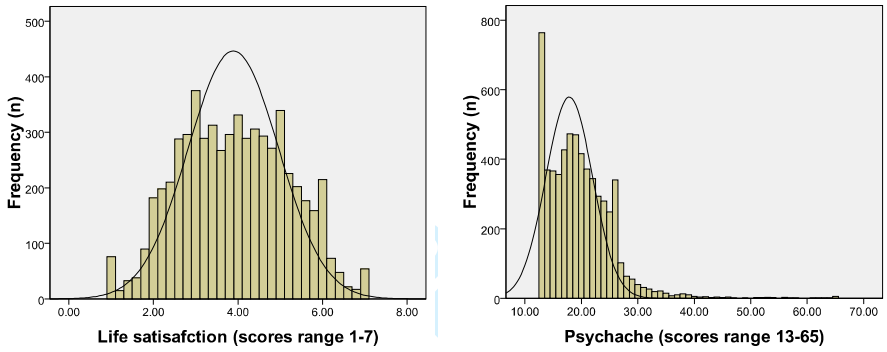


Figure 1 Distribution of life satisfaction and psychache scores in the study subjects

Table 3 presents the means and standard deviations of the scores on life satisfaction and psychache ~~scores~~ according to the presence of suicidal ideation and suicide attempt. The results from t tests indicate that students with suicidal ideation or suicide attempt reported a significantly lower score of life satisfaction and a significantly higher score of psychache. This, ~~which~~, in ~~an~~other words, means that high level of life satisfaction and low degree of psychache are proactive against suicidal behavior within this ~~group of~~ population.

Table 3 Scores of life satisfaction and psychache by presence of ~~on~~ suicidal ideation and suicide attempt

| | | Number of subjects | Mean (Standard deviation) | |
|---|---|---|---|---|
| | | | Life satisfaction | Psychache |
| Total | | | 3.93（1.29） | 1.56 (1.27) |
| Suicidal ideation | Yes | 982 | 3.50（1.22） | 2.44 (1.21) |
| | No | 5006 | 4.02（1.28） | 1.39 (1.20) |
| t-test | | | -11.97 | 24.95 |
| df | | | 5986 | 5986 |
| p | | | 0.0000 | 0.0000 |
| Suicide attempt | Yes | 114 | 3.48（1.44） | 2.55 (1.36) |

12

| | | | | |
|---|---|---|---|---|
| | No | 5874 | 3.94（1.28） | 1.54 (1.26) |
| t-test | | | -3.81 | 8.49 |
| df | | | 5986 | 5986 |
| p | | | 0.0001 | 0.0000 |

*Note.* ~~*p<0.05, **p<0.01;~~ Life satisfaction score~~s~~ range~~s~~ from 1 to ~~-~~7~~;~~ ; Psychache score ~~s~~ range~~s~~ from 1 to 5 ~~0-4~~.

**Effect of life satisfaction and psychache on risk for suicidal ideation and suicide attempt**

Table 4 displays the results from modelling the data with l~~L~~ogistic regression in order to assess the ~~s were further manipulated to evaluate the relative importance of~~ statistical predictive power ~~effects~~ of psychache and life satisfaction on risk for suicidal ideation and suicide attempt~~,~~ ~~as shown in table 4~~.

13

Table 4 Predictive ~~effect~~ power of life satisfaction and psychache on risk of suicidal ideation and of suicide attempt

| Suicidal ideation | Model I | | | | | Model II | | | | | Model III | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable of study | B | Wald | p | OR | CI (95%) | B | Wald | p | OR | CI (95%) | B | Wald | p | OR | CI (95%) |
| Gender | -0.55 | 59.75 | 0.0000 | 0.58 | 0.51-0.67 | | | | | | -0.64 | 71.53 | 0.0000 | 0.53 | 0.45-0.61 |
| Grade | -0.13 | 11.04 | 0.0009 | 0.88 | 0.81-0.95 | | | | | | 0.04 | 0.69 | 0.4049 | 0.96 | 0.87-1.06 |
| Ages | -0.19 | 7.48 | 0.0062 | 0.83 | 0.73-0.95 | | | | | | -0.07 | 0.78 | 0.3785 | 0.93 | 0.79-1.10 |
| Life satisfaction | -0.32 | 127.81 | 0.0000 | 0.73 | 0.69-0.77 | -0.36 | 151.82 | 0.0000 | 0.70 | 0.66-0.74 | -0.15 | 19.89 | 0.0000 | 0.81 | 0.81-0.92 |
| Psychache | 0.67 | 497.41 | 0.0000 | 1.96 | 1.85-2.08 | -0.68 | 498.28 | 0.0000 | 1.98 | 1.86-2.10 | 0.63 | 379.54 | 0.0000 | 1.76 | 1.76-2.00 |

| Suicide attempt | Model I | | | | | Model II | | | | | Model III | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variables of study | B | Wald | p | OR | CI (95%) | B | Wald | p | OR | CI (95%) | B | Wald | p | OR | CI (95%) |
| Gender | -0.69 | 12.47 | 0.0004 | 0.50 | 0.34-0.74 | | | | | | -0.73 | 13.18 | 0.0003 | 0.48 | 0.33-0.72 |
| Grade | -0.15 | 1.95 | 0.1626 | 0.86 | 0.70-1.06 | | | | | | -0.06 | 0.25 | 0.6164 | 0.94 | 0.73-1.20 |
| Ages | -0.20 | 1.17 | 0.2802 | 0.82 | 0.57-1.17 | | | | | | -0.04 | 0.04 | 0.5810 | 0.96 | 0.63-1.46 |
| Life satisfaction | -0.29 | 14.27 | 0.0002 | 0.75 | 0.65-0.87 | -0.33 | 17.85 | 0.0000 | 0.72 | 0.62-0.84 | -0.11 | 1.56 | 0.2123 | 0.90 | 0.76-1.06 |
| Psychache | 0.62 | 63.12 | 0.0000 | 1.86 | 1.60-2.17 | 0.62 | 62.90 | 0.0000 | 1.87 | 1.60-2.18 | 0.58 | 47.10 | 0.0000 | 1.79 | 1.52-2.11 |

Value of variables: Gender 0(female) – 1 (male); Grade 1 – 4; Age group 1 (14-18 years old) – 3 (22-16 years old); Life satisfaction score 1 – 7; Psychache score 1 – 5.~~Note. Life satisfaction scores range 1-7; Psychache scores range 1-5; Gender male=1 and female=0; Grade scores range 1-4.~~

Model I: crude analyses without any adjustment; Model II: only adjusted for gender, grade and age; Model III: adjusted for all variables listed in the table.

Note: *P<0.05, **p<0.01; Life satisfaction scores range 1-7; Psychache scores range 1-5; Gender male=1 and female=0; Grade scores range 1-4.

Model I: crude analyses without any adjustment; Model II: only adjusted for gender, grade and age; Model III: adjusted for all variables listed in the table.

The results from of model I and model II both indicated that life satisfaction and psychache had a were significant power in predicting ors of suicidal ideation and suicide attempt, and that a higher level of life satisfaction was associated with a reduced risk while a higher level of psychache was associated with an increased risk for suicidal ideation and for suicide attempt. In the model III, psychache remained to have a significant effect on the risk for both suicidal ideation and suicide attempt. The effect was generally stronger for risk of suicidal ideation than that for suicide attempt as demonstrated consistently in all three models. However, the effect of life satisfaction, however, on suicidal behaviour differed somehow in the model III; its predictive power . Its effect remained highly significant for the risk of suicidal ideation but ; but for suicide attempt, the effect attenuated into insignificant for suicide attempt. This means that when the effects of demographic variables and psychache were controlled, life satisfaction did not have a significant predictive effect on suicide attempt, it was relevant to suicide attempt only insofar as it they lead to psychache.

**Discussion**

In this study, we have investigated the role of life satisfaction and psychache on suicidal ideation and suicide attempt among university students in China using a large random sample from 6 universities. It is, to our awareness, the first study to examine Schneidman's theory on psychache and suicidology in a Chinese culture, and also the first to assess the role of psychache on suicidality in the context of the positive psychological factor of life satisfaction. With the rapid economic reform in the last 30 years and its attendant deleterious sociological and infrastructure, the rates of suicide in China increased[36], a comparativelyhigh national suicide rate two to three times the global average is evident and female suicides outnumber male suicides by a 3:1 ratio.However, the most studied which test Shneidman's model were based on North American population, to our knowledge, there is no study test Shneidman's theory of suicide in a large sample of China. Therefore, there are two important ways in which this study extends the literature on test Shneidman's theory of suicide. Firstly, the present study was appliedpredominantly North American research on Shneidman's model to China culture. Secondary, consider life satisfaction as protect factor and evaluating the contributions of life satisfaction and psychache to the statistical prediction of suicidality. The key findings are discussed in turn.

**Differences in suicidal ideation and attempt by gender, grade and specialty**

The present study demonstrates that both suicidal ideation and suicide attempt were more prevalent in female students than in the males. This mostly aligns with previous studies from

China and many other places reporting higher prevalence of suicidal behaviors in young females than young males. [36-39] One explanation of the higher female versus male suicidal behavior in our study population perhaps lies in the Chinese culture, especially, the deep-rooted Confucianism produced in a patriarchy which trended to denigrate women. ~~There are several reasons to explain the gender difference in suicide behavior in China. Most importantly, the value conflict between Confucianism and egalitarianism of communist ideology among women could partially explains the higher suicide risk for the female~~[39 40] On the other hand, since the observed phenomenon exists worldwide regardless of culture, we believe that, the gender specific personality traits may to a large extend contribute to our observation. [36-39]~~Confucianism produced in patriarchy, and trended to denigrate women and limit female for success. While, communist ideology advocates the equality between male and female, and the female should have the same social status and rights as the male. Confucianism is deep-rooted while communist ideology is the mainstream value; the both are incompatible about the attitude of female. However, this value conflict does not exist to the male. Therefore, according to the Strain Theory of Suicide, this value conflict among female will induce a psychological frustration, and eventually led to a high risk of suicide [42]. In addition, the injustice toward the female is very prevalent in China. For example, the female is injustice in job opportunities, and the salary of female is less than the male at the same position. The gender discrimination make the female encounter more adverse life events than the male, and contribute to the high risk of female suicide[41]~~

Our finding that students studying Literal Arts reported a significantly higher occurrence of suicidal ideation and also modestly higher suicide attempt than their peers ~~As for the effect of specialty of study, there is no significant difference in suicidal attempt but a highly significant difference in suicidal ideations with a higher prevalence found in students studying Liberal Arts than those~~ studying Engineering and Science is interesting. Of course, the fact ~~One possible reason for this could be~~ that relative more female students choose to study Literal Arts than other subjects may contribute to the result. ~~as Engineering or Science.~~ It may also reflect a selection of personality traits that Liberal Arts students may react more sensitively and emotionally to events and stressors than counterpart students studying other subjects.

In addition, we note ~~the study indicates~~ that students in the early school years or at a ~~at lower grade or~~ younger age reported more suicidal ideation than their higher grade or ~~e~~older peers. These results are somehow as expected and could well ~~might~~ be explained by the hardship to adapt to the college life and limited experience ~~s~~in handling ~~and abilityto cope with~~ stressors at the beginning of college life. With the increase of age and experience, ~~the ability of coping is developing and the individuals~~the students become better in coping with and handling~~with~~ stressors that they would not be able to handle at younger ages.

**Psychache, life satisfaction and suicidal behavior**

The present ~~results of the~~ study indicates that psychache and life satisfaction were both significant predictors for suicidal ideation and suicide attempt in the study population. Psychache

had stronger power in predicting ~~could better predict~~ suicidal ideation and suicide attempt than had~~did~~ life satisfaction, as evidenced by its larger standardized regression coefficients. This result is in line with the finding from~~Similar findings have also been documented in~~ other studies testing Shneidman's theory with samples of general population [41][31] and special groups as offenders, [33 42][26 32] homeless people [20] [14] and ~~or~~ patients with mental illness. [43][33] The result supports Shneidman's view that psychache is a fundamentally important predictor for suicidal behavior.

Moreover, our analyses further ~~Further regression analyses of our data~~ indicate that the mediating role of psychache on the occurrence of suicidal behavior differed slightly between suicidal ideation and suicide attempt. In prediction of suicide attempt, psychache accounted for a greater proportion of variance than did life satisfaction. The association between life satisfaction and suicidal attempt were completely residualized by psychache as Shneidman had predicted. Life satisfaction was relevant to suicide attempt only when it was associated with psychache. However, for suicidal ideation, life satisfaction, independent of psychache, remained to have an additional significant contribution ~~to suicidal ideation~~. In other words, psychache was not inevitable to suicidal ideation and played a partial role mediating the link between life satisfaction and suicidal ideation. This observation is in line with findings in a number of published studies. For instance, a study of a large scale college students showed that psychache did not fully mediate the association of suicidal ideation with hopelessness and the change in hopelessness during the ~~over~~ follow~~ing~~-up period remained to be a significant predictor. [44][34] One possible explanation to this result is that psychache may be associated with ~~the~~ more serious forms of suicidal behavior. Suicide is known as a continuous process with suicide attempt being more severe form than suicidal ideation. [16][11] Many factors influence suicidal attempt only insofar they are related to psychache, so psychache is the inevitable channel to suicidal attempt. A study conducted by Mendonca and Holden on population-based psychiatric inpatients also demonstrated that psychache exhibited a stronger influence in persons who had actually formulated a plan for suicide than those who had general suicidal desires. [45] [35]That is to say that, psychache represents a more distal vulnerability in a chain culminating in suicidality.

In addition, our results show that psychache is independently and positively associated with ~~predicted~~ suicidal ideation and suicide attempt, and that the odds ratios associated with psychache were eliminated when adjusted for effects of life satisfaction and demographic variables simultaneously. These results suggest that life satisfaction may be opposed and relieve psychache, and thus verify Shneidman's theory that if the psychache surpasses the threshold of tolerance and is subjectively judged to be unbearable, intolerable or unacceptable , the individuals would then die from suicide in order to escape from the suffering. [16][11] However, if psychache is relieved, e.g., via effect of protective factors such as life satisfaction, then the originally unbearable psychological pain become acceptable and the individual would stay to live on. [24][17]

From a clinical poin of view, the phenomenology of suicide refers to the inner world of individuals and focuses on what the individual feels as well as understanding from the inside

whenever a clinician encounters a patient. [46] Shneidman considers psychache to be the main ingredient of suicide, [17] and regards suicide not as a movement toward death but rather as a remedy to escape from intolerable emotion, unendurable or unacceptable anguish. [24] Suicidal individuals experience dichotomous thinking, wishing for either some specific (almost magical) total solution for their psychache or cessation (suicide), and suicide is the result of an interior dialogue during which the mind scans its options. [23] The present study indicates that life satisfaction may relieve the psychache and therefore reduces the risk for suicidal ideation and suicide attempt. Treatment for psychache, e.g., using anodyne psychotherapy [47] to mollify unbearable psychological pain, may well have an effect on reducing the risk for suicidal behavior.

**Limitations of the study**

There are several limitations ofin the present study. Firstly, like most research ~~of reports published~~ in this area, the present study is a cross-sectional investigation. This makes it impossible to document any causal relationship of ~~between~~ life satisfaction and ~~,~~psychache with ~~and~~ suicidal ideation or suicide attempte. While the present study is supportive to ~~has provided some suggestive evidence,~~Shneidman's view concerning the preeminent role of ~~that~~ psychache on suicidal behavior, further ~~is preeminence and prior the suicide needs to be further tested by~~ studies with a cohort design are needed to verity the possible causal pathways.[17] Secondly, self-reported suicide attempts have limited validity or reliability due to recall bias, [35]~~,~~ we are unable to verify if the reported suicide attempt truly happened in the students' real life. Another concern ~~limitation~~ is related to~~about~~ the generalizability of the findings from the present study. The study students were sampled strictly by a stratified cluster sampling method and from 6 ~~of 8~~ universities in a major city in Central China. Yet we are confident that these students ~~our subjects~~ could well represent all undergraduate college students in the area of Central China, we are ~~it is~~ uncertain whether ~~to us if~~ they are representative to undergraduates studying in other places of China such as the more developed coasts ~~in China~~ and ~~or~~ the less developed western China. This calls for more research to test the model using samples from other parts of China as well from areas with different cultures. Moreover, ~~In addition, the present study focus on college students who live and study in urban area, we did not consider the rural area in which suicide rates are higher. Moreover, it has been reported that Chinese are more emotionally reserved, introverted, overly considerate, socially overcautious, and habituated to self-restraint. Coupled with the culturally highly valued imperatives of maintaining personal honor, face, and reputation, and increasing level of social stressors, such Chinese characteristics are thought to predispose people to suicide as a means to resolve crisis and conflict~~to our awareness, no protective variable such as life satisfaction have been encompassed in the Shneidman's model so far. Some postulates, for example, that life satisfaction could relieve psychache and thus prevent suicide, need to be further verified by studies from various social settings.

**Conclusions**

The present study sought to test the Shneidman's theory of suicide as psychache using a large sample of university students in China, ~~among Chinese college~~ and to extend existing research by including thea protective variable of life satisfaction. The results indicate that psychache and life satisfaction both contribute to the risk~~s~~ for suicidal ideation and suicide attempt, and that psychache plays a mediating role on the link between life satisfaction and suicidal behavior. More specifically, psychache could fully mediate the relationship of life satisfaction with suicidal attempt, but acts as partial mediator linking life satisfaction with suicidal ideation, suggesting that Shneidman's theory is probably more applicable to severe forms of suicidality.

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**Contributors** ZZ, PQ and ZY conceived the idea of the study; ZZ, PQ, ZY and CW designed the study. ZY and ~~,~~ SJ~~Y and MC~~ undertook the data analysis and ~~; SY~~ produced the tables and graphs; ~~MC,~~ ZY and SJ~~Y~~ prepared the initial draft of the manuscript. ZZ and~~,~~ PQ contributed to the interpretation of the results and made the ~~provided~~ critical revision ~~comments on the revised draft~~ of the manuscript ~~and contributed to the interpretation of the results.~~ All authors read and approved the final manuscript.

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**Competing interests** None.

**Ethical approval** The study was approved by the Ethical Committee for Scientific Research at Central China Normal University.

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**Data sharing statement** No additional data are available.

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**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1, 2 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 4, 5 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 4, 5 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5, 6, 7 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5, 6, 7 |
| Bias | 9 | Describe any efforts to address potential sources of bias | *5, 6* |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 7 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 6, 7 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 6 |
| | | (*c*) Explain how missing data were addressed | 5 |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | 5 |
| | | (*e*) Describe any sensitivity analyses | |
| **Results** | | | |

| | | | |
|---|---|---|---|
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 7, 8, 9, 10 |
| | | (b) Give reasons for non-participation at each stage | 5, 6, 7 |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 7, 8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | 7, 8, 9, 10, 11 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 7, 8, 9, 10, 11 |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 11, 12 |
| | | (*b*) Report category boundaries when continuous variables were categorized | 5, 6, 7 |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 12, 13, 14 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 14 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 12, 13, 14 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 13, 14 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 15 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

# Effects of life satisfaction and psychache on risk for suicidal behavior: a study based on data from Chinese undergraduates

| | |
|---|---|
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# Effects of life satisfaction and psychache on risk for suicidal behavior: a study based on data from Chinese undergraduates

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**ABSTRACT**

**Objectives:** To examine the predicting power of psychache and life satisfaction on risks for suicidal ideation and suicide attempt among young people.

**Design:** A cross-sectional study.

**Setting**: Data were collected from an online survey in Wuhan, China.

**Participants:** 5988 university students from 6 universities were selected by a stratified cluster sampling method.

**Primary and secondary outcome measures:** Suicidal ideation and suicide attempt at some point of the students' life time were the outcomes of interest.

**Results:** Students with suicidal ideation or attempt more often reported low level of life satisfaction and high degree of psychache than counterparts without suicidal ideation or attempt. Regression analyses indicated that life satisfaction and psychache were significantly associated with the risk of suicidal ideation and the risk of suicidal attempt. Though psychache showed a relatively stronger predictive power than did life satisfaction, the effect of the two factors remained significant when they were individually adjusted for personal demographic characteristics. However, when the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt. Life satisfaction remained to contribute unique variance in the statistical prediction of suicidal ideation.

**Conclusions:** Psychache and life satisfaction both have a significant predict power on risk for suicidal behavior, and life satisfaction could relieve the predict power of psychache when suicidal behavior is in the beginning. Shneidman's theory that psychache is the pre-eminent psychological cause of suicide is perhaps applicable only to a more serious form of suicidal behavior.

## ARTICLE SUMMARY

### Research focus

Most studies testing Shneidman's theory on the pre-eminence of psychache in suicidality have been predominantly from North America and only involved negative psychological variables. The present study extends Shneidman's theory to another culture and includes the positive factor of life satisfaction into the model. Our purpose is to examine the predicting power of psychache and life satisfaction on risks for suicidal ideation and suicide attempt among university students in China.

### Key messages

- Life satisfaction and psychache were individually significantly associated with the risk for suicidal ideation and the risk for suicidal attempt. When the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt, but not the relationship of life satisfaction with suicidal ideation.
- The results suggest that Shneidman's theory that psychache is the pre-eminent psychological cause of suicide, is perhaps applicable only to a more serious form of suicidal behavior.

### Strengths and limitations of this study

- It is a cross-section study.
- Study subjects comprise a large sample of students randomly selected from 6 universities in a city of central China but it is uncertain if they could represent all university students in China.
- Self-reported suicide attempts may have limited validity or reliability.

**Introduction**

Suicidal behaviour in young people has become an increasing social and public health problem in the contemporary China as well as in many other parts of the world.[1-3] With around 287.000 casualties in the total population of China each year,[4] suicide is the first leading cause of death for young people of 15 to 34 years old and the mortality among Chinese aged 15-24 years stands in the second highest place among the 39 countries that provide the data on suicide to the World Health Organization.[5] Suicide in China is known for its high odds ratio of the rates in rural versus urban areas, and in women versus men particularly in young age groups, [67] but the problem in other forms as suicidal ideation and suicide attempt in young Chinese is generally less known and warrants thorough investigation.

Suicidal behavior is a complicated phenomenon. It is associated with social and environmental factors and particularly with a variety of traits and disadvantages on a personal level. A great number of studies have demonstrated significant relationships of suicide with personal socio-demographics, [8] life stressors, [9] biological features, [10] psychological traits, [11] psychiatric problems, [12] coping skills, [13] etc. Psychological pain is thought to be of great importance, playing an indispensable role in the process of becoming suicidal. [1415]

Psychache, according to Shneidman, is defined as an acute state of intense and intolerable psychological pain that encompasses shame, guilt, humiliation, loneliness, fear, angst, dread, anguish, etc.[1617] It is associated with many psychological suicideogenic factors such as depression and hopelessness, but is also conceptually distinct from these factors. [1819] Evidence has shown that psychache is a significant and unique predictor for various suicide criteria, including suicidal ideation and suicide attempt, even after controlled for effects of depression and hopelessness. [182021] According to Shneidman, psychache is fundamentally linked with suicide in its own, whereas other psychological factors and affective states (e.g., depression, hopelessness) are relevant to suicide only insofar as they lead to psychache.[1617] In other words, if psychache is controlled, the single effect of many factors would be largely attenuated or become insignificant.[22] Thus, psychache is the switch deciding whether a suicide happens or not. In concrete terms, if psychache is too heavy to tolerant for a person, the person will become suicidal -- thinking of dying as the best solution to relief from the intolerable psychache.[1623] In contrast, if psychache can be relieved or mollified, the lethality of method chosen for suicide would be reduced, and the individuals will continue to live on. [24]

It is suggested that completion of suicide is a balanced consequence, depending upon both the presence of risk factors and the absence of protective factors against suicide.[25] However, most of available studies about the pre-eminence of psychache in suicidality have only involved negative psychological variables, such as hopelessness,[18] depression[21] and alexithymia.[26] Little research attention has delved into positive factors, such as life satisfaction – a measure that is reported to be strongly and negatively correlated with suicidal ideation and suicide attempt[2728] and to have a long-term effect on the risk of suicidal behavior.[29] At the same

time, suicide studies testing Shneidman's model have been predominantly from North America, sparse study, to our awareness, has tested Shneidman's theory with a large sample from another culture. To better understand the role of psychache in mechanism of suicidality, we believe, studies that take into account effects of positive factors such as life satisfaction and that use data from diverse cultural backgrounds would provide interesting insights.

We therefore conducted the present study with the primary purpose to test Shneidman's theory of suicide by assessing the predictive power of life satisfaction and psychache on risk of suicidal behavior in a large sample of Chinese college students. Our specific aims include: (1) to examine the prevalence of suicidal ideation and suicide attempt among Chinese college students, (2) to assess the predictive power of life satisfaction and psychache on risk for suicidal behavior, and (3) to explore the role of psychache in the mechanism of suicidality.

## Method

### Participants

Of 8 universities that are attached directly to the ministries of the P. R.China and located in the city of Wuhan, 6 universities agreed to join the survey for this study. A stratified cluster sampling method was used to draw study subjects from all undergraduate students in these universities. A 10% sample of undergraduate students was assigned to each university, and then randomly selected in classes -- the cluster unite that is organized according to specialty and school year with usually 30-80 students. In case a selected class has more than 100 students, 100 students were drawn randomly from this class. Otherwise, all students in the drawn classes were enrolled into the study. The rationale of restricting samples from a large class to up to 100 students is to reduce the likelihood of overweight of large classes and thus to ensure a better representativeness of the 10% sampled students in each university. Consequently, we drew a 10% sample students from all 6 universities, consisted of 93 cluster units (classes). Of 21 large classes (22.58%) , 100 students were further sampled.

With this sampling procedure, a total of 7220 college students were sampled and 6096 students finally attended questionnaire survey for the data collection, corresponding to a response rate of 84.44%. Most students who did not attend the survey were out of the university campus for their internship during the period when the survey was conducted.

The survey was conducted online. Each selected student was assigned with an encrypted code unique to their student identification to be used as personal password for online access to the website designed for the survey. Students enrolled into the survey were informed about the purpose of the study, the confidentiality of personal information and the principle of voluntarily. Of 6096 students who attended the online survey, 5988 completed all question items designed for this study and were therefore included in the final dataset for analyses.

**Measurements**

For each participant, we collected data on personal general information and demographic status such as gender, age, place of family residence, school year and specialty of study alongside data on life satisfaction, psychache and suicidal behavior as described below.

***Life satisfaction***

Life satisfaction was assessed with the Satisfaction with Life Scale[30] which is a self-report questionnaire comprising 5 items [ i.e. (1) 'In most ways my life is close to my ideal'; (2) 'My life condition is very good'; (3) 'I am satisfied with my life', (4) 'I have got the important things which I want in the life'; (5) 'If I had new life, I would enjoy it just as I do now' ]. All items are answered on a 7-point Likert scale (1= 'strongly disagree'; 2= 'disagree'; 3= 'incomplete disagree'; 4= 'not sure'; 5= 'incomplete agree'; 6= 'agree'; and 7= 'strongly agree'). The averages score of the 5 items was calculated as the score of life satisfaction (scores range 1-7). The Satisfaction with Life Scale has strong psychometric properties with alpha reliability coefficients was 0.89[31] and 0.86.[32] In present study, the Alpha reliability coefficient was 0.85.

***Psychache***

Psychache was measured with the Psychache Scale which is a 13-item (e.g., ''My soul aches'') self-report questionnaire designed to assess Shneidman's conceptualization of psychache. [22] All items are answered on a 5-point Likert scale and the total scores range from 13 to 65 (High score indicates high psychache level). In order to precisely capture the level of psychache, we constructed a continuous variable to categorize the score into 5 levels defined after taking into account the frequency distribution and score value as 1=13-15, 2=16-19, 3=20-22, 4=23-26, 5=27-65. Alpha reliability coefficients of this scale were generally exceeding 0.90,[2233] and the scale could distinguish between suicide attempters and non-attempters.[22] In present study, the Alpha reliability coefficient was 0.92.

***Suicidal ideation and suicide attempt***

Suicidal ideation was defined as thoughts or wishes to be dead or to kill oneself according to Schneidman and Silverman et al.[143435] It was assessed through the following two question items: (1) ''have you seriously considered about killing yourself in the past one year'', and (2) ''have you ever seriously considered about killing yourself in your life''. These two items were answered on a 3-point Likert rating (0 = 'never', 1 = 'sometimes', 2 = 'very often'). Participants who answered with '0' for the both items were regarded as ''without suicidal ideation'', all others were regarded as ''with suicidal ideation''.

Suicide attempt was defined as a self-inflicted behavior with a nonfatal outcome for which there is evidence of intent to die. [34] It was assessed with three questions: (1) "have you ever tried or attempted to kill yourself in the past year", (2) "have you ever tried or attempted to kill yourself in your life" and (3)"have you ever taken any non-fatal suicidal action". The first two items were answered on a 3-point Likert rating (0 = never, 1 = sometimes, 2 = very often) and the

third item had a binary answer of 'yes' or 'no'. Participants who answered with '0' for both of the first two items and 'no' for the third item were regarded as "without suicide attempt", and otherwise regarded as "with suicide attempt".

**Statistical analysis**

Chi-square test was used to examine the distribution difference of suicidal behavior (suicidal ideation and suicidal attempt) by demographic variables. T-test was conducted to test the variation of scores on life satisfaction and psychache according to the presence of suicidal behaviour. Logistic regression was used to assess the predictive power of psychache and life satisfaction on risk of suicidal behavior and also to evaluate the relative importance of these two factors via three models. Model I estimated the crude effect of each variable of interest; model II estimated the individual effect of life satisfaction and of psychache in the adjustment of demographic variables; and model III adjusted the effect when all variables were included in the model.

## Results

**General description**

The total sample of 5988 students comprised 3203 male and 2785 female students, with the age ranging from 14 to 26 years (Mean=19.94; SD=1.38). Table 1 shows the demographic distribution of the study participants in details.

Table1 Demographic distribution of students in the study

| Demographic variables | Number (%) | | |
|---|---|---|---|
| | Total | Male | Female |
| Residence place of family | | | |
| Provincial capital or direct-controlled municipality | 924 (15.4) | 413 (44.7) | 511 (55.3) |
| County-level city | 1353 (22.6) | 665 (49.2) | 688 (50.8) |
| County | 803 (13.4) | 417 (51.9) | 386 (48.1) |
| Township | 861 (14.4) | 465 (54.0) | 396 (46.0) |
| Suburban countryside | 930 (15.5) | 510 (54.8) | 420 (45.2) |
| Remote countryside | 1114 (18.6) | 733 (65.8) | 381 (34.2) |
| Specialty of study | | | |
| Engineering | 2036 (34.0) | 1568 (77.0) | 468 (23.0) |
| Science | 2310 (38.6) | 1107 (47.9) | 1203 (52.1) |
| Liberal arts | 1642 (27.4) | 528 (32.2) | 1114 (67.8) |
| Grade | | | |

| | | | |
|---|---|---|---|
| Freshman | 2770 (46.3) | 1351 (48.8) | 1419 (51.2) |
| Sophomore | 1748 (29.2) | 1025 (58.6) | 723 (41.4) |
| Junior | 1134 (18.9) | 589 (51.9) | 545 (48.1) |
| Senior | 336 (5.6) | 238 (70.8) | 98 (29.2) |
| Age | | | |
| 14-18 years old | 828 (13.8) | 352 (42.5) | 476 (57.5) |
| 19-21 years old | 4390 (73.3) | 2349 (53.5) | 2041 (46.5) |
| 22-26 years old | 770 (12.9) | 502 (65.2) | 268 (34.8) |

Note. In the study population, 3 students did not report the region of permanent family residence.

Of the total students, 16.4% (982) participants reported the presence of suicidal ideation and 1.9% (114) reported a history of suicide attempt at some point of their life time. The prevalence differed significantly with regards to most demographic variables as shown in Table 2. Suicidal ideation was more prevalent in female than male students (20.4% vs 12.9%), in students coming from large cities as provincial capitals or direct-controlled municipalities (18.9%), and in students studying liberal arts (20.8%), in freshman students (17.8%),and consistent with this, in students at relatively younger age groups. These observed patterns remained very similar when looking at the self-reported presence of suicide attempt, although the differences by most demographic factors did not reach a statistical significance. Still, it is evident that female students reported a significantly higher rate of suicide attempt (2.6%) than their male counterparts studying in the universities (2.6% vs 1.3%).

Table 2 Prevalence of suicidal ideation and suicide attempt by demographic variables

| | **Number** | **Suicidal ideation** | **Test of difference** | **Suicidal attempt** | **Test of difference** |
|---|---|---|---|---|---|
| | **N** | **N (%)** | | **N (%)** | |
| *Total* | 5988 | 982(16.4) | | 114(1.9) | |
| *Gender* | | | $\chi^2$=60.63 | | $\chi^2$=12.95 |
| Males | 3203 | 414(12.9) | df=1 | 42(1.3) | df=1 |
| Females | 2785 | 568(20.4) | p=0.0000 | 72(2.6) | p=0.0002 |
| *Residence place of family* | | | $\chi^2$=6.26 | | $\chi^2$=8.92 |
| Provincial capital or direct-controlled municipality | 924 | 175(18.9) | df=5 p=0.2819 | 26(2.8) | df=5 p=0.1123 |
| County-level city | 1353 | 218(16.1) | | 27(2.0) | |

| | | | | | |
|---|---|---|---|---|---|
| County | 803 | 124(15.4) | | 19(2.4) | |
| Township | 861 | 129(15.0) | | 15(1.7) | |
| Suburban countryside | 930 | 151(16.2) | | 12(1.3) | |
| Remote countryside | 1114 | 184(16.5) | | 15(1.3) | |
| *Specialty of study* | | | $\chi^2$=33.16 | | $\chi^2$=4.51 |
| Engineering | 2036 | 289(14.2) | df=2 | 30(1.5) | df=2, |
| Science | 2310 | 351(15.2) | p=0.0000 | 44(1.9) | p=0.105 |
| Liberal arts | 1642 | 342(20.8) | | 40(2.4) | |
| *School year* | | | $\chi^2$=21.22 | | $\chi^2$=5.61 |
| Freshman | 2770 | 493(17.8) | df=3 | 58(2.1) | df=3 |
| Sophomore | 1748 | 270(15.4) | p=0.0001 | 31(1.8) | p=0.1322 |
| Junior | 1134 | 191(16.8) | | 24(2.1) | |
| Senior | 336 | 28(8.3) | | 1(0.3) | |
| *Age* | | | $\chi^2$=8.56 | | $\chi^2$=3.79 |
| 14-18 | 828 | 150(18.1) | df=2 | 15(1.8) | df=2 |
| 19-21 | 4390 | 732(16.7) | p=0.0138 | 91(2.1) | p=0.1500 |
| 22-26 | 770 | 100(13.0) | | 8(1.0) | |

Note. In the study population, 3 students did not report the region of permanent family residence.

**Distribution of life satisfaction and psychache according to presence of suicidal behaviour**

Figure 1 shows the frequency distribution of students according to the level of life satisfaction and the raw score of psychache. For life satisfaction, the scores exhibited a normal distribution, ranging from 1 to 7. However, the scores of psychache exhibited a partial normal distribution with the majority having a low score and a few at the high end. According to the Shneidman's theory, psychache is an intense and intolerable extreme state involving heavy psychological pain. It is therefore reasonable that most of people experienced a mild psychological pain whilst intense psychological pain was present in the minority.

Figure 1 Distribution of life satisfaction and psychache scores in the study subjects

Table 3 presents the means and standard deviations of the scores on life satisfaction and psychache according to the presence of suicidal ideation and suicide attempt. The results from t tests indicate that students with suicidal ideation or suicide attempt reported a significantly lower score of life satisfaction and a significantly higher score of psychache. This, in other words, means that high level of life satisfaction and low degree of psychache are proactive against suicidal

behavior within this population.

Table 3 Scores of life satisfaction and psychache by presence of suicidal ideation and suicide attempt

| | | Number of subjects | Mean (Standard deviation) | |
|---|---|---|---|---|
| | | | Life satisfaction | Psychache |
| Total | | | 3.93（1.29） | 1.56 (1.27) |
| Suicidal ideation | Yes | 982 | 3.50（1.22） | 2.44 (1.21) |
| | No | 5006 | 4.02（1.28） | 1.39 (1.20) |
| t-test | | | -11.97 | 24.95 |
| df | | | 5986 | 5986 |
| p | | | 0.0000 | 0.0000 |
| Suicide attempt | Yes | 114 | 3.48（1.44） | 2.55 (1.36) |
| | No | 5874 | 3.94（1.28） | 1.54 (1.26) |
| t-test | | | -3.81 | 8.49 |
| df | | | 5986 | 5986 |
| p | | | 0.0001 | 0.0000 |

*Note.* Life satisfaction score ranges from 1 to 7; Psychache score ranges from 1 to 5.

**Effect of life satisfaction and psychache on risk for suicidal ideation and suicide attempt**

Table 4 displays the results from modelling the data with logistic regression in order to assess the statistical predictive power of psychache and life satisfaction on risk for suicidal ideation and suicide attempt.

Table 4 Predictive power of life satisfaction and psychache on risk of suicidal ideation and of suicide attempt

| Suicidal ideation | Model I | | | | | Model II | | | | | Model III | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables of study** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** |
| Gender | -0.55 | 59.75 | 0.0000 | 0.58 | 0.51-0.67 | | | | | | -0.64 | 71.53 | 0.0000 | 0.53 | 0.45-0.61 |
| Grade | -0.13 | 11.04 | 0.0009 | 0.88 | 0.81-0.95 | | | | | | 0.04 | 0.69 | 0.4049 | 0.96 | 0.87-1.06 |
| Ages | -0.19 | 7.48 | 0.0062 | 0.83 | 0.73-0.95 | | | | | | -0.07 | 0.78 | 0.3785 | 0.93 | 0.79-1.10 |
| Life satisfaction | -0.32 | 127.81 | 0.0000 | 0.73 | 0.69-0.77 | -0.36 | 151.82 | 0.0000 | 0.70 | 0.66-0.74 | -0.15 | 19.89 | 0.0000 | 0.81 | 0.81-0.92 |
| Psychache | 0.67 | 497.41 | 0.0000 | 1.96 | 1.85-2.08 | -0.68 | 498.28 | 0.0000 | 1.98 | 1.86-2.10 | 0.63 | 379.54 | 0.0000 | 1.76 | 1.76-2.00 |

| Suicide attempt | Model I | | | | | Model II | | | | | Model III | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables of study** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** |
| Gender | -0.69 | 12.47 | 0.0004 | 0.50 | 0.34-0.74 | | | | | | -0.73 | 13.18 | 0.0003 | 0.48 | 0.33-0.72 |
| Grade | -0.15 | 1.95 | 0.1626 | 0.86 | 0.70-1.06 | | | | | | -0.06 | 0.25 | 0.6164 | 0.94 | 0.73-1.20 |
| Ages | -0.20 | 1.17 | 0.2802 | 0.82 | 0.57-1.17 | | | | | | -0.04 | 0.04 | 0.5810 | 0.96 | 0.63-1.46 |
| Life satisfaction | -0.29 | 14.27 | 0.0002 | 0.75 | 0.65-0.87 | -0.33 | 17.85 | 0.0000 | 0.72 | 0.62-0.84 | -0.11 | 1.56 | 0.2123 | 0.90 | 0.76-1.06 |
| Psychache | 0.62 | 63.12 | 0.0000 | 1.86 | 1.60-2.17 | 0.62 | 62.90 | 0.0000 | 1.87 | 1.60-2.18 | 0.58 | 47.10 | 0.0000 | 1.79 | 1.52-2.11 |

Value of variables: Gender 0(female) – 1 (male); Grade 1 – 4; Age group 1 (14-18 years old) – 3 (22-16 years old); Life satisfaction score 1 – 7; Psychache score 1 – 5.

Model I: crude analyses without any adjustment; Model II: only adjusted for gender, grade and age; Model III: adjusted for all variables listed in the table.

The results from model I and model II both indicated that life satisfaction and psychache had a significant power in predicting suicidal ideation and suicide attempt, and that a higher level of life satisfaction was associated with a reduced risk while a higher level of psychache was associated with an increased risk for suicidal ideation and for suicide attempt. In model III, psychache remained to have a significant effect on the risk for both suicidal ideation and suicide attempt. The effect of life satisfaction, however, differed somehow in model III; its predictive power remained highly significant for the risk of suicidal ideation but attenuated into insignificant for suicide attempt. This means that when the effects of demographic variables and psychache were controlled, life satisfaction did not have a significant predictive effect on suicide attempt, it was relevant to suicide attempt only insofar as it led to psychache.

**Discussion**

In this study, we have investigated the role of life satisfaction and psychache on suicidal ideation and suicide attempt among university students in China using a large random sample from 6 universities. It is, to our awareness, the first study to examine Schneidman's theory on psychache and suicidology in a Chinese culture, and also the first to assess the role of psychache on suicidality in the context of the positive psychological factor of life satisfaction.

**Differences in suicidal ideation and attempt by gender, grade and specialty**

The present study demonstrates that both suicidal ideation and suicide attempt were more prevalent in female students than in the males. This mostly aligns with previous studies from China and many other places reporting higher prevalence of suicidal behaviors in young females than young males.[36-39] One explanation of the higher female versus male suicidal behavior in our study population perhaps lies in the Chinese culture, especially, the deep-rooted Confucianism produced in a patriarchy which trended to denigrate women. [3940] On the other hand, since the observed phenomenon exists worldwide regardless of culture, we believe that, the gender specific personality traits may to a large extend contribute to our observation.[36-39]

Our finding that students studying Literal Arts reported a significantly higher occurrence of suicidal ideation and also modestly higher suicide attempt than their peers studying Engineering and Science is interesting. Of course, the fact that relative more female students choose to study Literal Arts than other subjects may contribute to the result. It may also reflect a selection of personality traits that Liberal Arts students may react more sensitively and emotionally to events and stressors than counterpart students studying other subjects.

In addition, we note that students in the early school years or at a younger age reported more suicidal ideation than their higher grade or elder peers. These results are somehow as expected and could well be explained by the hardship to adapt to the college life and limited experience in handling stressors at the beginning of college life. With the increase of age and experience, the students become better in coping with and handling stressors that they would not be able to handle at younger ages.

**Psychache, life satisfaction and suicidal behavior**

The present study indicates that psychache and life satisfaction were both significant predictors for suicidal ideation and suicide attempt in the study population. Psychachehad stronger power in predicting suicidal ideation and suicide attempt than had life satisfaction, as evidenced by its larger standardized regression coefficients. This result is in line with the finding from other studies testing Shneidman's theory with samples of general population[41] and special groups as offenders,[3342] homeless people[20] and patients with mental illness.[43] The result supports Shneidman's view that psychache is a fundamentally important predictor for suicidal behavior.

Moreover, our analyses further indicate that the mediating role of psychache on the occurrence of suicidal behavior differed slightly between suicidal ideation and suicide attempt. In prediction of suicide attempt, psychache accounted for a greater proportion of variance than did life satisfaction. The association between life satisfaction and suicidal attempt were completely residualized by psychache as Shneidman had predicted. Life satisfaction was relevant to suicide attempt only when it was associated with psychache. However, for suicidal ideation, life satisfaction, independent of psychache, remained to have an additional significant contribution. In other words, psychache was not inevitable to suicidal ideation and played a partial role mediating the link between life satisfaction and suicidal ideation. This observation is in line with findings in a number of published studies. For instance, a study of a large scale college students showed that psychache did not fully mediate the association of suicidal ideation with hopelessness and the change in hopelessness during the follow-up period remained to be a significant predictor.[44] One possible explanation to this result is that psychache may be associated with more serious forms of suicidal behavior. Suicide is known as a continuous process with suicide attempt being more severe form than suicidal ideation.[16] Many factors influence suicidal attempt only insofar they are related to psychache, so psychache is the inevitable channel to suicidal attempt. A study conducted by Mendonca and Holden on population-based psychiatric inpatients also demonstrated that psychache exhibited a stronger influence in persons who had actually formulated a plan for suicide than those who had general suicidal desires.[45] That is to say that, psychache represents a more distal vulnerability in a chain culminating in suicidality.

In addition, our results show that psychache is independently and positively associated with suicidal ideation and suicide attempt, and that the odds ratios associated with psychache were eliminated when adjusted for effects of life satisfaction and demographic variables simultaneously. These results suggest that life satisfaction may be opposed and relieve psychache, and thus verify Shneidman's theory that if the psychache surpasses the threshold of tolerance and is subjectively judged to be unbearable, intolerable or unacceptable , the individuals would then die from suicide in order to escape from the suffering.[16] However, if psychache is relieved, e.g., via effect of protective factors such as life satisfaction, then the originally unbearable psychological pain become acceptable and the individual would stay to live on.[24]

From a clinical point of view, the phenomenology of suicide refers to the inner world of individuals and focuses on what the individual feels as well as understanding from the inside

whenever a clinician encounters a patient. [46] Shneidman considers psychache to be the main ingredient of suicide, [17] and regards suicide not as a movement toward death but rather as a remedy to escape from intolerable emotion, unendurable or unacceptable anguish.[24] Suicidal individuals experience dichotomous thinking, wishing for either some specific (almost magical) total solution for their psychache or cessation (suicide), and suicide is the result of an interior dialogue during which the mind scans its options. [23] The present study indicates that life satisfaction may relieve the psychache and therefore reduces the risk for suicidal ideation and suicide attempt. Treatment for psychache, e.g., using anodyne psychotherapy [47] to mollify unbearable psychological pain, may well have an effect on reducing the risk for suicidal behavior.

**Limitations of the study**

There are several limitations of the present study. Firstly, like most research in this area, the present study is a cross-sectional investigation. This makes it impossible to document any causal relationship of life satisfaction and psychache with suicidal ideation or suicide attempt. While the present study is supportive to Shneidman's view concerning the preeminent role of psychache on suicidal behavior, further studies with a cohort design are needed to verity the possible causal pathways. Secondly, self-reported suicide attempts have limited validity or reliability due to recall bias, [35] we are unable to verify if the reported suicide attempt truly happened in the students' real life. Another concern is related to the generalizability of the findings from the present study. The study students were sampled strictly by a stratified cluster sampling method and from 6 universities in a major city in Central China. Yet we are confident that these students could well represent all undergraduate college students in the area of Central China, we are uncertain whether they are representative to undergraduates studying in other places of China such as the more developed coasts and the less developed western China. This calls for more research to test the model using samples from other parts of China as well from areas with different cultures. Moreover, to our awareness, no protective variable such as life satisfaction have been encompassed in the Shneidman's model so far. Some postulates, for example, that life satisfaction could relieve psychache and thus prevent suicide, need to be further verified by studies from various social settings.

**Conclusions**

The present study sought to test the Shneidman's theory of suicide as psychache using a large sample of university students in China, and to extend existing research by including the protective variable of life satisfaction. The results indicate that psychache and life satisfaction both contribute to the risk for suicidal ideation and suicide attempt, and that psychache plays a mediating role on the link between life satisfaction and suicidal behavior. More specifically, psychache could fully mediate the relationship of life satisfaction with suicidal attempt, but acts as partial mediator linking life satisfaction with suicidal ideation, suggesting that Shneidman's theory is probably more applicable to severe forms of suicidality.

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**Contributors** ZZ, PQ and ZY conceived the idea of the study; ZZ, PQ, ZY and CW designed the study. ZY and SJ undertook the data analysis and produced the tables and graphs; ZY and SJ prepared the initial draft of the manuscript. ZZ and PQ contributed to the interpretation of the results and made the critical revision of the manuscript. All authors read and approved the final manuscript.

**Competing interests** None.

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# Effects of life satisfaction and psychache on risk for suicidal behavior: a study based on data from Chinese undergraduates

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**Running Title:** LIFE SATISFACTION, PSYCHACHE AND SUICIDE BEHAVIOR

**Key words:** Suicidal ideation, suicide attempt, life satisfaction, psychache, Chinese undergraduates

**Word count: 4267**

**ABSTRACT**

**Objectives:** To examine the predicting power of psychache and life satisfaction on risks for suicidal ideation and suicide attempt among young people.

**Design:** A cross-sectional study.

**Setting**: Data were collected from an online survey in Wuhan, China.

**Participants:** 5988 university students from 6 universities were selected by a stratified cluster sampling method.

**Primary and secondary outcome measures:** Suicidal ideation and suicide attempt at some point of the students' life time were the outcomes of interest.

**Results:** Students with suicidal ideation or attempt more often reported low level of life satisfaction and high degree of psychache than counterparts without suicidal ideation or attempt. Regression analyses indicated that life satisfaction and psychache were significantly associated with the risk of suicidal ideation and the risk of suicidal attempt. Though psychache showed a relatively stronger predictive power than did life satisfaction, the effect of the two factors remained significant when they were individually adjusted for personal demographic characteristics. However, when the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt. Life satisfaction remained to contribute unique variance in the statistical prediction of suicidal ideation.

**Conclusions:** Psychache and life satisfaction both have a significant predict power on risk for suicidal behavior, and life satisfaction could relieve the predict power of psychache when suicidal behavior is in the beginning. Shneidman's theory that psychache is the pre-eminent psychological cause of suicide is perhaps applicable only to a more serious form of suicidal behavior.

## ARTICLE SUMMARY

### Research focus

Most studies testing Shneidman's theory on the pre-eminence of psychache in suicidality have been predominantly from North America and only involved negative psychological variables. The present study extends Shneidman's theory to another culture and includes the positive factor of life satisfaction into the model. Our purpose is to examine the predicting power of psychache and life satisfaction on risks for suicidal ideation and suicide attempt among university students in China.

### Key messages

- Life satisfaction and psychache were individually significantly associated with the risk for suicidal ideation and the risk for suicidal attempt. When the two factors were included in the model simultaneously to adjust for each other, psychache could fully explain the association between life satisfaction and suicidal attempt, but not the relationship of life satisfaction with suicidal ideation.
- The results suggest that Shneidman's theory that psychache is the pre-eminent psychological cause of suicide, is perhaps applicable only to a more serious form of suicidal behavior.

### Strengths and limitations of this study

- It is a cross-section study.
- Study subjects comprise a large sample of students randomly selected from 6 universities in a city of central China but it is uncertain if they could represent all university students in China.
- Self-reported suicide attempts may have limited validity or reliability.

**Introduction**

Suicidal behaviour in young people has become an increasing social and public health problem in the contemporary China as well as in many other parts of the world.[1-3] With around 287.000 casualties in the total population of China each year,[4] suicide is the first leading cause of death for young people of 15 to 34 years old and the mortality among Chinese aged 15-24 years stands in the second highest place among the 39 countries that provide the data on suicide to the World Health Organization.[5] Suicide in China is known for its high odds ratio of the rates in rural versus urban areas, and in women versus men particularly in young age groups, [67] but the problem in other forms as suicidal ideation and suicide attempt in young Chinese is generally less known and warrants thorough investigation.

Suicidal behavior is a complicated phenomenon. It is associated with social and environmental factors and particularly with a variety of traits and disadvantages on a personal level. A great number of studies have demonstrated significant relationships of suicide with personal socio-demographics, [8] life stressors, [9] biological features, [10] psychological traits, [11] psychiatric problems, [12] coping skills, [13] etc. Psychological pain is thought to be of great importance, playing an indispensable role in the process of becoming suicidal. [1415]

Psychache, according to Shneidman, is defined as an acute state of intense and intolerable psychological pain that encompasses shame, guilt, humiliation, loneliness, fear, angst, dread, anguish, etc.[1617] It is associated with many psychological suicideogenic factors such as depression and hopelessness, but is also conceptually distinct from these factors. [1819] Evidence has shown that psychache is a significant and unique predictor for various suicide criteria, including suicidal ideation and suicide attempt, even after controlled for effects of depression and hopelessness. [182021] According to Shneidman, psychache is fundamentally linked with suicide in its own, whereas other psychological factors and affective states (e.g., depression, hopelessness) are relevant to suicide only insofar as they lead to psychache.[1617] In other words, if psychache is controlled, the single effect of many factors would be largely attenuated or become insignificant.[22] Thus, psychache is the switch deciding whether a suicide happens or not. In concrete terms, if psychache is too heavy to tolerant for a person, the person will become suicidal -- thinking of dying as the best solution to relief from the intolerable psychache.[1623] In contrast, if psychache can be relieved or mollified, the lethality of method chosen for suicide would be reduced, and the individuals will continue to live on. [24]

It is suggested that completion of suicide is a balanced consequence, depending upon both the presence of risk factors and the absence of protective factors against suicide.[25] However, most of available studies about the pre-eminence of psychache in suicidality have only involved negative psychological variables, such as hopelessness,[18] depression[21] and alexithymia.[26] Little research attention has delved into positive factors, such as life satisfaction – a measure that is reported to be strongly and negatively correlated with suicidal ideation and suicide attempt[2728] and to have a long-term effect on the risk of suicidal behavior.[29] At the same

time, suicide studies testing Shneidman's model have been predominantly from North America, sparse study, to our awareness, has tested Shneidman's theory with a large sample from another culture. To better understand the role of psychache in mechanism of suicidality, we believe, studies that take into account effects of positive factors such as life satisfaction and that use data from diverse cultural backgrounds would provide interesting insights.

We therefore conducted the present study with the primary purpose to test Shneidman's theory of suicide by assessing the predictive power of life satisfaction and psychache on risk of suicidal behavior in a large sample of Chinese college students. Our specific aims include: (1) to examine the prevalence of suicidal ideation and suicide attempt among Chinese college students, (2) to assess the predictive power of life satisfaction and psychache on risk for suicidal behavior, and (3) to explore the role of psychache in the mechanism of suicidality.

## Method

### Participants

Of 8 universities that are attached directly to the ministries of the P. R.China and located in the city of Wuhan, 6 universities agreed to join the survey for this study. A stratified cluster sampling method was used to draw study subjects from all undergraduate students in these universities. A 10% sample of undergraduate students was assigned to each university, and then randomly selected in classes -- the cluster unite that is organized according to specialty and school year with usually 30-80 students. In case a selected class has more than 100 students, 100 students were drawn randomly from this class. Otherwise, all students in the drawn classes were enrolled into the study. The rationale of restricting samples from a large class to up to 100 students is to reduce the likelihood of overweight of large classes and thus to ensure a better representativeness of the 10% sampled students in each university. Consequently, we drew a 10% sample students from all 6 universities, consisted of 93 cluster units (classes). Of 21 large classes (22.58%) , 100 students were further sampled.

With this sampling procedure, a total of 7220 college students were sampled and 6096 students finally attended questionnaire survey for the data collection, corresponding to a response rate of 84.44%. Most students who did not attend the survey were out of the university campus for their internship during the period when the survey was conducted.

The survey was conducted online. Each selected student was assigned with an encrypted code unique to their student identification to be used as personal password for online access to the website designed for the survey. Students enrolled into the survey were informed about the purpose of the study, the confidentiality of personal information and the principle of voluntarily. Of 6096 students who attended the online survey, 5988 completed all question items designed for this study and were therefore included in the final dataset for analyses.

**Measurements**

For each participant, we collected data on personal general information and demographic status such as gender, age, place of family residence, school year and specialty of study alongside data on life satisfaction, psychache and suicidal behavior as described below.

***Life satisfaction***

Life satisfaction was assessed with the Satisfaction with Life Scale[30] which is a self-report questionnaire comprising 5 items [ i.e. (1) 'In most ways my life is close to my ideal'; (2) 'My life condition is very good'; (3) 'I am satisfied with my life', (4) 'I have got the important things which I want in the life'; (5) 'If I had new life, I would enjoy it just as I do now' ]. All items are answered on a 7-point Likert scale (1= 'strongly disagree'; 2= 'disagree'; 3= 'incomplete disagree'; 4= 'not sure'; 5= 'incomplete agree'; 6= 'agree'; and 7= 'strongly agree'). The averages score of the 5 items was calculated as the score of life satisfaction (scores range 1-7). The Satisfaction with Life Scale has strong psychometric properties with alpha reliability coefficients was 0.89[31] and 0.86.[32] In present study, the Alpha reliability coefficient was 0.85.

***Psychache***

Psychache was measured with the Psychache Scale which is a 13-item (e.g., ''My soul aches'') self-report questionnaire designed to assess Shneidman's conceptualization of psychache. [22] All items are answered on a 5-point Likert scale and the total scores range from 13 to 65 (High score indicates high psychache level). In order to precisely capture the level of psychache, we constructed a continuous variable to categorize the score into 5 levels defined after taking into account the frequency distribution and score value as 1=13-15, 2=16-19, 3=20-22, 4=23-26, 5=27-65. Alpha reliability coefficients of this scale were generally exceeding 0.90,[2233] and the scale could distinguish between suicide attempters and non-attempters.[22] In present study, the Alpha reliability coefficient was 0.92.

***Suicidal ideation and suicide attempt***

Suicidal ideation was defined as thoughts or wishes to be dead or to kill oneself according to Schneidman and Silverman et al.[143435] It was assessed through the following two question items: (1) ''have you seriously considered about killing yourself in the past one year'', and (2) ''have you ever seriously considered about killing yourself in your life''. These two items were answered on a 3-point Likert rating (0 = 'never', 1 = 'sometimes', 2 = 'very often'). Participants who answered with '0' for the both items were regarded as ''without suicidal ideation'', all others were regarded as ''with suicidal ideation''.

Suicide attempt was defined as a self-inflicted behavior with a nonfatal outcome for which there is evidence of intent to die. [34] It was assessed with three questions: (1) ''have you ever tried or attempted to kill yourself in the past year'', (2) ''have you ever tried or attempted to kill yourself in your life'' and (3)''have you ever taken any non-fatal suicidal action''. The first two items were answered on a 3-point Likert rating (0 = never, 1 = sometimes, 2 = very often) and the

third item had a binary answer of 'yes' or 'no'. Participants who answered with '0' for both of the first two items and 'no' for the third item were regarded as "without suicide attempt", and otherwise regarded as "with suicide attempt".

**Statistical analysis**

Chi-square test was used to examine the distribution difference of suicidal behavior (suicidal ideation and suicidal attempt) by demographic variables. T-test was conducted to test the variation of scores on life satisfaction and psychache according to the presence of suicidal behaviour. Logistic regression was used to assess the predictive power of psychache and life satisfaction on risk of suicidal behavior and also to evaluate the relative importance of these two factors via three models. Model I estimated the crude effect of each variable of interest; model II estimated the individual effect of life satisfaction and of psychache in the adjustment of demographic variables; and model III adjusted the effect when all variables were included in the model.

**Results**

**General description**

The total sample of 5988 students comprised 3203 male and 2785 female students, with the age ranging from 14 to 26 years (Mean=19.94; SD=1.38). Table 1 shows the demographic distribution of the study participants in details.

Table1 Demographic distribution of students in the study

| Demographic variables | Number (%) | | |
|---|---|---|---|
| | Total | Male | Female |
| Residence place of family | | | |
| Provincial capital or direct-controlled municipality | 924 (15.4) | 413 (44.7) | 511 (55.3) |
| County-level city | 1353 (22.6) | 665 (49.2) | 688 (50.8) |
| County | 803 (13.4) | 417 (51.9) | 386 (48.1) |
| Township | 861 (14.4) | 465 (54.0) | 396 (46.0) |
| Suburban countryside | 930 (15.5) | 510 (54.8) | 420 (45.2) |
| Remote countryside | 1114 (18.6) | 733 (65.8) | 381 (34.2) |
| Specialty of study | | | |
| Engineering | 2036 (34.0) | 1568 (77.0) | 468 (23.0) |
| Science | 2310 (38.6) | 1107 (47.9) | 1203 (52.1) |
| Liberal arts | 1642 (27.4) | 528 (32.2) | 1114 (67.8) |
| Grade | | | |

8

| | | | |
|---|---|---|---|
| Freshman | 2770 (46.3) | 1351 (48.8) | 1419 (51.2) |
| Sophomore | 1748 (29.2) | 1025 (58.6) | 723 (41.4) |
| Junior | 1134 (18.9) | 589 (51.9) | 545 (48.1) |
| Senior | 336 (5.6) | 238 (70.8) | 98 (29.2) |
| Age | | | |
| 14-18 years old | 828 (13.8) | 352 (42.5) | 476 (57.5) |
| 19-21 years old | 4390 (73.3) | 2349 (53.5) | 2041 (46.5) |
| 22-26 years old | 770 (12.9) | 502 (65.2) | 268 (34.8) |

Note. In the study population, 3 students did not report the region of permanent family residence.

Of the total students, 16.4% (982) participants reported the presence of suicidal ideation and 1.9% (114) reported a history of suicide attempt at some point of their life time. The prevalence differed significantly with regards to most demographic variables as shown in Table 2. Suicidal ideation was more prevalent in female than male students (20.4% vs 12.9%), in students coming from large cities as provincial capitals or direct-controlled municipalities (18.9%), and in students studying liberal arts (20.8%), in freshman students (17.8%),and consistent with this, in students at relatively younger age groups. These observed patterns remained very similar when looking at the self-reported presence of suicide attempt, although the differences by most demographic factors did not reach a statistical significance. Still, it is evident that female students reported a significantly higher rate of suicide attempt (2.6%) than their male counterparts studying in the universities (2.6% vs 1.3%).

Table 2 Prevalence of suicidal ideation and suicide attempt by demographic variables

| | **Number** | **Suicidal ideation** | **Test of difference** | **Suicidal attempt** | **Test of difference** |
|---|---|---|---|---|---|
| | **N** | **N (%)** | | **N (%)** | |
| *Total* | 5988 | 982(16.4) | | 114(1.9) | |
| *Gender* | | | $\chi^2$=60.63 | | $\chi^2$=12.95 |
| Males | 3203 | 414(12.9) | df=1 | 42(1.3) | df=1 |
| Females | 2785 | 568(20.4) | p=0.0000 | 72(2.6) | p=0.0002 |
| *Residence place of family* | | | $\chi^2$=6.26 | | $\chi^2$=8.92 |
| Provincial capital or direct-controlled municipality | 924 | 175(18.9) | df=5 p=0.2819 | 26(2.8) | df=5 p=0.1123 |
| County-level city | 1353 | 218(16.1) | | 27(2.0) | |

9

| | | | | | |
|---|---|---|---|---|---|
| County | 803 | 124(15.4) | | 19(2.4) | |
| Township | 861 | 129(15.0) | | 15(1.7) | |
| Suburban countryside | 930 | 151(16.2) | | 12(1.3) | |
| Remote countryside | 1114 | 184(16.5) | | 15(1.3) | |
| *Specialty of study* | | | $\chi^2$=33.16 | | $\chi^2$=4.51 |
| Engineering | 2036 | 289(14.2) | df=2 | 30(1.5) | df=2, |
| Science | 2310 | 351(15.2) | p=0.0000 | 44(1.9) | p=0.105 |
| Liberal arts | 1642 | 342(20.8) | | 40(2.4) | |
| *School year* | | | $\chi^2$=21.22 | | $\chi^2$=5.61 |
| Freshman | 2770 | 493(17.8) | df=3 | 58(2.1) | df=3 |
| Sophomore | 1748 | 270(15.4) | p=0.0001 | 31(1.8) | p=0.1322 |
| Junior | 1134 | 191(16.8) | | 24(2.1) | |
| Senior | 336 | 28(8.3) | | 1(0.3) | |
| *Age* | | | $\chi^2$=8.56 | | $\chi^2$=3.79 |
| 14-18 | 828 | 150(18.1) | df=2 | 15(1.8) | df=2 |
| 19-21 | 4390 | 732(16.7) | p=0.0138 | 91(2.1) | p=0.1500 |
| 22-26 | 770 | 100(13.0) | | 8(1.0) | |

Note. In the study population, 3 students did not report the region of permanent family residence.

**Distribution of life satisfaction and psychache according to presence of suicidal behaviour**

Figure 1 shows the frequency distribution of students according to the level of life satisfaction and the raw score of psychache. For life satisfaction, the scores exhibited a normal distribution, ranging from 1 to 7. However, the scores of psychache exhibited a partial normal distribution with the majority having a low score and a few at the high end. According to the Shneidman's theory, psychache is an intense and intolerable extreme state involving heavy psychological pain. It is therefore reasonable that most of people experienced a mild psychological pain whilst intense psychological pain was present in the minority.

10

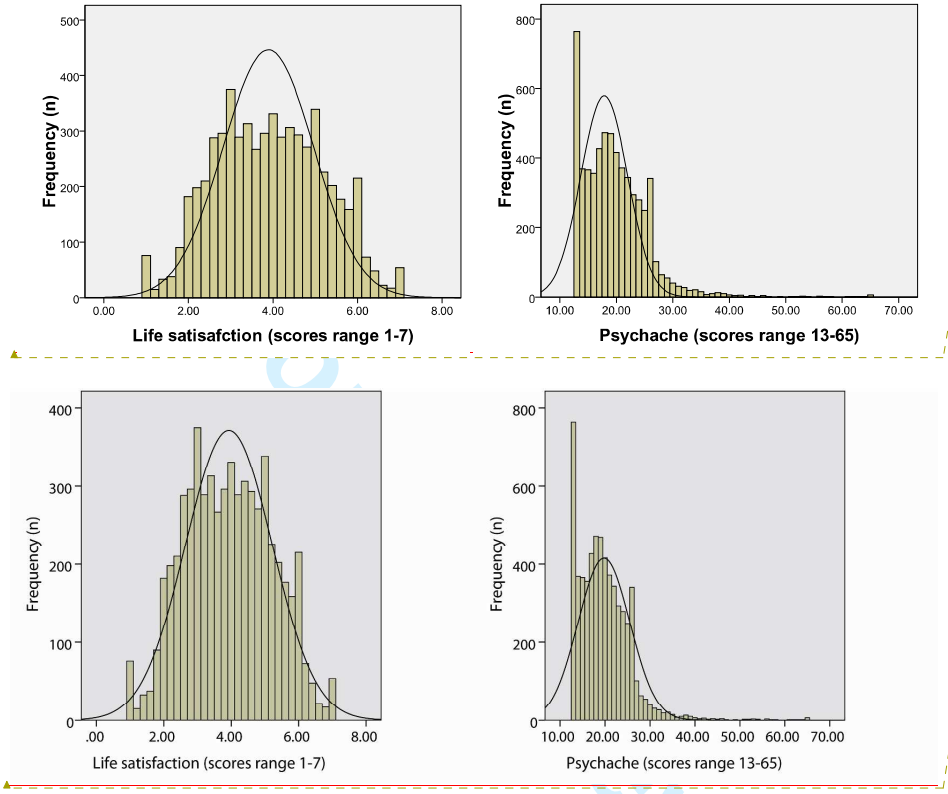


Figure 1 Distribution of life satisfaction and psychache scores in the study subjects

Table 3 presents the means and standard deviations of the scores on life satisfaction and psychache according to the presence of suicidal ideation and suicide attempt. The results from t tests indicate that students with suicidal ideation or suicide attempt reported a significantly lower score of life satisfaction and a significantly higher score of psychache. This, in other words, means that high level of life satisfaction and low degree of psychache are proactive against suicidal behavior within this population.

Table 3 Scores of life satisfaction and psychache by presence of suicidal ideation and suicide attempt

| | | Number of subjects | Mean (Standard deviation) | |
|---|---|---|---|---|
| | | | Life satisfaction | Psychache |
| Total | | | 3.93（1.29） | 1.56 (1.27) |
| Suicidal ideation | Yes | 982 | 3.50（1.22） | 2.44 (1.21) |
| | No | 5006 | 4.02（1.28） | 1.39 (1.20) |
| t-test | | | -11.97 | 24.95 |

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| | | | | |
|---|---|---|---|---|
| df | | | 5986 | 5986 |
| p | | | 0.0000 | 0.0000 |
| Suicide attempt | Yes | 114 | 3.48（1.44） | 2.55 (1.36) |
| | No | 5874 | 3.94（1.28） | 1.54 (1.26) |
| t-test | | | -3.81 | 8.49 |
| df | | | 5986 | 5986 |
| p | | | 0.0001 | 0.0000 |

*Note.* Life satisfaction score ranges from 1 to 7; Psychache score ranges from 1 to 5.

**Effect of life satisfaction and psychache on risk for suicidal ideation and suicide attempt**

Table 4 displays the results from modelling the data with logistic regression in order to assess the statistical predictive power of psychache and life satisfaction on risk for suicidal ideation and suicide attempt.

12

Table 4 Predictive power of life satisfaction and psychache on risk of suicidal ideation and of suicide attempt

| Suicidal ideation | Model I | | | | | Model II | | | | | Model III | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables of study** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** |
| Gender | -0.55 | 59.75 | 0.0000 | 0.58 | 0.51-0.67 | | | | | | -0.64 | 71.53 | 0.0000 | 0.53 | 0.45-0.61 |
| Grade | -0.13 | 11.04 | 0.0009 | 0.88 | 0.81-0.95 | | | | | | 0.04 | 0.69 | 0.4049 | 0.96 | 0.87-1.06 |
| Ages | -0.19 | 7.48 | 0.0062 | 0.83 | 0.73-0.95 | | | | | | -0.07 | 0.78 | 0.3785 | 0.93 | 0.79-1.10 |
| Life satisfaction | -0.32 | 127.81 | 0.0000 | 0.73 | 0.69-0.77 | -0.36 | 151.82 | 0.0000 | 0.70 | 0.66-0.74 | -0.15 | 19.89 | 0.0000 | 0.81 | 0.81-0.92 |
| Psychache | 0.67 | 497.41 | 0.0000 | 1.96 | 1.85-2.08 | -0.68 | 498.28 | 0.0000 | 1.98 | 1.86-2.10 | 0.63 | 379.54 | 0.0000 | 1.76 | 1.76-2.00 |

| Suicide attempt | Model I | | | | | Model II | | | | | Model III | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables of study** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** | **B** | **Wald** | **p** | **OR** | **CI (95%)** |
| Gender | -0.69 | 12.47 | 0.0004 | 0.50 | 0.34-0.74 | | | | | | -0.73 | 13.18 | 0.0003 | 0.48 | 0.33-0.72 |
| Grade | -0.15 | 1.95 | 0.1626 | 0.86 | 0.70-1.06 | | | | | | -0.06 | 0.25 | 0.6164 | 0.94 | 0.73-1.20 |
| Ages | -0.20 | 1.17 | 0.2802 | 0.82 | 0.57-1.17 | | | | | | -0.04 | 0.04 | 0.5810 | 0.96 | 0.63-1.46 |
| Life satisfaction | -0.29 | 14.27 | 0.0002 | 0.75 | 0.65-0.87 | -0.33 | 17.85 | 0.0000 | 0.72 | 0.62-0.84 | -0.11 | 1.56 | 0.2123 | 0.90 | 0.76-1.06 |
| Psychache | 0.62 | 63.12 | 0.0000 | 1.86 | 1.60-2.17 | 0.62 | 62.90 | 0.0000 | 1.87 | 1.60-2.18 | 0.58 | 47.10 | 0.0000 | 1.79 | 1.52-2.11 |

Value of variables: Gender 0(female) – 1 (male); Grade 1 – 4; Age group 1 (14-18 years old) – 3 (22-16 years old); Life satisfaction score 1 – 7; Psychache score 1 – 5.

Model I: crude analyses without any adjustment; Model II: only adjusted for gender, grade and age; Model III: adjusted for all variables listed in the table.

The results from model I and model II both indicated that life satisfaction and psychache had a significant power in predicting suicidal ideation and suicide attempt, and that a higher level of life satisfaction was associated with a reduced risk while a higher level of psychache was associated with an increased risk for suicidal ideation and for suicide attempt. In model III, psychache remained to have a significant effect on the risk for both suicidal ideation and suicide attempt. The effect of life satisfaction, however, differed somehow in model III; its predictive power remained highly significant for the risk of suicidal ideation but attenuated into insignificant for suicide attempt. This means that when the effects of demographic variables and psychache were controlled, life satisfaction did not have a significant predictive effect on suicide attempt, it was relevant to suicide attempt only insofar as it led to psychache.

**Discussion**

In this study, we have investigated the role of life satisfaction and psychache on suicidal ideation and suicide attempt among university students in China using a large random sample from 6 universities. It is, to our awareness, the first study to examine Schneidman's theory on psychache and suicidology in a Chinese culture, and also the first to assess the role of psychache on suicidality in the context of the positive psychological factor of life satisfaction.

**Differences in suicidal ideation and attempt by gender, grade and specialty**

The present study demonstrates that both suicidal ideation and suicide attempt were more prevalent in female students than in the males. This mostly aligns with previous studies from China and many other places reporting higher prevalence of suicidal behaviors in young females than young males.[36-39] One explanation of the higher female versus male suicidal behavior in our study population perhaps lies in the Chinese culture, especially, the deep-rooted Confucianism produced in a patriarchy which trended to denigrate women. [3940] On the other hand, since the observed phenomenon exists worldwide regardless of culture, we believe that, the gender specific personality traits may to a large extend contribute to our observation.[36-39]

Our finding that students studying Literal Arts reported a significantly higher occurrence of suicidal ideation and also modestly higher suicide attempt than their peers studying Engineering and Science is interesting. Of course, the fact that relative more female students choose to study Literal Arts than other subjects may contribute to the result. It may also reflect a selection of personality traits that Liberal Arts students may react more sensitively and emotionally to events and stressors than counterpart students studying other subjects.

In addition, we note that students in the early school years or at a younger age reported more suicidal ideation than their higher grade or elder peers. These results are somehow as expected and could well be explained by the hardship to adapt to the college life and limited experience in handling stressors at the beginning of college life. With the increase of age and experience, the students become better in coping with and handling stressors that they would not be able to handle at younger ages.

**Psychache, life satisfaction and suicidal behavior**

The present study indicates that psychache and life satisfaction were both significant predictors for suicidal ideation and suicide attempt in the study population. Psychachehad stronger power in predicting suicidal ideation and suicide attempt than had life satisfaction, as evidenced by its larger standardized regression coefficients. This result is in line with the finding from other studies testing Shneidman's theory with samples of general population[41] and special groups as offenders,[3342] homeless people[20] and patients with mental illness.[43] The result supports Shneidman's view that psychache is a fundamentally important predictor for suicidal behavior.

Moreover, our analyses further indicate that the mediating role of psychache on the occurrence of suicidal behavior differed slightly between suicidal ideation and suicide attempt. In prediction of suicide attempt, psychache accounted for a greater proportion of variance than did life satisfaction. The association between life satisfaction and suicidal attempt were completely residualized by psychache as Shneidman had predicted. Life satisfaction was relevant to suicide attempt only when it was associated with psychache. However, for suicidal ideation, life satisfaction, independent of psychache, remained to have an additional significant contribution. In other words, psychache was not inevitable to suicidal ideation and played a partial role mediating the link between life satisfaction and suicidal ideation. This observation is in line with findings in a number of published studies. For instance, a study of a large scale college students showed that psychache did not fully mediate the association of suicidal ideation with hopelessness and the change in hopelessness during the follow-up period remained to be a significant predictor.[44] One possible explanation to this result is that psychache may be associated with more serious forms of suicidal behavior. Suicide is known as a continuous process with suicide attempt being more severe form than suicidal ideation.[16] Many factors influence suicidal attempt only insofar they are related to psychache, so psychache is the inevitable channel to suicidal attempt. A study conducted by Mendonca and Holden on population-based psychiatric inpatients also demonstrated that psychache exhibited a stronger influence in persons who had actually formulated a plan for suicide than those who had general suicidal desires.[45] That is to say that, psychache represents a more distal vulnerability in a chain culminating in suicidality.

In addition, our results show that psychache is independently and positively associated with suicidal ideation and suicide attempt, and that the odds ratios associated with psychache were eliminated when adjusted for effects of life satisfaction and demographic variables simultaneously. These results suggest that life satisfaction may be opposed and relieve psychache, and thus verify Shneidman's theory that if the psychache surpasses the threshold of tolerance and is subjectively judged to be unbearable, intolerable or unacceptable , the individuals would then die from suicide in order to escape from the suffering.[16] However, if psychache is relieved, e.g., via effect of protective factors such as life satisfaction, then the originally unbearable psychological pain become acceptable and the individual would stay to live on.[24]

From a clinical point of view, the phenomenology of suicide refers to the inner world of individuals and focuses on what the individual feels as well as understanding from the inside

whenever a clinician encounters a patient. [46] Shneidman considers psychache to be the main ingredient of suicide, [17] and regards suicide not as a movement toward death but rather as a remedy to escape from intolerable emotion, unendurable or unacceptable anguish.[24] Suicidal individuals experience dichotomous thinking, wishing for either some specific (almost magical) total solution for their psychache or cessation (suicide), and suicide is the result of an interior dialogue during which the mind scans its options. [23] The present study indicates that life satisfaction may relieve the psychache and therefore reduces the risk for suicidal ideation and suicide attempt. Treatment for psychache, e.g., using anodyne psychotherapy [47] to mollify unbearable psychological pain, may well have an effect on reducing the risk for suicidal behavior.

**Limitations of the study**

There are several limitations of the present study. Firstly, like most research in this area, the present study is a cross-sectional investigation. This makes it impossible to document any causal relationship of life satisfaction and psychache with suicidal ideation or suicide attempt. While the present study is supportive to Shneidman's view concerning the preeminent role of psychache on suicidal behavior, further studies with a cohort design are needed to verity the possible causal pathways. Secondly, self-reported suicide attempts have limited validity or reliability due to recall bias, [35] we are unable to verify if the reported suicide attempt truly happened in the students' real life. Another concern is related to the generalizability of the findings from the present study. The study students were sampled strictly by a stratified cluster sampling method and from 6 universities in a major city in Central China. Yet we are confident that these students could well represent all undergraduate college students in the area of Central China, we are uncertain whether they are representative to undergraduates studying in other places of China such as the more developed coasts and the less developed western China. This calls for more research to test the model using samples from other parts of China as well from areas with different cultures. Moreover, to our awareness, no protective variable such as life satisfaction have been encompassed in the Shneidman's model so far. Some postulates, for example, that life satisfaction could relieve psychache and thus prevent suicide, need to be further verified by studies from various social settings.

**Conclusions**

The present study sought to test the Shneidman's theory of suicide as psychache using a large sample of university students in China, and to extend existing research by including the protective variable of life satisfaction. The results indicate that psychache and life satisfaction both contribute to the risk for suicidal ideation and suicide attempt, and that psychache plays a mediating role on the link between life satisfaction and suicidal behavior. More specifically, psychache could fully mediate the relationship of life satisfaction with suicidal attempt, but acts as partial mediator linking life satisfaction with suicidal ideation, suggesting that Shneidman's theory is probably more applicable to severe forms of suicidality.

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**Contributors** ZZ, PQ and ZY conceived the idea of the study; ZZ, PQ, ZY and CW designed the study. ZY and SJ undertook the data analysis and produced the tables and graphs; ZY and SJ prepared the initial draft of the manuscript. ZZ and PQ contributed to the interpretation of the results and made the critical revision of the manuscript. All authors read and approved the final manuscript.

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**Competing interests** None.

**Ethical approval** The study was approved by the Ethical Committee for Scientific Research at Central China Normal University.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** No additional data are available.

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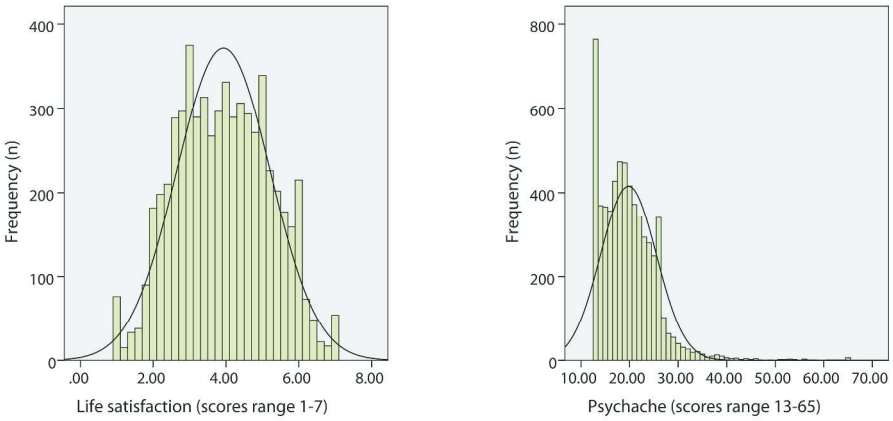


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**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1, 2 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 4, 5 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 4, 5 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5, 6, 7 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5, 6, 7 |
| Bias | 9 | Describe any efforts to address potential sources of bias | *5, 6* |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 7 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 6, 7 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 6 |
| | | (*c*) Explain how missing data were addressed | 5 |
| | | (*d*) If applicable, describe analytical methods taking account of sampling strategy | 5 |
| | | (*e*) Describe any sensitivity analyses | |
| **Results** | | | |

| | | | |
|---|---|---|---|
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 7, 8, 9, 10 |
| | | (b) Give reasons for non-participation at each stage | 5, 6, 7 |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 7, 8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | 7, 8, 9, 10, 11 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 7, 8, 9, 10, 11 |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 11, 12 |
| | | (*b*) Report category boundaries when continuous variables were categorized | 5, 6, 7 |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 12, 13, 14 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 14 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 12, 13, 14 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 13, 14 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 15 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.