Studying suicide using proxy-based data: reliability and validity of a short version scale for measuring quality of life in rural China

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Abstract

Background: To evaluate the reliability and validity of the short version six-item Quality of Life Scale (QOLS-6) and the consistency of subject-proxy data in a case-control psychological autopsy study on elderly suicide in rural China.

Methods: A two-stage stratified cluster sampling method was used to select research sites. We used self-administered questionnaires to collect proxy-based information from informants and subject-based information from living comparisons.

Results: A total of 242 pairs of suicide cases and living comparisons were selected in our research. Subject-proxy consistency for QOLS-6 was good (Intraclass correlation coefficient (ICC) was 0.688) in living controls. Good internal consistency of QOLS-6 was validated by Cronbach's α being greater than 0.6 among suicide cases and living comparisons. The mean scores of quality of life were lower among suicide cases than living controls. Quality of life was negatively correlated with depression, loneliness, hopelessness, impulsiveness and stressful life events, while it was positively correlated with activities of daily living and family function.

Conclusions: QOLS-6 has good reliability and validity, which can be used for assessing quality of life among Chinese rural older adults. It is shorter and easier than any other scale for measuring quality of life and can be used as a screening tool in future studies.

Keywords: Quality of life, Psychological autopsy, Suicide, Chinese rural elderly

Introduction

The World Health Organization defines quality of life as an individual's perception of their position in life in the context of their culture and value systems. It is affected in a complex way by the person's physic, psychology, level of independence, social relationships, and environment *(WHOQOL-Group, 1993)*.

Quality of life includes a person's physical health, psychological state, and social relationships. According to the definition of healthy, quality of life can be considered a reflection of the health status. Some researchers found that quality of life is one of the critical factors leading to suicidal behavior *(Balazs et al., 2018)*.

As the population aging process accelerates, we should pay more attention to quality of life among the elderly to ensure that their life is worth living. The elderly's income may be reduced due to loss of work, and the living environment also undergoes certain changes. With advancing age, the elderly begin to develop chronic diseases, face reduced income, and lose some connection with their networks. These will inevitably cause declines in their quality of life.

The population aged 60 or older reached 900 million worldwide *(WHO, 2016)*. In China, the population aged 60 or older accounted for 17.9% of the general population and those aged 65 or older accounted for 11.9% in 2018 *(National Bureau of Statistics of China, 2019)*. Moreover, suicide rates are highest in both old men and women in almost all regions of the world *(WHO, 2018)*. It was estimated that the average suicide rate among the elderly was 6.2-fold higher than that among the population under 65 *(Zhong, Chiu & Conwell, 2016)*. Suicide rates among

81 Chinese rural older adults are the highest compared to all age groups; however, little is known
82 about quality of life in this rapidly growing vulnerable population.
83   There are many well-developed scales used to measure quality of life, such as WHOQOL-100,
84 WHOQOL-BREF, EQ-5D, SF-36, and so on *(Makovski et al., 2019)*. However, no studies on the
85 reliability and validity of these scales were conducted in elderly suicide cases. Phillips *(Phillips*
86 *et al., 2002)* developed Quality of Life scale (QOLS-6) based on their psychological autopsy
87 studies among the general population in 2002. As a short version measurement, this scale is
88 easier and more convenient to carry out in suicide research especially among the elderly. Thus,
89 the purpose of this study is to evaluate the reliability and validity of this scale. As far as we
90 know, this study is the first to evaluate QOLS-6 in several sequential periods in a large sample of
91 rural older adults. In short, as the population aging rate and the number of elderly people increase
92 rapidly, the rural elderly have a higher suicide rate, and the quality of life of the elderly is
93 receiving increasing attention. Therefore, this is a very useful study on the quality of life for
94 suicidal elderly. This scale has practical significance for clinical work. We can assess the
95 person's quality of life quickly through it and quality of life can be seen as a reflection of
96 personal health. So it means we can promote health and suicide prevention through this scale.
97

Materials & Methods

Participants and procedures

100   A two-stage stratified cluster sampling was used to select research sites. Firstly, according to
101 the GDP per capita of 31 provinces in mainland China*(National Bureau of Statistics of China,*
102 *2015)*, 3 provinces ---- Shandong, Hunan, and Guangxi, were randomly selected from the top 10,
103 11-20 and 21-31 provinces in terms of GDP. Secondly, counties of each province were divided
104 into three levels according to economic status and 12 counties were randomly selected. Suicide
105 cases aged 60 or older were collected continuously based on the death certificate system in each
106 county. According to age (±3 years old), sex, and living location of suicide cases, living
107 comparisons were 1:1 matched. When a suicide case was selected, trained investigators would
108 list and numbered suitable living older adults, and then a living comparison was selected
109 randomly from the list by a computer program. We selected two informants for each suicide case
110 and living comparison, respectively. The first informant (e.g. a next-to-kin) was always the
111 person who lived with a suicide case or living comparison, whereas the second informant (e.g. a
112 friend, a neighbor or a relative) usually didn't lived with them. Interviews with informants of
113 living comparisons were conducted as soon as comparisons and their informants were identified,
114 while interviews with informants of suicide cases were conducted in a schedule of 2-6 months
115 after death. Each informant was interviewed separately by one trained interviewer. The average
116 interview time was 90 minutes. The content of the interview with the informants was to reflect
117 the situation of the target person (suicide case or living control) rather than the informants. The
118 information of a suicide case was obtained from the description of two corresponding
119 informants. Besides, the information of a living control was obtained by himself as well as the
120 corresponding informants. Thus, the information obtained from the living control themselves

121 was also called the gold standard. Questionnaires are almost the same between informants and
122 living controls themselves, the questionnaire of informants is interviewed for information of the
123 target person (a suicide case or a living comparison) but not informants'. A total of 242 suicides
124 and 242 living controls were investigated in this study. Informed consent was obtained from
125 participants in this study by signing the informed consent form prior to the interview. The
126 participants of suicide case group were the informants of suicide cases, but those of living
127 control group were living controls and their informants. This study was approved by the Human
128 Research Ethics Committees of Shandong University (Ethical Application Ref: 20150306-1),
129 Central South University (Ethical Application Ref: CTXY-130041-1) , and Guangxi Medical
130 University (Ethical Application Ref: 20150146).
131   There were some discrepancies and differences from two informants for a target person, thus
132 the information needed to be integrated. For the demographic characteristics, the information
133 provided by the first informant was more reliable than those from second informant. If the target
134 person has behaviors that increase the risk of suicide, this answer of informant should be
135 adopted. Because when one of the two informants observed targeting behavior, it may exist.
136
137 **Measurements**
138   1. Demographic characteristics
139   Demographic data such as sex, age, education level, family income, marital status,
140 employment status, and living arrangements were collected. Education level included below
141 primary school, primary school and above primary school. Based on 33 and 66 percentiles,
142 family annual income in Chinese yuan (CNY) was divided into three groups : < 3600 yuan,
143 3600-10000 yuan and >10000 yuan. For marital status, people who were married and living with
144 the spouse or cohabiting were classified as "stable marital status", while people with another
145 marital status (including single, divorced, widowed, married but living apart) were classified as
146 "unstable marital status". Being left-behind is defined as all adult family members who have
147 been away from home for at least 10 months and had visited the elderly no more than twice in
148 the nearly 12 months prior to death/investigation.
149   2. Quality of life
150   Quality of Life scale (QOLS-6) *(Phillips et al., 2002)* developed by Phillips was adopted, in
151 which six items in question form were used to collect the quality of life of the target person in
152 the last month before the suicide or investigation. It includes physical health, psychological
153 health, economic status, work, family relationships and relationships with others. On each item,
154 participants were asked to indicate the status using a 5-point scale: 1 = very poor, 2 = poor, 3 =
155 fair, 4 = good and 5 = excellent. The total score ranges from 6 to 30, higher scores indicate
156 higher living quality.
157   3. Other related factors
158   Geriatric Depression Scale (GDS) *(Chan, 1996; Yesavage et al., 1982)*, Chinese Revision of
159 Short-form of the UCLA Loneliness Scale (ULS-6) *(Hays & DiMatteo, 1987; Zhou et al., 2012)*,
160 short Beck Hopeless Scale (BHS-4) *(Beck & Weissman, 1974; Liu et al., 2011)*, Barratt

161   Impulsiveness Scale (BIS-11) *(Li et al., 2011; Patton, Stanford & Barratt, 1995)*, Life Events
162   Scale for the Elderly (LESE) *(Xiao & Xu, 2007)*, and Duke Social Support Index (DSSI) *(Koenig*
163   *et al., 1993; Mao et al., 2015)*, Activity of Daily Living Scale (ADL) *(Lawton & Brody, 1969)*
164   and the family Adaptive, Partnership, Growth, Affection and Resolve Scale (family APGAR)
165   *(Smilkstein, 1978)* were also used in this study to measure related suicide risk factors. All of
166   these measurement tools had been widely applied in suicide research to evaluate people's
167   physical, psychological, and social well-being and showed good reliability and validity among
168   Chinese rural suicide elderly *(Mo et al., 2019; Niu et al., 2018a; Niu et al., 2018b)*.
169

170   **Statistical analysis**
171   Descriptive analysis, McNemar's test, paired t-test, Wilcoxon signed-rank test were used to
172   compare demographic characteristics. Intraclass correlation coefficient (ICC) was used to
173   evaluate the agreement between proxy-based data from informants and subject-based data from
174   living controls (gold standard). Exploratory factor analysis was used to analyze structural
175   validity of QOLS-6. Concurrent validity of QOLS-6 were examined by using Spearman's
176   correlation analysis between QOLS-6 and other related scales.
177   Statistical analysis was performed by using SPSS 23.0 for Windows (SPSS Inc, Chicago, IL).
178   All reported *P* values were two-sided, and *P* values <0.05 were considered statistically
179   significant.
180

181   # Results
182   **Demographic characteristics and other scales**
183   A total of 242 elderly suicide cases and 242 living comparisons were investigated. As shown
184   in Table 1, no significant differences were found in education, pain, family annual income.
185   Suicide cases were significantly more likely to have unstable marital status, unemployed, living
186   alone, being left-behind and suffering from serious or chronic diseases. Also, suicide cases show
187   higher scores in depression, loneliness, hopelessness, impulsiveness and life events, lower scores
188   in social support, activity of daily living and family function than living controls ($P < 0.001$).
189

190   **Reliability**
191   Cronbach's α of suicide cases and living controls was 0.641 and 0.782, respectively, which
192   indicated that the internal consistency of QOLS-6 was good.
193   The consistency between gold standards and proxy information among living controls is
194   shown in Table 2. ICC values of living comparisons between the first informant, the second
195   informant, and integrated information are 0.653, 0.621, and 0.688, respectively.
196

197   **Construct validity**
198   Data on suicide cases and living controls of QOLS-6 were performed using the Kaiser-Meyer-
199   Olkin (KMO) measure of sampling adequacy and Bartlett's spherical test. The results of this
200   study were KMO = 0.659, χ^2= 365.350, *P*<0.001 for suicide victims and KMO = 0.737, χ^2=

201 449.878, *P<0.001* for living comparisons. This study was appropriate for exploratory factor
202 analysis to discuss the factors structure, because both groups have KMO > 0.600 and *P* < 0.05.
203   Two common factors were extracted using exploratory factor analysis. The cumulative
204 variance percentage of these two factors was 65.847% for suicide victims and 69.032% for living
205 comparisons. Scree plots of exploratory factor analysis of suicide cases and living controls are
206 shown in Figure 1 and Figure 2, respectively. The rotated component matrix is shown in Table 3.
207 Factor 1 mainly explains Items 1 to 4, which is an internal self-related component. Factor 2
208 mainly explains Items 5 and 6, which is an external relationship-related component.
209
210 **Concurrent validity**
211   The concurrent validity of QOLS-6 were examined using Spearman's correlation coefficients
212 between scores of QOLS-6 and other related scales. As shown in Table 4, quality of life is
213 positively correlated with activities of daily living and family function and is negatively
214 correlated with depression, loneliness, hopelessness, impulsiveness, and life events both among
215 suicide cases and living controls.
216
217 **Quality of life in suicide cases and living controls**
218   As shown in Table 5, compared with living controls, suicide cases have a lower score, which
219 indicates a poorer quality of life among suicide cases than living controls (*P* < 0.001).
220

Discussion

222 This study was designed to assess the reliability and validity of QOLS-6 through psychological
223 autopsy among elderly suicide cases and controls in rural China. The scale reported in this study
224 provides a useful and practical tool much needed for research on older adults. It evaluates quality
225 of life in three dimensions: physical, mental, and social well-being. The result showed that
226 QOLS-6 had good reliability and validity among Chinese rural older adults. This instrument is
227 simple to use and well accepted by rural residents or others with a minimum of primary school
228 education.
229   It is important to use a reliable scale to measure quality of life for suicide prevention. Poor
230 quality of life is associated with increased risk of suicide *(He et al., 2017)*. By contrasting the
231 proxy data of the suicide group and the control group, QOLS-6 can play a better role in suicide
232 prevention. In Liu Yao's research *(Liu et al., 2014)*, the score of quality of life among college
233 students who attempted suicide was 58.41 (the total score was 100), and the average score of
234 those without suicide attempts was 66.62. Both scores are slightly higher than those in our study.
235 There are two inferences about this: different age groups have different quality of life, and the
236 person who committed suicide and the one who attempted suicide may have different quality of
237 life. Quality of life was lower among suicide cases than living controls *(Li et al., 2005)*,
238 indicating that poor quality of life should be considered a risk factor for elderly suicide cases.
239 Quality of life showed the potential to identify the elderly who may be at risk of suicide, but the

240 mechanism of effect on suicide also needs to be carried out in follow-up research. Therefore, this
241 scale has practical significance for clinical work.
242   The short version of the QOL scale has good reliability, and proxy data are reliable for
243 evaluating the quality of life of the target population. The ICC between gold standard and
244 informants is greater than 0.6, which indicates that the quality of life obtained through proxy data
245 is reliable. This result is consistent with other studies *(Wang et al., 2007)*. ICC values range from
246 0 to 1, with 0 being untrusted and 1 fully credible, and are evaluated based on the following
247 benchmarks: poor (<0.40), fair (0.40-0.59), good (0.60-0.74) and excellent (>0.75) *(Cicchetti,*
248 *1994)*. Good internal consistency of QOLS-6 was validated by that two Cronbach's alpha were
249 both greater than 0.6 among suicide cases and living comparisons, which was also consistent
250 with previous studies *(Tian et al., 2013)*.
251   Moreover, the scale has good construct validity. Two factors were found for the suicide and
252 control groups, which could be defined as the internal and external components, respectively.
253 The internal components mainly reflect the physical, psychological, economic, and working
254 conditions, while the external components are mainly related to relationships with family or
255 others. The items which the factor loading concentrated on were consistent both in suicide and
256 comparison cases, which indicated that the scale's structural validity was acceptable.
257   The scale has good concurrent validity. Older adults with depression, loneliness, hopelessness,
258 impulsiveness, or low family function have a poor quality of life. Previous studies indicate that
259 depression is associated with quality of life, and people with good quality of life suffer less from
260 depressive symptoms *(Zhang et al., 2019)*. Similarly, in this study, quality of life is negatively
261 correlated with depression in older adults. The number of life events is negatively correlated with
262 quality of life *(Tian et al., 2013)*. Some studies indicate that increased loneliness is associated
263 with reduced quality of life *(Arslantaş et al., 2015)*, which is consistent with the results of our
264 study. Meanwhile, previous studies *(İzci et al., 2018)* showed that both hopelessness and
265 impulsiveness reduce quality of life. Similarly, our study shows that quality of life is negatively
266 correlated with hopelessness and impulsiveness. Moreover, our study shows that people who are
267 able to do living activities have good quality of life, which is consistent with previous reports
268 *(Yang et al., 2017)*. The APGAR is positively correlated with the QOLS-6 *(Lu et al., 2017)*.
269 Good family function could improve the elderly's quality of life. Therefore, the quality of life
270 scale also shows good concurrent validity according to the correlation between the above
271 mentioned factors.
272   This scale has practical significance for clinical work. Through above analysis, we can know
273 that quality of life is related to suicide and various other mental health problems (Such as
274 depression, etc.). Therefore, we can use it to predict and prevent the risk of suicide and other
275 mental health problems.
276   There are some limitations to this study. There is information bias in both the suicide cases
277 and living controls, while the case-control design can minimize the impact of information bias.
278 In this study, we used living comparisons as the gold standard to assess the validity of their
279 informants' reports. Informants in suicide group may be in grief and reported information may

280   be affected. This study adjusted and matched the age, sex, and living location to identify
281   potential risk factors, which meant that we could not consider the potential interaction between
282   these factors and other potential risk factors. Men and women are very different in their
283   communications and interpersonal interactions. Thus, we may miss a key potential element when
284   not comparing results for men and women. In addition, with the rural elderly as the study objects
285   in this study, further research should be carried out in other groups, and more other risk factors
286   should be considered.
287

Conclusions

289   In conclusion, QOLS-6 scale has good reliability and validity for assessing quality of life
290   among older adults in China. It is shorter and easier than any other scale for measuring quality of
291   life and could be used as a screening tool in future studies. With changes in the medical models,
292   future research should pay more attention to mental and social factors. In addition to the
293   components of physical and psychological health, the scale also explains quality of life from a
294   social perspective, which is more conducive to comprehensive assessment of quality of life. As
295   our study focuses on Chinese rural older adults, we recommend that future studies should be
296   conducted on different age groups in various populations to further evaluate the validity and
297   reliability of QOLS-6. Quality of life showed the potential to identify the elderly who may be at
298   risk of suicide, but the mechanism of effect on suicide may need to be carried out in follow-up
299   research.
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Demographic characteristics and comparisons of suicide cases and living controls

1   **Table 1** Demographic characteristics and comparisons of suicide cases and living controls

demographic characteristics	Suicide cases ($n =$ 242)	Living controls ($n =$ 242)	$\chi^2/t/(Z/W_+)$	P
Sex			—	—
Male	135 (55.79)	135 (55.79)		
Female	107 (44.21)	107 (44.21)		
Age groups			0.913	0.633
60-69	73 (30.17)	70 (28.93)		
70-79	100 (41.32)	110 (45.45)		
≥80	69 (28.51)	62 (25.62)		
Education			3.199	0.362
Below primary school	111 (45.87)	96 (39.67)		
primary school	105 (43.39)	116 (47.93)		
Above primary school	26 (10.74)	30 (12.40)		
Employment			9.149	0.027
Employed	41 (16.94)	61 (25.21)		
Unemployed	194 (80.17)	167 (69.01)		
Retired	7 (2.89)	14 (5.78)		
Family annual income (CNY)			2.122	0.547
<3600	88 (36.36)	74 (30.58)		
3600-10000	88 (36.36)	98 (40.50)		
>10000	66 (27.28)	70 (28.92)		
Marital status			21.240	<0.001
Stable marital status	122 (50.41)	170 (70.25)		
Unstable marital status	120 (49.59)	72 (29.75)		
Suffering from serious or chronic diseases			17.582	<0.001
Yes	202 (83.47)	161 (66.53)		
No	40 (16.53)	81 (33.47)		
Living alone			9.924	0.001
Yes	64 (26.45)	35 (14.46)		

demographic characteristics	Suicide cases (n = 242)	Living controls (n = 242)	$\chi^2/t/(Z/W_+)$	P
No	178 (73.55)	207 (85.54)		
Being left behind			4.500	0.033
Yes	41 (16.94)	25 (10.33)		
No	201 (83.06)	217 (89.67)		
Age, mean (S.D.)	74.43 (8.22)	74.05 (8.16)	2.080	0.039
GDS, mean (SD)	21.41 (5.95)	9.22 (6.42)	21.604	<0.001
ULS-6, mean (SD)	15.55 (5.00)	10.99 (4.01)	11.855	<0.001
BHS, mean (SD)	14.55 (2.54)	9.66 (2.72)	20.049	<0.001
BIS-11, mean (SD)	98.79 (16.63)	86.91 (15.18)	8.888	<0.001
DSSI, mean (SD)	22.88 (5.98)	27.47 (6.82)	-8.843	<0.001
ADL, mean (SD)	46.26 (12.49)	52.47 (6.03)	-7.148	<0.001
APGAR, mean (SD)	4.50 (3.39)	7.02 (2.79)	-9.487	<0.001
No. life events, median (QR)	5.00 (4.00)	3.0 (4.25)	-5.666/6456.50	<0.001

2 GDS, Geriatric Depression Scale; ULS-6, University of California Los Angeles Loneliness

3 Scale-6; BHS, Beck's Hopelessness Scale; BIS-11, Barratt Impulsiveness Scale; DSSI, Duke

4 Social Support Index; ADL, Activity of Daily Living Scale; APGAR, family Adaptive,

5 Partnership, Growth, Affection and Resolve Scale.

Consistency test between living comparisons and proxy information

2 **Table 2** Consistency test between living comparisons and proxy information

Items	Comparisons and first informants		Comparisons and Second informants		Comparisons and integrated information	
	ICC	*P*	ICC	*P*	ICC	*P*
1. How was your physical health in the last month?	0.571	<0.001	0.505	<0.001	0.621	<0.001
2. How was your psychological health in the last month?	0.526	<0.001	0.362	<0.001	0.492	<0.001
3. How was your economic status in the last month?	0.546	<0.001	0.491	<0.001	0.571	<0.001
4. How was your work (study or farm work) in the last month?	0.541	<0.001	0.505	<0.001	0.591	<0.001
5. How were your relationships with your family in the last month?	0.418	<0.001	0.297	0.003	0.318	0.002
6. How were your relationships with others in the last month?	0.390	<0.001	0.462	<0.001	0.468	<0.001
Total scores	0.653	<0.001	0.621	<0.001	0.688	<0.001

Rotated component matrix for each item in the QOLS-6

2 **Table 3** Rotated component matrix for each item in the QOLS-6

Items	Components of suicide cases		Components of living controls	
	Factor 1	Factor 2	Factor 1	Factor 2
Item 1	0.833	-0.157	0.846	0.001
Item 2	0.816	0.047	0.796	0.172
Item 3	0.591	0.243	0.696	0.274
Item 4	0.798	-0.014	0.749	0.157
Item 5	-0.006	0.892	0.151	0.883
Item 6	0.048	0.849	0.158	0.888

Correlation coefficient between the QOLS-6 and other relevant scales

2 **Table 4** Correlation coefficient between the QOLS-6 and other relevant scales

| Scales | QOLS-6 score | | | |
| | Suicide cases (n = 242) | | Living controls (n = 242) | |
	r	P	r	P
GDS	-0.568	<0.001	-0.574	<0.001
ULS-6	-0.344	<0.001	-0.382	<0.001
BHS-4	-0.499	<0.001	-0.580	<0.001
BIS-11	-0.287	<0.001	-0.482	<0.001
LESE	-0.444	<0.001	-0.572	<0.001
DSSI	0.072	0.263	0.426	<0.001
ADL	0.329	<0.001	0.303	<0.001
APGAR	0.188	0.003	0.359	<0.001

3 QOLS-6, Quality of Life Scale; GDS, Geriatric Depression Scale; ULS-6, University of
4 California Los Angeles Loneliness Scale-6; BHS, Beck's Hopelessness Scale; BIS-11, Barratt
5 Impulsiveness Scale; LESE, Life Event Scale for the Elderly; DSSI, Duke Social Support Index;
6 ADL, Activity of Daily Living Scale; APGAR, family Adaptive, Partnership, Growth, Affection
7 and Resolve Scale.
8
9
10
11
12

Comparison of quality of life between suicide cases and living controls

Table 5 Comparison of quality of life between suicide cases and living controls

Items	Suicide cases ($n = 242$) Mean ± SD	Living controls ($n = 242$) Mean ± SD	t	P
Item 1	1.98 ± 0.946	2.99 ± 0.876	-11.973	<0.001
Item 2	2.09 ± 0.881	3.36 ± 0.751	-16.963	<0.001
Item 3	2.62 ± 0.754	2.90 ± 0.772	-4.020	<0.001
Item 4	2.14 ± 0.836	2.83 ± 0.815	-9.441	<0.001
Item 5	3.19 ± 0.946	3.74 ± 0.611	-8.020	<0.001
Item 6	3.39 ± 0.727	3.68 ± 0.634	-5.299	<0.001
Total score	15.40 ± 3.062	19.50 ± 3.108	-14.613	<0.001

Figure 1

Scree plot of exploratory factor analysis of suicide cases
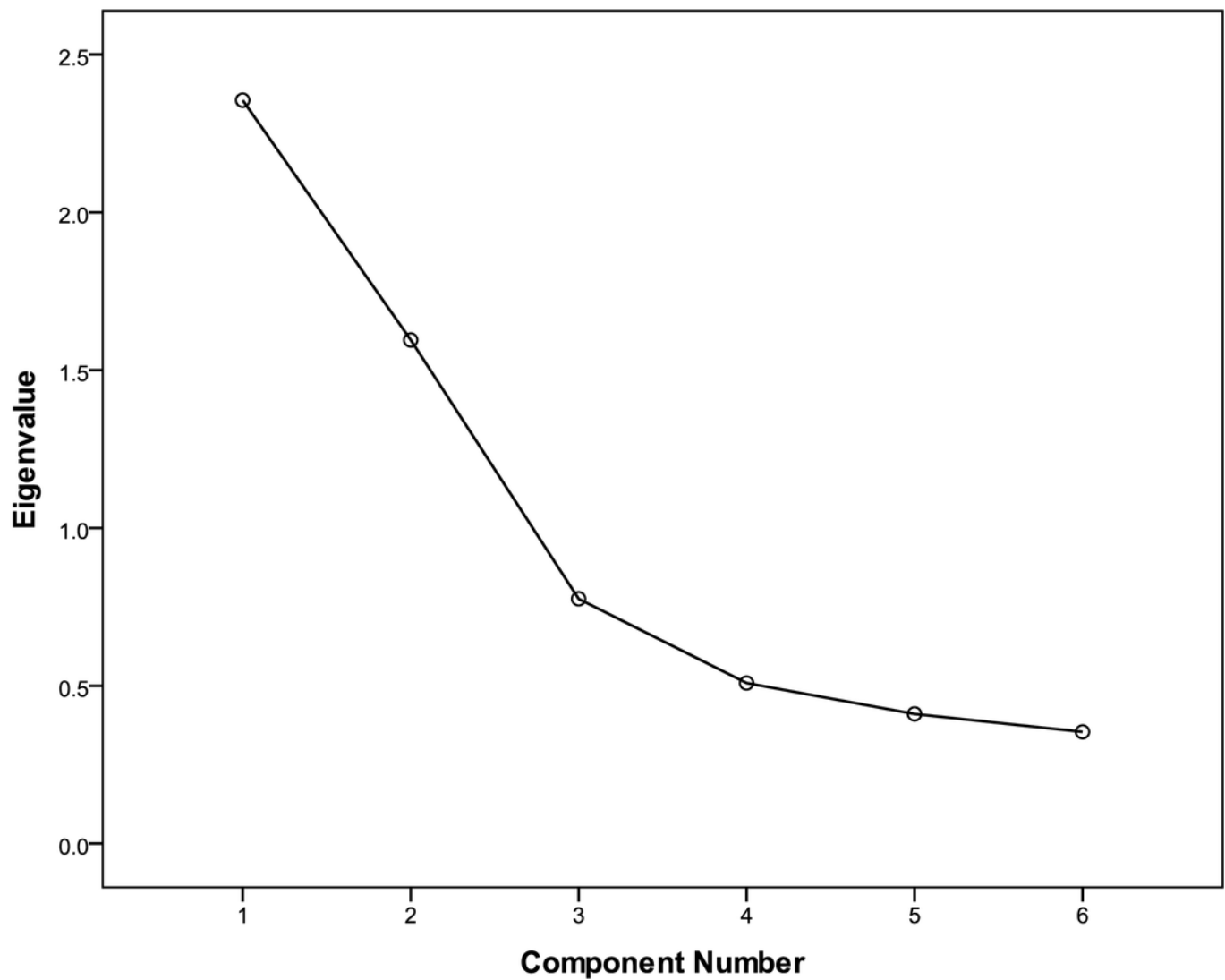
Figure 2

Scree plot of exploratory factor analysis of living controls