

Comparison of inequity in health-related quality of life among unemployed and employed in China

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1 **Comparison of inequity in health-related quality of life**
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23 **Abstract**

24 **Background:** In China, achieving the health equity has been regarded as a key issue of
25 health reforms and development in the current stage. It is well known that unemployment
26 have a negative effect on health. However, few studies have addressed the association
27 between unemployment and the inequity of health-related quality of life (HRQOL). The
28 study aims to compare the inequality and inequity in HRQOL among the unemployed and
29 employed in China.

30 **Methods:** The material regarding this study has been illustrated from the Chinese National
31 Health Services Survey (NHSS) of Shaanxi Province for 2013. We have controlled the
32 confounding factors by the utilization of coarsened exact matching method (CEM). Finally,
33 7,524 employed individuals and 283 unemployed individuals were aged 15 to 64 in urban
34 area has been incorporated for this study. We use HRQOL as the outcome variable, which
35 was evaluated by the Chinese version of EQ-5D-3L. Health concentration index,
36 decomposition analysis based on the Tobit model and the horizontal inequity index were
37 employed to compute the income-related equity and the contribution of factors among the
38 unemployed and employed.

39 **Results:** After matching, unemployed people tended to express poorer EQ-5D utility than
40 employed people. The horizontal inequity indices among employed and unemployed people
41 were 0.0020 and 0.0077 respectively, demonstrating that the pro-rich health inequity of
42 unemployed people was a great deal superior to employed people. Economic status, age,
43 education, smoking and health insurances are the main impact factors that affect the
44 inequality in HRQOL among employed and unemployed. Education status and basic health
45 insurances reduce the pro-rich inequity in HRQOL for the unemployed.

46 **Conclusion:** It is suggested that unemployment intensifies the inequality and inequity in
47 HRQOL. In view of the policy makers, the basic health insurances are still a critical health
48 policy for improving health equity of the unemployed. Re-employment programs, the
49 socialization of medical health insurances, initiatives to improve educational equity and the
50 psychological counseling for the unemployed should be considered by government to attain
51 health equity.

52 **Keywords:** Health-related quality of life, Health equity, EQ-5D, Unemployment, Coarsened
53 exact matching, China

54 **Background**

55 Health equity has gradually become a research hotspot in the field of health systems reform ^[1],
56 ^{2]}. Achieving health equity has been widely concerned about, supported and responded by all
57 countries of the world ^[3]. China also regards the realization of health equity as the key issue
58 of health reform and development in the current stage. Specifically, the planning outline of
59 "Healthy China 2030" proposed that we should focus on health problems of vulnerable
60 groups of people and to achieve the health equity ^[4]. Health inequalities is not only affected
61 by physiological conditions but also widely determined by socioeconomic characteristics,
62 inequalities may be further widened by unemployment ^[5]. The World Health Organization
63 proposed that each countries should set up health equity monitoring systems to reduce health
64 inequalities through collecting key indicators like employment status which can be
65 determined by the labor market ^[6]. Unlike retired people, most unemployed people quit the
66 labor force for non-physiological reasons and cannot sell their labor at a balanced price in the
67 market ^[7].

68 There is a body of literature exploring the association between unemployment and
69 health and paying attention to the different dimensions of lifestyle behaviors (e.g. alcohol

70 consumption and smoking) ^[8, 9], mental health (e.g. depression, mental disorder and suicide
71 thoughts) ^[10-13] and self-reported health ^[14-16]. Experimental evidences has demonstrated
72 that unemployment has a severe depressing outcome on health ^[17, 18] and may lead
73 households into a cycle of poverty ^[19]. There is also some evidence that unemployment had
74 a positive or no effect on health. Therefore, it is logical to start from the key groups and to
75 carry out the research on inequity in health-related quality of life among the unemployed. It
76 is with great consequence to prevent the unemployed from falling into long-term health and
77 poverty, to improve the precise poverty alleviation policy and to promote the construction
78 of healthy China.

79 Despite many health measurement being used to assess the effect of unemployment on
80 health, there is still not much knowledge about health-related quality of life ^[20].
81 Health-Related Quality of Life (HRQOL) is generally considered as a key measurement
82 indicator of health care outcomes and is a multidimensional construct that relates to a
83 person's self-perceived health ^[21]. The EuroQol 5 dimensions (EQ-5D) is a standardized
84 instrument and the most commonly used instrument for measuring the quality of life in
85 public health research ^[22, 23]. Some recent studies examine the correlates of unemployment
86 and HRQOL by using SF-8 instrument, SF-12 instrument and SF-36 instrument ^[24-27], but
87 using EQ-5D instrument are lacking. In addition, few studies have addressed the
88 association between unemployment and the inequity of HRQOL.

89 Therefore, we aim to fill the research gap by focusing on the unemployment and the
90 inequity of HRQOL. First, this research calculates and compares the health utility among
91 the employed and unemployed in China. Second, we seek to evaluate and decompose the
92 inequality in HRQOL among the employed and unemployed. Third, this research further
93 evaluates inequity in HRQOL among the unemployed and employed in China. The current
94 investigation has also three key strengths. First, it is for the first time to compare the

95 HRQOL of unemployed and employed by using EQ-5D-3L based on Chinese-preferences
96 tariff. Furthermore, we will offer well-informed estimates on the associations between
97 unemployment and income related inequality and inequity of Chinese HRQOL under
98 consideration. The third key strength is the findings of this investigation guarantee better
99 balance between the unemployed and employed groups by using the coarsened exact
100 matching method (CEM).

101 **Methods**

102 **Data and Sample**

103 This study draws upon data from the Chinese National Health Services Survey (NHSS)
104 of Shaanxi Province in 2013, a representative cross-sectional survey of households and
105 individuals (adults and children), launched in 1993 by National Health Commission of China
106 every five years. The 5th wave survey adopted a multi-stage stratified cluster sampling
107 method was conducted in Shaanxi Province. At first stage this survey selected 32 counties
108 (districts), whereas, 160 towns (streets) were selected in next stage and 320 villages
109 (communities) were selected in the final stage. Finally, 20,700 households (57,529 people)
110 were identified [28, 29].

111 The NHSS survey pay attention to the health status, health services need and utilization
112 of the Chinese residents covering a broad range of information on socio-economic
113 characteristics (e.g. age, gender, education status and economic level), health (e.g.
114 self-assessed health and HRQOL) and health service utilization. In this study, 10,337
115 employed and 285 unemployed respondents whose ages are from 15-64 years in urban were
116 identified in the final sample before CEM.

117 **Variables and Measures**

118 **Health-related quality of life variables**

119 We used EQ-5D health utility as the outcome variable. HRQOL was measured by the
120 classical 3-level EQ-5D (EQ-5D-3L), which has been widely validated and utilized in the
121 world ^[30]. The EQ-5D is a self-report questionnaire that including five dimensions: (1)
122 mobility (2) self-care (3) usual activities (such as work, studies, housework and leisure
123 activities) (4) pain / discomfort (5) anxiety / depression. The three response alternatives to
124 above five mentioned dimensions are: (1) no problem (2) some problems (3) extreme
125 problems ^[31]. Finally, we used Chinese-preferences tariff which is applicable to Chinese
126 people to generate the score of EQ-5D utility among the unemployed and employed which
127 ranges from -0.1490 (stands for the worst health) to 1 (stands for the full health) ^[32] .

128 **Control variables**

129 In the light of the existing literature, we controlled variables for socioeconomic
130 characteristics and health behavior related to inhabitants, such as gender (0=Male,
131 1=Female), age (in years), per capita annual income (Yuan) (1=Lowest group, 0=other;
132 1=Lower group, 0=other; 1=Medium group, 0=other; 1=Higher group, 0=other; 1=Highest
133 group, 0=other), marital status (1= Single, 0=other; 1=Marriage, 0=other; 1=Widowed and
134 Divorced, 0=other), education status(1=Elementary school and below, 0=other; 1=Middle
135 school, 0=other; 1=Senior high school, 0=other; 1=College degree and above, 0=other),
136 health insurances (1=No, 0=other; 1=Basic medical insurances, 0=other; 1=commercial
137 insurances and other insurances,0=other;), smoking status (1=No smoking, 0=other;
138 1=Non-daily smoking, 0=other; 1=Daily smoking, 0=other;) and drinking status (0=don't
139 drink alcohol, 1= drink alcohol).

140 **Statistical analysis**

141 **Coarsened exact matching**

142 A rough comparison of equity in HRQOL between the unemployed and employed would

143 ignore the fact that there may be other potential confounding factors. Therefore, we adopted
 144 the coarsened exact matching method (CEM) in this article, which is a new technique for
 145 improving the assessment of causal inference between two groups by controlling potentially
 146 confounding variables [33,34]. The original sample can be retained to the maximum extent and
 147 the weighted variables generated to equalize samples within two groups during the matching
 148 process [35]. The multivariate imbalance measure L_1 was employed to ensure the balance
 149 before and after matching. L_1 ranges from 0 to 1, where 1 indicates that the data of two
 150 comparison groups are completely unbalanced and a smaller value indicates the better
 151 balance between comparison groups. The multivariate imbalance measured by the Eq.1 [34] :

$$152 \quad L_1(f, g; H) = \frac{1}{2} \sum_{\varepsilon_1 \dots \varepsilon_k \in H(X)} |f_{\varepsilon_1 \dots \varepsilon_k} - g_{\varepsilon_1 \dots \varepsilon_k}| \quad (1)$$

153 f and g are the relative frequencies for distributions of the two groups. $H(X)$ Represents
 154 the Cartesian product of $H(X_1) \times \dots \times H(X_k)$. $f_{\varepsilon_1 \dots \varepsilon_k}$ Indicate the relative frequency for
 155 samples falling into the cell with coordinates $\varepsilon_1 \dots \varepsilon_k$ of the multivariate cross-tabulated of
 156 the treated units and $g_{\varepsilon_1 \dots \varepsilon_k}$ for the control units.

157 **Analysis of inequity in Health-related quality of life**

158 **Concentration index**

159 Concentration index (CI) has been widely accepted as a standard method for measuring the
 160 income related inequality of health status [36]. The CI value is between -1 and 1 . The positive
 161 of the CI indicates that the health is more concentrated among the members with higher per
 162 capita household income and vice versa 0 indicates that there is no inequality [37]. The

163 concentration index was computed by Eq.2 :

$$164 \quad C = 2cov(x, h) / \mu \quad (2)$$

165 Where C denotes concentration index, x refers to HRQOL, μ is the average of EQ-5D
166 utility value, h symbolizes the ranking of per capita household income.

167 **Decomposition of the concentration index**

168 The decomposition analysis is to decompose the concentration index into the contribution of
169 every variables to the inequality in HRQOL. However, the EQ-5D utility value generally has
170 a ceiling effect (i.e. most residents had the full health of 1), the decomposition analysis based
171 on Tobit model ^[38] was commonly used as Eq.3:

$$172 \quad y_i = \alpha + \sum_j \beta_j^m x_{ji} + \sum_k \gamma_k^n z_{ki} + \varepsilon_i \quad (3)$$

173 Where y_i is the score of EQ-5D utility; x are the unavoidable determinants of HRQOL
174 (e.g. gender and age); z indicates the avoidable determinants of HRQOL (health insurances,
175 education status, marital status, economic level and health behaviour); β_j^m and γ_k^n
176 indicates the marginal effects (dy/dx) of every variables; ε_i refers to the error term. The
177 decomposition of the concentration index C could be written as:

$$178 \quad C = \sum_j (\beta_j^m \bar{x}_j / \mu) C_j + GC_\varepsilon / \mu \quad (4)$$

179 Where μ represents the mean of the EQ-5D utility, C_j denotes the concentration index of
180 x_j , \bar{x}_j is the mean for x_j . The last term is the concentration index of ε .

181 **Horizontal inequity index**

182 The horizontal inequity (HI) of HRQOL indicates the inequality in HRQOL by eliminating

183 the contribution of unavoidable variables. In present investigation, the horizontal inequity
184 index is generated by the subtraction of the contribution of the unavoidable variables (e.g.
185 gender and age) from the concentration index of HRQOL [39]. The HI is positive that signifies
186 that there exist a pro-rich inequity and vice versa.

187 **Results**

188 **Matching results**

189 Summary statistics of the employed and unemployed before and after CEM are presented in
190 Table 1. Results before matching represents that overall there were statistical differences on
191 basic characteristics among the two groups except for smoking status and drinking alcohol.
192 Specifically, results after matching demonstrated that there were no significantly statistical
193 differences on basic characteristics between employed and unemployed except for medical
194 health insurances which were controlled in health inequity analysis. Additionally, compared
195 with the L1 pre-matching (0.461), the value between employed and unemployed were
196 obviously lower after matching that signified that matching performance is good and two
197 groups became more comparable. As presented in Table 1, a total of 7,807 residents were
198 collected in this study with 7524 employed and 283 unemployed residents after CEM.

199 [Insert Table 1 about here]

200 **Description of EQ-5D dimensions**

201 Table 2 reported the EQ-5D health utility among the employed and unemployed in China.
202 After matching, the results indicated that the mean of EQ-5D utility scores are also
203 statistically significant (0.9814 and 0.9510 respectively) in the employed and unemployed
204 people. Unemployed residents tended to express significantly poorer EQ-5D utility than
205 employed residents. That is to declare, unemployed people are significantly expected to

206 suffer from health troubles in each of EQ-5D dimensions than the employed. In other words,
 207 unemployment may reduce HRQOL.

208 **Table 2** The values of EQ-5D utility and each dimensions of the employed and unemployed

EQ-5D dimensions	Employed		Unemployed		p-value
	Mean	S.D.	Mean	S.D.	
Mobility	-0.0023	0.0163	-0.0077	0.0310	<0.0001
Self-care	-0.0009	0.0106	-0.0052	0.0259	<0.0001
Activity	-0.0013	0.0116	-0.0057	0.0252	<0.0001
Pain	-0.0064	0.0253	-0.0134	0.0360	<0.0001
Anxiety	-0.0040	0.0199	-0.0094	0.0299	<0.0001
EQ-5D	0.9814	0.0723	0.9510	0.1358	<0.0001

209 **Inequity in HRQOL by Employed and Unemployed**

210 The CIs of the 5 dimensions and EQ-5D utility scores among employed and unemployed
 211 were presented in Table 3. Although, the concentration index of the five dimensions were
 212 negative among the employed and unemployed, the overall CIs of EQ-5D utility values for
 213 both employed (0.0024) and unemployed (0.0091) were positive, signifying that there is a
 214 statistically pro-rich inequality in HRQOL among employed and unemployed people in
 215 Shaanxi province, China. This concludes that the overall better HRQOL are more
 216 concentrated in two groups that are based in the rich economic level. On the contrary, the
 217 respondents with a poor economic level had more health issues than the good economic level
 218 residents. Furthermore, the degree of inequality in HRQOL among the unemployed is higher
 219 than of the employed people.

220 The overall decomposition analysis for the EQ-5D utility values among the employed
 221 and unemployed was presented in Table 4. The marginal effect estimates from the two
 222 groups suggested that education status has a positive marginal effect, represented that the

223 higher level of education was significantly related to higher EQ-5D utility values. However,
 224 age has a negative marginal effect, suggested that the aged people were associated with the
 225 decline of HRQOL. As distinguished in Table 4, the key contributions were from economic
 226 level (19.45%), age (16.26%) and health insurances (7.28%) respectively for the employed
 227 whereas, the three key contributors were economic status (68.46%), educational status
 228 (-12.65%) and smoking status (8.60%) respectively for the unemployed. Furthermore,
 229 different types of health insurances have different directions of contribution. For
 230 unemployed, the basic health insurances have a negative contribution and reduce the pro-rich
 231 impact on HRQOL for the unemployed. However, the commercial insurances and other
 232 insurances had a positive contribution to inequity of HRQOL. As depicted in Fig 1, the
 233 contributors of need variables, residual and control variables to the HRQOL were above the
 234 level of the horizontal equity line, implying that these variables intensify the pro-rich
 235 inequity among the employed and unemployed.

236 The horizontal inequity index of HRQOL is also presented in Table 5. After deduction of
 237 the contributions of need variables in health (e.g. age and gender) from the concentration
 238 index of EQ-5D utility value, the horizontal inequity index of the HRQOL among employed
 239 and unemployed individuals were 0.0020 and 0.0077 respectively, which entails that there is
 240 a pro-rich inequity in HRQOL among the unemployed and employed. In addition, the
 241 horizontal inequity was higher in unemployed as compared to the employed.

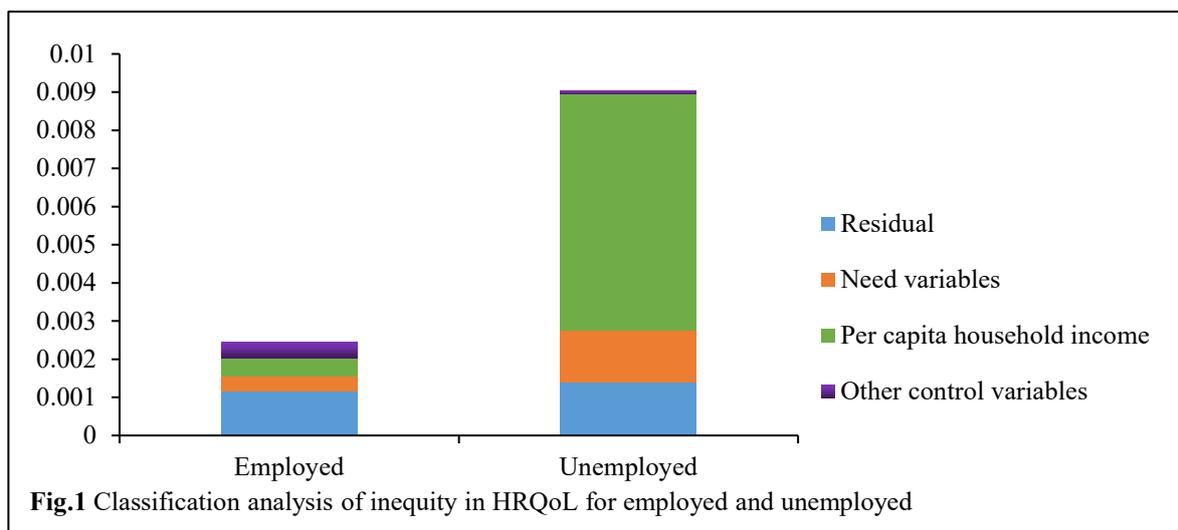
242 **Table 3** Concentration index of theEQ-5D scores and each of its dimensions

EQ-5D dimensions	Employed		Unemployed		p-value
	Mean	S.D.	Mean	S.D.	
Mobility	-0.2197***	0.0473	-0.2217	0.1379	0.9934
Self-care	-0.1722**	0.0775	-0.2273	0.1712	0.8906
Activity	-0.1928***	0.0610	-0.1924	0.1513	0.9990

Pain	-0.0921***	0.0264	-0.0905	0.0923	0.9902
Anxiety	-0.1359***	0.0328	-0.2629**	0.1086	0.4561
EQ-5D	0.0024***	0.0005	0.0091*	0.0049	0.0147

243 *p< 0.1, **p< 0.05, ***p< 0.01

244 [Insert Table 4 about here]



245 **Fig.1** Classification analysis of inequity in HRQoL for employed and unemployed

246 **Table 5** Horizontal inequity of EQ-5D for Employed and Unemployed

	Employed	Unemployed
Contribution of need variables (age-gender)	0.0004	0.0014
Contribution of control variables	0.0009	0.0063
Residual	0.0011	0.0014
CI	0.0024	0.0091
HI	0.0020	0.0077

247 Discussion

248 In present research, we assessed the topic of HRQOL for long-term interest in the research
 249 area of health care and economics. Based on the matched data, our results demonstrated that
 250 unemployed people reported lower HRQOL than employed. It is appealing to note that
 251 unemployed people had higher pro-rich inequality and horizontal inequity in HRQOL, which

252 is mainly contributed by economic status, education status and age. Therefore, there are three
253 aspects of this study that should to be discussed.

254 Firstly, the most fascinating finding was that there was statistically lower EQ-5D utility
255 in employed compared with the unemployed, which was for the first time to assessed
256 HRQOL among the employed and unemployed by using EQ-5D-3L instrument in China.
257 This concluded that unemployment is associated with poor HRQOL. This is consistent with
258 several reports that unemployed people more possible to have poorer HRQOL than the
259 employed [20, 25, 40]. Specifically, it may be due to the fact that people experienced
260 unemployment are deprived of these benefits (e.g. income, social contact, status and
261 activity), face greater financial and mental stress and less utilization of health care.

262 Secondly, the present study demonstrated that the CI of HRQOL between the employed
263 and the unemployed were both positive values, recommended that the better HRQOL were
264 concentrated in the rich men among the employed and unemployed people in Shaanxi.
265 Additionally, compared to the employed, the CI of the EQ-5D utility values among the
266 unemployed were higher suggested much greater pro-rich inequality in HRQOL of
267 unemployed people. Another motivating finding was that unemployment intensified the
268 inequality of HRQOL, which fills the gap by the comparison of income-related inequality
269 between employed and unemployed. Since previous researches have not primarily focus on
270 the health inequality of the employed and unemployed people in China, we can only compare
271 this estimation with previous research of different kinds of people. Consistent with several
272 previous reports of the different insured population [35], findings from the marginal effect
273 estimates among employed and unemployed indicated that a advanced level of education was
274 connected with better HRQOL. It might be because of the people with high degree of
275 education have a stronger health senses and better ability to cope with the diseases.
276 Moreover, as expected, age had a negative marginal effect, signified that elderly people tend

277 to have lower health outcomes. Our results are in agreement with previous literatures
278 assessing health inequality of the whole residents in Shaanxi Province ^[38], that the main
279 contribution of the pro-rich inequality in HRQOL was economic level. Furthermore, Our
280 findings were that the economic level intensified the pro-rich inequality in HRQOL and the
281 gap between the rich and poor people remains the key influencing factor of inequality in
282 HRQOL among the employed and unemployed, which was in agreement with previous
283 studies of the different population ^[28, 35, 38]. Apart from the economic level, age, educational
284 status, smoking status and health insurances were also has their own contributions towards
285 inequality in HRQOL. From the government point of view, it is vital that the basic health
286 insurances schemes and educational level would reduce the pro-rich impact on HRQOL for
287 unemployed, to insure basic medical insurances and enhancing education remains important
288 health policies for reducing the inequity in HRQOL ^[27]. In contrast, the commercial
289 insurances and other insurances increase the pro-rich inequity of HRQOL in unemployed. It
290 seems that commercial insurances focus on efficiency due to market competition and most of
291 the beneficiaries are high-income groups.

292 Thirdly, our results of the inequity in HRQOL may be attractive to policy makers, the
293 regions are in significant increase in unemployment due to the financial crisis. In our
294 research, after subtracting the contribution of the “need” variables, the horizontal inequity
295 index not only illustrated that there are the pro-rich inequity in HRQOL among two groups,
296 but also this inequity of unemployed was still higher than employed which may be explained
297 through the reduction in income associated with unemployment ^[19, 27]. People have unequal
298 access to social resources including health resources resulted in an increased in horizontal
299 inequity in HRQOL. Specifically, it indicated that unemployment had a negative effect on
300 health equity and increased the pro-rich inequity of HRQOL. Therefore, when promoting a
301 healthy China strategy to achieve health equity between different groups like the unemployed

302 and employed, the government should consider the contribution of education and basic
303 health insurances schemes to reduce the pro-rich inequity.

304 At the same time, we acknowledge that the present study has some limitations. Firstly,
305 the data derived from Shaanxi Province and our conclusion may not be generalized to the
306 whole of China. Moreover, due to the cross-sectional study, causal interpretations are
307 hazardous. Therefore, we refer to associations between unemployment and HRQOL.
308 Additionally, it is difficult to solve the endogenous problem between unemployment and
309 HRQOL. The present study was subject to possible unobserved confounding factors, such as
310 the disability status, access to healthy food, social interaction and so on.

311 **Conclusions**

312 In conclusion, the unemployment is linked with health related quality of life and inequality in
313 HRQOL. It appeared that unemployment intensified the inequality and inequity in HRQOL.
314 Furthermore, the major contributors of the inequality in HRQOL were economic status,
315 education status, age and health insurances for employed and unemployed residents. The
316 education status and the basic health insurances have positive effects on decreasing the
317 inequity in HRQOL among the unemployed. Suggestible, intervention initiatives aiming to
318 narrow economic gap, improve educational equity and promote health status of the
319 unemployed should be consider by government to achieve health equity. Additionally, the
320 socialization of health insurances for the unemployed should be improved. Not only the
321 re-employment programs should be considered as an important measure to narrow health
322 inequity, but also the extensive social services such as psychological counseling and spiritual
323 care should also be provided ^[25].

324 **Abbreviations**

325 HRQOL: health-related quality of life; EQ5D: EuroQol 5 dimensions; NHSS: National Health Services
326 Survey; CEM: Coarsened Exact Matching; CI: concentration index; HI: horizontal inequity.

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330 the data collection.

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334 **Availability of data and materials**

335 This data was drawn from the 5th Chinese National Health Services Survey (NHSS) of Shaanxi Province,
336 which are not opened to everyone. Researchers who want to use the data should contact Zhongliang
337 Zhou (zzliang1981@163.com).

338 **Author contributions**

339 YXZ conceptualized the research idea, did the analysis and write-up the manuscript. CS, XJF and SL
340 contributed to the analysis and interpretation of data. ZLZ and MS made substantial contributions to the
341 study design, critically edit and approved the final manuscript. NR, DTZ, TGX and DC participated
342 sufficiently in providing constructive suggestions and revising the manuscript. All authors read and
343 approved the final manuscript.

344 **Ethical statements**

345 The plan of the fifth NHSS was accepted by the National Bureau of Statistics of China (NO.2013 (65)).
346 The present investigation has the approval of the Ethics Committee of Xi'an Jiaotong University Health
347 Science Center (No. 2015–644). The study was conducted in accordance with the ethics guidelines of the

348 declaration of Helsinki. Informed consent has been obtained prior to our analysis and the statistics was
349 anonymous.

350 **Consent for publication**

351 Not applicable.

352 **Competing interests**

353 The authors declare that they have no other competing interests.

354 **References**

- 355 1. Marmot M: Achieving health equity: from root causes to fair outcomes. *The Lancet* 2007,
356 370(9593):1153-1163.
- 357 2. Bailey ZD, Krieger N, Agenor M, Graves J, Linos N, Bassett MT: Structural racism and health
358 inequities in the USA: evidence and interventions. *Lancet* 2017, 389(10077):1453-1463.
- 359 3. Marmot M, Friel S, Bell R, Houweling TAJ, Taylor S: Closing the gap in a generation: health
360 equity through action on the social determinants of health. *The Lancet* 2008,
361 372(9650):1661-1669.
- 362 4. The L: The best science for achieving Healthy China 2030. *Lancet* (London, England) 2016,
363 388(10054):1851.
- 364 5. Huang J, Birkenmaier J, Kim Y: Job Loss and Unmet Health Care Needs in the Economic
365 Recession: Different Associations by Family Income. *American Journal of Public Health* 2014,
366 104(11):E178-E183.
- 367 6. Puig-Barrachina V, Malmusi D, Martínez JM, Benach J: Monitoring social determinants of
368 health inequalities: the impact of unemployment among vulnerable groups. *International Journal*
369 *of Health Services* 2011, 41(3):459-482.
- 370 7. Lundin A, Hemmingsson T: Unemployment and suicide. *The Lancet* 2009.
- 371 8. Jorgensen MB, Pedersen J, Thygesen LC, Lau CJ, Christensen AI, Becker U, Tolstrup JS: Alcohol
372 consumption and labour market participation: a prospective cohort study of transitions between
373 work, unemployment, sickness absence, and social benefits. *Eur J Epidemiol* 2019,
374 34(4):397-407.
- 375 9. Latif E: The impact of recession on drinking and smoking behaviours in Canada. *Economic*
376 *Modelling* 2014, 42:43-56.

- 377 10. Cygan-Rehm K, Kuehnle D, Oberfichtner M: Bounding the causal effect of unemployment on
378 mental health: Nonparametric evidence from four countries. *Health Economics* 2017,
379 26(12):1844-1861.
- 380 11. Stankunas M, Kalediene R, Starkuviene S, Kapustinskiene V: Duration of unemployment and
381 depression: a cross-sectional survey in Lithuania. *BMC public health* 2006, 6(1):174.
- 382 12. Frasquilho D, Matos MG, Salonna F, Guerreiro D, Storti CC, Gaspar T, Caldas-de-Almeida JM:
383 Mental health outcomes in times of economic recession: a systematic literature review. *Bmc*
384 *Public Health* 2016, 16.
- 385 13. Chang S-S, Gunnell D, Sterne JA, Lu T-H, Cheng AT: Was the economic crisis 1997–1998
386 responsible for rising suicide rates in East/Southeast Asia? A time–trend analysis for Japan,
387 Hong Kong, South Korea, Taiwan, Singapore and Thailand. *Social science & medicine* 2009,
388 68(7):1322-1331.
- 389 14. Kristian H, Ivar EJ: Is it Easier to Be Unemployed When the Experience Is More Widely Shared?
390 Effects of Unemployment on Self-rated Health in 25 European Countries with Diverging
391 Macroeconomic Conditions. *European Sociological Review* 2018, 34(1):22-39.
- 392 15. Böckerman P, Ilmakunnas P: Unemployment and self-assessed health: evidence from panel data.
393 *Health economics* 2009, 18(2):161-179.
- 394 16. Ronchetti J, Terriau A: Impact of unemployment on self-perceived health. *European Journal of*
395 *Health Economics* 2019, 20(6):879-889.
- 396 17. Karanikolos M, Mladovsky P, Cylus J, Thomson S, Basu S, Stuckler D, Mackenbach JP, McKee
397 M: Financial crisis, austerity, and health in Europe. *Lancet* 2013, 381(9874):1323-1331.
- 398 18. Drydakis N: The effect of unemployment on self-reported health and mental health in Greece
399 from 2008 to 2013: a longitudinal study before and during the financial crisis. *Social Science &*
400 *Medicine* 2015, 128:43-51.
- 401 19. Mills C: Health, employment and recession: the impact of the global crisis on health inequities
402 in New Zealand. *Policy Quarterly* 2010, 6(4).
- 403 20. Norstrom F, Waenerlund A-K, Lindholm L, Nygren R, Sahlen K-G, Brydsten A: Does
404 unemployment contribute to poorer health-related quality of life among Swedish adults? *Bmc*
405 *Public Health* 2019, 19.
- 406 21. Evaristo OS, Moreira C, Lopes L, Abreu S, Agostinis-Sobrinho C, Oliveira-Santos J, Povoas S,
407 Oliveira A, Santos R, Mota J: Associations between physical fitness and adherence to the
408 Mediterranean diet with health-related quality of life in adolescents: results from the LabMed
409 Physical Activity Study. *European Journal of Public Health* 2018, 28(4):631-635.
- 410 22. Brooks R: EuroQol: The current state of play. *Health Policy* 1996, 37(1):53-72.

- 411 23. Alcaniz M, Sole-Auro A: Feeling good in old age: factors explaining health-related quality of
412 life. *Health and Quality of Life Outcomes* 2018, 16.
- 413 24. Hirao K, Kobayashi R: Health-related quality of life and sense of coherence among the
414 unemployed with autotelic, average, and non-autotelic personalities: a cross-sectional survey in
415 Hiroshima, Japan. *PLoS One* 2013, 8(9):e73915.
- 416 25. Extremera N, Rey L: Health-related quality of life and cognitive emotion regulation strategies in
417 the unemployed: a cross-sectional survey. *Health and quality of life outcomes* 2014, 12(1):172.
- 418 26. Gonzalez-Chica DA, Adams R, Dal Grande E, Avery J, Hay P, Stocks N: Lower educational
419 level and unemployment increase the impact of cardiometabolic conditions on the quality of life:
420 results of a population-based study in South Australia. *Qual Life Res* 2017, 26(6):1521-1530.
- 421 27. Axelsson L, Andersson IH, Edén L, Ejlertsson G: Inequalities of quality of life in unemployed
422 young adults: A population-based questionnaire study. *International Journal for Equity in Health*
423 2007, 6(1):1.
- 424 28. Xu Y, Yang J, Gao J, Zhou Z, Zhang T, Ren J, Li Y, Qian Y, Lai S, Chen G: Decomposing
425 socioeconomic inequalities in depressive symptoms among the elderly in China. *BMC public
426 health* 2016, 16(1):1214.
- 427 29. Fan X, Zhou Z, Dang S, Xu Y, Gao J, Zhou Z, Su M, Wang D, Chen G: Exploring status and
428 determinants of prenatal and postnatal visits in western China: in the background of the new
429 health system reform. *Bmc Public Health* 2017, 18.
- 430 30. Richardson JRJ, Mckie JR, Bariola EJ: Multiattribute utility instruments and their use. In:
431 *Encyclopedia of Health Economics, Volume 2*. edn.: Elsevier; 2014: 341-357.
- 432 31. Davison NJ, Thompson AJ, Turner AJ, Longworth L, McElhone K, Griffiths CEM, Payne K,
433 Grp BS: Generating EQ-5D-3L Utility Scores from the Dermatology Life Quality Index: A
434 Mapping Study in Patients with Psoriasis. *Value in Health* 2018, 21(8):1010-1018.
- 435 32. Liu GG, Wu H, Li M, Gao C, Luo N: Chinese time trade-off values for EQ-5D health states.
436 *Value in health* 2014, 17(5):597-604.
- 437 33. Blackwell M, Iacus S, King G, Porro G: cem: Coarsened exact matching in Stata. *The Stata
438 Journal* 2009, 9(4):524-546.
- 439 34. Iacus SM, King G, Porro G: Multivariate matching methods that are monotonic imbalance
440 bounding. *Journal of the American Statistical Association* 2011, 106(493):345-361.
- 441 35. Su M, Zhou Z, Si Y, Wei X, Xu Y, Fan X, Chen G: Comparing the effects of China's three basic
442 health insurance schemes on the equity of health-related quality of life: Using the method of
443 coarsened exact matching. *Health and quality of life outcomes* 2018, 16(1):41.

- 444 36. Wagstaff A, Doorslaer EV: Equity in Health Care Finance and Delivery. *Handbook of Health*
445 *Economics* 2000, 1:1803-1862.
- 446 37. Xu Y, Zhu S, Zhang T, Wang D, Hu J, Gao J, Zhou Z: Explaining Income-Related Inequalities in
447 *Dietary Knowledge: Evidence from the China Health and Nutrition Survey. International*
448 *Journal of Environmental Research and Public Health* 2020, 17(2).
- 449 38. Zhou Z, Fang Y, Zhou Z, Li D, Wang D, Li Y, Lu L, Gao J, Chen G: Assessing income-related
450 *health inequality and horizontal inequity in China. Social Indicators Research* 2017,
451 132(1):241-256.
- 452 39. Fan X, Xu Y, Stewart M, Zhou Z, Dang S, Wang D, Gao J: Effect of China's maternal health
453 *policy on improving rural hospital delivery: Evidence from two cross-sectional surveys.*
454 *Scientific reports* 2018, 8(1):12326.
- 455 40. McKee-Ryan FM, Song ZL, Wanberg CR, Kinicki AJ: Psychological and physical well-being
456 *during unemployment: A meta-analytic study. Journal of Applied Psychology* 2005, 90(1):53-76.
457

458 **Table1** Summary statistics before and after Coarsened Exact Matching

Variables	Before matching			After matching		
	Employed	Unemployed	p-value	Employed	Unemployed	p-value
N	10,337	285		7,524	283	
Gender ^a						
Male*	5,472 (52.94)	134 (47.02)	0.048	3,563 (47.35)	134 (47.35)	1.000
Female	4,865 (47.06)	151 (52.98)		3,961 (52.65)	149 (52.65)	
Age(years) ^a						
18–29*	2,055 (19.27)	27 (9.47)	<0.001	718 (9.54)	27 (9.54)	1.000
30–44	3,974 (38.44)	102 (35.79)		2,712 (36.04)	102 (36.04)	
>45	4,308 (41.68)	156 (54.74)		4,094 (54.42)	154 (54.42)	
Marital status ^a						
Single*	1,065 (10.30)	15 (5.26)	<0.001	399 (5.30)	15 (5.30)	1.000
Marriage	8,984 (86.91)	247 (86.67)		6,567 (87.28)	247 (87.28)	
Widowed and Divorced	288 (2.79)	23 (8.07)		558 (7.42)	21 (7.42)	
Education status ^a						
Elementary school and below*	2,028 (19.62)	20 (7.02)	<0.001	532 (7.07)	20 (7.07)	1.000

Middle school	4,600 (44.50)	116 (40.70)		3,084 (40.99)	116 (40.99)	
Senior high school	2,143 (20.73)	126 (44.21)		3,323 (44.17)	125 (44.17)	
College degree and above	1,566 (15.15)	23 (8.07)		585 (7.77)	22 (7.77)	
Health insurances ^a						
No*	227 (2.20)	11 (3.86)	<0.001	146 (1.94)	11 (3.89)	<0.001
Basic medical insurance	7,382 (71.43)	158 (55.44)		5,694 (75.82)	166 (58.66)	
commercial insurances and other insurances	2,726 (26.38)	116 (40.70)		1,670 (22.24)	106 (37.46)	
Smoking status ^a						
No smoking *	6,801 (65.86)	189 (66.78)	0.262	4,937 (65.68)	187 (66.55)	0.338
Non-daily smoking	464 (4.49)	7 (2.47)		322 (4.28)	7 (2.49)	
Daily smoking	3,062 (29.65)	87 (30.74)		2,258 (30.04)	87 (30.96)	
Drinking alcohol ^a						
No *	7,659 (75.35)	213 (76.34)	0.703	5,648 (76.43)	211 (76.17)	0.922
Yes	2,506 (24.65)	66 (23.66)		1,742 (23.57)	66 (23.83)	
Economic status (Yuan) ^b						
Lowest group*	1,122 (10.87)	35 (12.28)	<0.001	931 (12.37)	35 (12.37)	0.343
Lower group	1,346 (13.04)	54 (18.95)		1,409 (18.73)	53 (18.73)	

Medium group	1,951 (18.90)	58 (20.35)	1,515 (20.14)	57 (20.14)
Higher group	2,485 (24.07)	69 (24.21)	1,835 (24.38)	69 (24.38)
Highest group	3,418 (33.11)	69 (24.21)	1,835 (24.38)	69 (24.38)

459 *Mean (S.D.) and Students' T-test were performed for continuous variables, N (%) and Chi-square test were performed for categorical variables.*

460 **Reference group in the Tobit regression. ^a Chi-squared test. ^b students' T-test*

461

462 **Table 4.** Decomposition of concentration index in HRQOL among the Employed and Unemployed

Variables	Employed			Unemployed		
	dy/dx	Contribution	%	dy/dx	Contribution	%
Female	0.0005	0	0.5254	0.0355*	0.0010	10.4425
30–44	-0.0018	0	-0.8244	-0.0212	-0.0003	-2.7392
>45	-0.0204***	0.0004	17.0847	-0.0346	0.0007	7.3609
Marriage	-0.0061	0	-1.3532	-0.0122	-0.0001	-0.7277
Widowed and Divorced	-0.0231***	0.0001	3.2664	-0.1002	0.0003	3.5903
Middle school	0.0205***	-0.0010	-40.4422	0.1137***	-0.0058	-63.6747
Senior high school	0.0217***	0.0005	18.8806	0.1180***	0.0027	29.9329
College degree and above	0.0219***	0.0006	24.3300	0.0692	0.0019	21.0958
Basic health insurances	-0.0041	0.0003	13.0731	0.0161	-0.0008	-8.3568
commercial insurances and other insurances	-0.0020	0.0001	-5.7919	0.0154	0.0006	6.6633
Non-daily smoking	-0.0060	0	0.6337	0.0476	0	-0.3715
Smoking daily	-0.0009	0	0.2700	0.0589**	0.0008	8.9732
drink	0.0071***	0.0001	3.9505	0.0202	0.0004	3.9327
Lower group	0.0076***	-0.0008	-31.5884	-0.0274	0.0031	33.8815

Medium group	0.0017	-0.0001	-3.0522	0.0170	-0.0006	-7.0598
Higher group	0.0051*	0.0003	10.7365	-0.0006	-0.0001	-0.4921
Highest group	0.0056**	0.0011	43.3573	0.0196	0.0038	42.1281

463 *p< 0.1, **p< 0.05, ***p< 0.01

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Figures

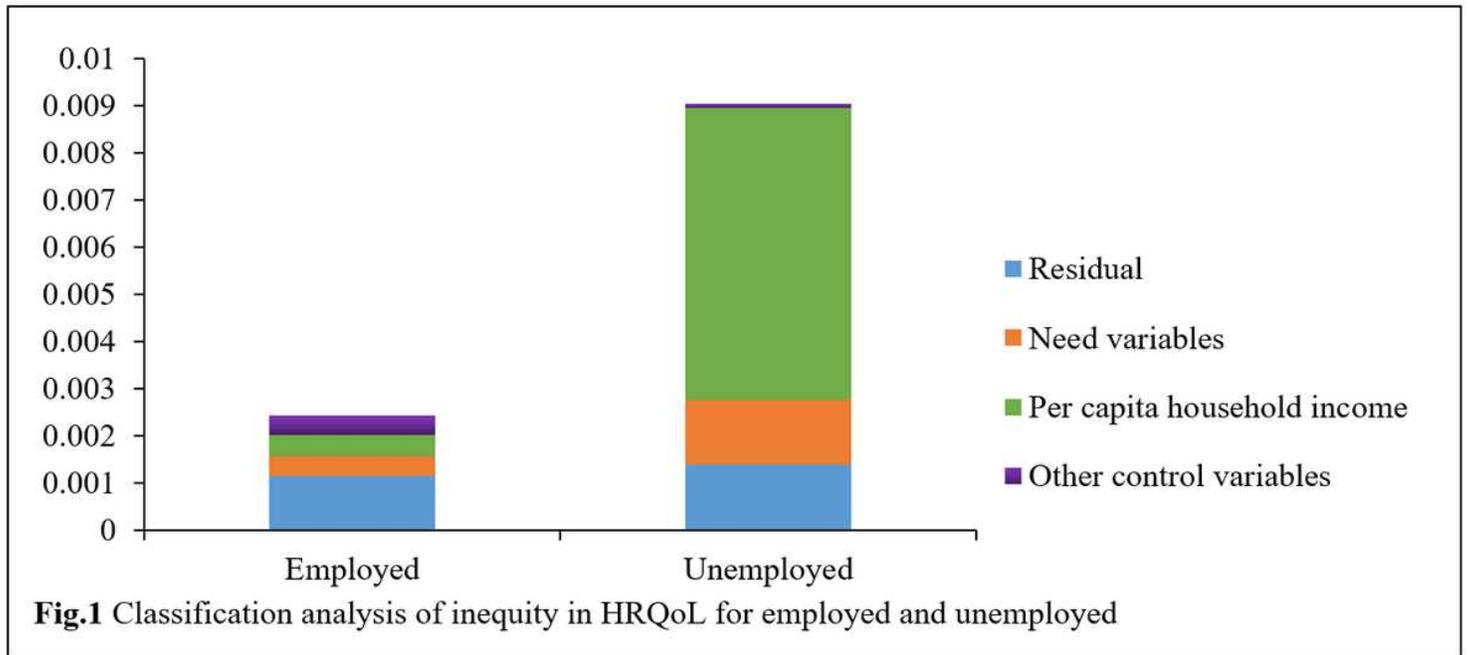


Figure 1

Classification analysis of inequity in HRQoL for employed and unemployed