Depressive symptoms and associated factors among renal-transplant recipients in China

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A B S T R A C T

Aim: This study aimed to explore depressive symptoms and associated factors among renal-transplant (RT) recipients in China.

Methods: This study included 287 RT recipients. Data were collected from August to November 2014 by utilizing demographic forms, namely, the Self-rating Depression Scale and the Multidimensional Scale of Perceived Social Support. Descriptive statistics, Student’s t test, Chi-square test, ANOVA, and multiple linear regression were used for data analysis.

Results: More than half of the recipients presented depressive symptoms. All recipients in the four transplant period groups (≤5 yr, 5–10 yr, 10–15 yr, and >15 yr) reported greater depressive symptoms than the Norm. No significant difference was observed in the depressive symptoms in the four transplant period groups. Multiple linear regression indicated that depressive symptoms were significantly associated with employment status, economic burden, inhabitation area, and social support. Follow-up clinics should prescribe the evaluation of depression as a routine examination for RT patients. Moreover, depressed recipients must be provided with individualized care by collecting information on the depressive symptoms, employment status, economic burden, inhabitation area, and perceived social support of recipients.

1. Introduction

Renal transplantation (RT) is considered the most effective renal replacement therapy for patients suffering from end-stage renal disease (ESRD) and chronic renal failure (CRF) [1]. More than 100,000 cases of RTs have been performed in China since Wu Jieping performed the first operation in 1960 [2]. Previous studies have proven that RT effectively improves the quality of life (QOL) and survival rate of ESRD and CRF patients [3,4]. However, patients who have undergone RT have presented high rates of psychological disorders after the operation [5], of which depression is one of the most apparent [6]. Depressive symptoms increase the risk of non-adherence of patients to medication and have been linked with abnormal renal function, poor QOL, and low employment rate after RT [7,8]. Therefore, depression among RT recipients and its associated factors should be investigated to develop routine screenings and individualized interventions of RT recipients manifesting depressive symptoms.

Such an investigation is particularly important in China because of the high incidence (ranging from 43.2% to 50.3%) of depressive symptoms among RT recipients [9,10]. Depressive symptoms among RT recipients have been reported in Canada [11], Panama [12], Iran [6], and Taiwan [13]. A study conducted in Belgium reported that 17.4% of adolescent RT recipients displayed depressive symptoms [14]. The prevalence of depression among cadaveric RT recipients (40.9%) differed considerably from that among living RT recipients (59.5%) [10].

Although several studies have analyzed depression by comparing RT recipients with dialysis patients, chronic kidney disease patients, or the general population, no conclusive finding has been established as to whether RT recipients manifest less severe depressive symptoms than other patients. A number of recipients have reportedly mitigated depression when compared to
waitlisted patients on maintenance dialysis [11,15]. However, Kar- 
aminia found no significant difference in the level of depression of 
RT recipients and hemodialysis patients [16]. In the literature, the 
emotional distress of patients suffering from chronic kidney disease 
was compared with that after transplantation, and the results 
showed that the emotional distress of RT recipients were improved 
[17].

Pascazio used the Beck Depression Inventory (BDI) scales to 
compare the depression manifested by RT recipients to that by 
healthy people, and no significant difference was observed; how-
ever, the Affective Neuroscience Personality Scale revealed that RT 
recipients had a significantly lower score than healthy people in 
terms of general negative emotions [5]. Tang and Zhu found that in 
China, RT recipients were significantly more depressed than the 
general population [9,10]. Depressive symptoms among RT recipients are reportedly 
associated with several factors. Many studies have found that RT 
recipients who have low family income or who paid for their own 
operation had higher tendencies of being depressed than those 
who have high family income or whose operation was paid for by 
public service or medical insurance [9,18]. Social support also af-

2.2. Measurement

We collected socio-demographic information, including age, 
gender, employment status, educational attainment, marital status, 
whether the transplant was self-paid or paid by public service or 
medical insurance, family income, economic burden, and perceived 
social support. We also collected transplant-specific information, 
including post-transplant period, type and duration of dialysis, 
donor type, and complications after transplantation. Depressive 
symptoms were assessed by using self-reported questionnaires.

2.2.1. Depression assessment

Depressive symptoms were assessed using the Self-rating Depression Scale (SDS), which was developed by Zung and was 
translated into Chinese and validated for use for the Chinese-
speaking population [22,23]. The questionnaire contained 20 
items, each describing a depression state. Ten of the items were 
worded symptomatically positive, and the other ten were worded 
symptomatically negative. Patients were asked to rate each item 
on the basis of how they felt at the time of testing, so that their 
depressive symptoms during the preceding week can be assessed. 
Patients chose among four ratings: a little of the time, some of the 
time, a good part of the time, or most of the time. In scoring the 
SDS, a value of 1, 2, 3, and 4 is assigned to each response 
depending on whether the item was worded positively (reverse 
scored) or negatively (forward scored). The sum of the values of all 
items denoted the raw score, which ranged from 20 to 80; a higher 
scores indicated a more severe depression. The SDS index, which 
was expressed as a decimal, was derived by dividing the raw 
scores by the maximum possible score (i.e., 80). In accordance with 
the guidelines for optimal cut-offs for the Chinese version of the 
SDS, an index score of <0.50 implied that the patient was 
symptom-free, whereas an index score of ≥ 0.50 indicated that the 
patient was symptomatic. Index scores between 0.50 and 0.59 
indicated that the patient was having mild depression. Moderate 
depression is confirmed if the patient scored between 0.60 and 
0.69. Patients having index scores > 0.70 are considered severely 
depressed [24]. In our study, the Cronbach’s α coefficient of the 
SDS was 0.804.

2.2.2. Perceived social support

We adopted the Multidimensional Scale of Perceived Social 
Support (MSPSS) to assess the perceived social support of RT 
recipients. The scale was developed by Zimet (1988) and was 
verified to have good internal reliability (Cronbach’s α = 0.84–0.92) [25]. 
Huang et al. translated the MSPSS into Chinese and used factor 
analysis to examine the components of the MSPSS [26]. The MSPSS 
cluded 12 items, which were divided into three subscales ac-

2.3. Ethical considerations

Both university and hospital ethics committees approved the 
methodology. We explained the purpose, risks, and benefits of this 
study to the recipients before they were asked to participate. Re-
cipients were guaranteed that their participation was voluntarily 
and that their refusal would not affect their clinical care. All par-
ticipants were requested to sign a written informed consent.
ensure that they knew the requirements and methods of data collection. The principal investigator prepared survey questionnaires, including survey packets and a cover letter containing a description of the project, response confidentiality, consent procedure, and investigator contact information. Recipients visiting the follow-up clinic were assessed whether they met the criteria and if so, were invited to participate. All participants signed a written informed consent in accordance with the 2000 Declaration of Helsinki. The investigators were present at the clinic until the recipients completed and returned the survey packet.

2.5. Statistical analysis

Two research assistants checked the original data and input them into Microsoft Excel software. Data were analyzed using SPSS 21.0 software. Continuous variables were expressed as mean ± standard deviation (SD) or a range. Categorical variables were reported as frequency and percentage. Student’s t test was conducted to identify differences in the SDS scores of RT recipients and the Norm. Student’s t test, chi-square ($\chi^2$) test, and non-parametric test were conducted to differentiate the depression-free group from the depression group in terms of sociodemographic data, transplant-specific data, and the MSPSS. ANOVA was conducted to compare the SDS raw scores of the four post-transplant period groups. Multiple linear regression was performed to analyze factors independently predicting the severity of depressive symptoms. All variables involved in the univariate analysis were entered into multivariable models. A p-value < 0.05 was considered statistically significant.

3. Results

3.1. Study enrolment and sample characteristics

A total of 301 questionnaires were distributed and returned, and 287 of which were completed. The mean age of recipients was 47.49 ± 12.31 years, and 167 (58.2%) were male. Thirty (14.7%) received their graft from living donors. The mean time since transplantation was 10.07 ± 6.14 years. The MSPSS scores and other characteristics of the recipients are presented in Table 1.

3.2. Depression

Table 2 shows the mean and standard deviations of the SDS raw scores of the recipients. The average raw score on the SDS was 41.30 ± 8.25, and the average SDS index was 0.52 ± 0.10. As shown in Fig. 1, 117 recipients (40.8%) showed no depressive symptoms (SDS index<0.50); 101 recipients (35.2%) presented mild depression (SDS index ranging from 0.50 to 0.59); 60 recipients (20.9%) exhibited moderate depression (SDS index ranging from 0.60 to 0.69); and 9 recipients (3.1%) manifested severe depression (SDS index>0.70). Depressive symptoms were observed for 59.2% of the recipients, and 24.0% exhibited symptoms of moderate to severe depression. All recipients were categorized into four groups according to the number of years since they underwent RT (<5 yr, 5–10 yr, 10–15 yr, and >15 yr). Student’s t test was performed to compare the SDS raw scores of each group and the total recipients to the scores of the Norm in China (Wang et al., 1986, [23]) and the results showed that SDS raw scores of all groups and the total

<table>
<thead>
<tr>
<th>Variables</th>
<th>n(%)</th>
<th>Mean ± SD Median(P25−P75)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(years)</td>
<td></td>
<td>47.49 ± 12.31</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>167(58.2)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>120(41.8)</td>
<td></td>
</tr>
<tr>
<td>Inhabitation area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>230(80.1)</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>57(19.9)</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full- or part-time job</td>
<td>90(31.4)</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>126(43.9)</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>66(23.0)</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>5(1.7)</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>middle school or below</td>
<td>57(19.9)</td>
<td></td>
</tr>
<tr>
<td>high school or technical secondary school</td>
<td>133(46.3)</td>
<td></td>
</tr>
<tr>
<td>college degree or above</td>
<td>97(33.8)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>229(79.8)</td>
<td></td>
</tr>
<tr>
<td>Single/widowed/divorced</td>
<td>58(20.2)</td>
<td></td>
</tr>
<tr>
<td>Medical payment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>by self</td>
<td>16(5.6)</td>
<td>14(2.7)−25(4.5)</td>
</tr>
<tr>
<td>public service or medical insurance</td>
<td>271(94.4)</td>
<td>257(49.8)−285(52.6)</td>
</tr>
<tr>
<td>Family income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3000</td>
<td>157(54.7)</td>
<td>146(49.7)−169(54.3)</td>
</tr>
<tr>
<td>3000–6000</td>
<td>83(28.9)</td>
<td>77(24.3)−89(29.5)</td>
</tr>
<tr>
<td>&gt;6000</td>
<td>47(16.4)</td>
<td>40(13.3)−52(17.8)</td>
</tr>
<tr>
<td>Economic burden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little</td>
<td>43(15.0)</td>
<td>38(12.7)−49(16.4)</td>
</tr>
<tr>
<td>Mild</td>
<td>82(28.6)</td>
<td>76(25.5)−88(29.4)</td>
</tr>
<tr>
<td>Moderate</td>
<td>85(29.6)</td>
<td>80(26.7)−90(30.4)</td>
</tr>
<tr>
<td>Severe</td>
<td>77(26.8)</td>
<td>72(24.1)−82(27.6)</td>
</tr>
<tr>
<td>Duration after RT(yr)</td>
<td></td>
<td>10.07 ± 6.14</td>
</tr>
<tr>
<td>Duration of dialysis before RT(month)</td>
<td>7.00(3.00–14.00)</td>
<td></td>
</tr>
<tr>
<td>Dialysis style</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemodialysis</td>
<td>265(92.3)</td>
<td>257(85.3)−273(91.9)</td>
</tr>
<tr>
<td>Peritoneal dialysis</td>
<td>12(4.2)</td>
<td>7(2.4)−17(5.7)</td>
</tr>
<tr>
<td>Neither</td>
<td>10(3.5)</td>
<td>8(2.7)−12(3.9)</td>
</tr>
<tr>
<td>Donor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deceased</td>
<td>174(55.3)</td>
<td>165(54.7)−183(60.1)</td>
</tr>
<tr>
<td>Living</td>
<td>30(14.7)</td>
<td>24(8.1)−36(12.1)</td>
</tr>
<tr>
<td>Complication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>215(74.9)</td>
<td>209(69.7)−221(75.1)</td>
</tr>
<tr>
<td>Yes</td>
<td>72(25.1)</td>
<td>68(22.3)−76(25.9)</td>
</tr>
<tr>
<td>MSPSS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>5.86 ± 1.09</td>
<td></td>
</tr>
<tr>
<td>Friend</td>
<td>5.19 ± 1.29</td>
<td></td>
</tr>
<tr>
<td>Significant other</td>
<td>5.23 ± 1.19</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5.43 ± 1.04</td>
<td></td>
</tr>
</tbody>
</table>
were not significantly different.

### 3.3. Association of depression with demographic variables and MSPSS

The 287 RT recipients were categorized into depression-free and depression groups on the basis of their SDS index score. RT recipients whose SDS index score was less than 0.50 were considered depression-free. The rest were included in the depression group. These two groups were compared in terms of socio-demographic data, transplant-specific data, and the MSPSS. The comparison results are provided in Table 3, which shows that the depression group contains a greater number of recipients having moderate or severe economic burden than the depression-free group. Moreover, compared to the recipients in the depression group, those in the depression-free group obtained higher scores in the MSPSS total scale and three subscales ($P < 0.05$). Other demographic variables, such as age, gender, employment status, educational attainment, marital status, type and duration of dialysis, donor type, and complications after transplantation, did not differ significantly in the two groups (see Table 4).

### 3.4. Predictors of depressive symptoms

Multiple stepwise regression was conducted to determine the best predictors of depressive symptoms. All variables involved in the univariate analysis were included in the regression analysis as independent variables. Categorical variables, including economic burden, employment status, educational attainment, family

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**Table 2**

Comparisons of the mean SDS scores between RT recipients and the Norm.

<table>
<thead>
<tr>
<th></th>
<th>Total recipients</th>
<th>RT recipients</th>
<th>Norm</th>
<th>$t$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$n$</td>
<td>287</td>
<td>58</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\leq 5$ yr</td>
<td>10.53 ± 8.25</td>
<td>33.46 ± 8.55</td>
<td>16.083</td>
<td>0.000*</td>
<td></td>
</tr>
<tr>
<td>$5$–$10$ yr</td>
<td>40.10 ± 8.28</td>
<td>33.46 ± 8.55</td>
<td>6.111</td>
<td>0.000*</td>
<td></td>
</tr>
<tr>
<td>$10$–$15$ yr</td>
<td>41.88 ± 7.89</td>
<td>33.46 ± 8.55</td>
<td>10.617</td>
<td>0.000*</td>
<td></td>
</tr>
<tr>
<td>$&gt;15$ yr</td>
<td>40.45 ± 8.72</td>
<td>33.46 ± 8.55</td>
<td>6.756</td>
<td>0.000*</td>
<td></td>
</tr>
</tbody>
</table>

$P < 0.05$; Norm: SDS raw scores of 1340 residents in China (Wang et al., 1986, [23]).

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**Table 3**

Univariate analyses for variables predicting depression.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Depression-free group</th>
<th>Depression group</th>
<th>$\psi^2/Z$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(years)</td>
<td>47.95 ± 12.08</td>
<td>47.14 ± 12.52</td>
<td>0.543</td>
<td>0.587</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>68(58.1%)</td>
<td>99(58.2%)</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>49(41.9%)</td>
<td>71(41.8%)</td>
<td></td>
</tr>
<tr>
<td>Inhabitation area</td>
<td>Urban</td>
<td>96(82.1%)</td>
<td>134(78.8%)</td>
<td>0.454</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>21(17.9%)</td>
<td>36(21.2%)</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td>Full- or part-time job</td>
<td>44(37.6%)</td>
<td>46(27.1%)</td>
<td>4.809</td>
</tr>
<tr>
<td></td>
<td>Retired</td>
<td>47(40.2%)</td>
<td>79(46.5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unemployed</td>
<td>23(19.7%)</td>
<td>43(25.3%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Student</td>
<td>3(2.6%)</td>
<td>2(1.2%)</td>
<td></td>
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<tr>
<td>Education level</td>
<td>Middle school or below</td>
<td>22(18.8%)</td>
<td>35(20.6%)</td>
<td>2.739</td>
</tr>
<tr>
<td></td>
<td>High school or technical secondary school</td>
<td>49(41.9%)</td>
<td>84(49.4%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>College degree or above</td>
<td>46(39.3%)</td>
<td>51(30.0%)</td>
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</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>97(82.9%)</td>
<td>132(77.6%)</td>
<td>1.189</td>
</tr>
<tr>
<td></td>
<td>Single/widowed/divorced</td>
<td>20(17.1%)</td>
<td>38(22.4%)</td>
<td></td>
</tr>
<tr>
<td>Medical payment</td>
<td>By self</td>
<td>4(3.4%)</td>
<td>12(7.1%)</td>
<td>1.744</td>
</tr>
<tr>
<td></td>
<td>Public service or medical insurance</td>
<td>113(96.6%)</td>
<td>158(92.9%)</td>
<td></td>
</tr>
<tr>
<td>Family income (CNY/month)</td>
<td>≤3000</td>
<td>60(51.3%)</td>
<td>97(57.1%)</td>
<td>6.575</td>
</tr>
<tr>
<td></td>
<td>3000–6000</td>
<td>30(25.6%)</td>
<td>53(31.2%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;6000</td>
<td>27(23.1%)</td>
<td>20(11.8%)</td>
<td></td>
</tr>
<tr>
<td>Economic burden</td>
<td>Little</td>
<td>23(19.7%)</td>
<td>20(11.8%)</td>
<td>8.578</td>
</tr>
<tr>
<td></td>
<td>Mild</td>
<td>39(33.3%)</td>
<td>43(25.3%)</td>
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</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>32(27.4%)</td>
<td>53(31.2%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>23(19.7%)</td>
<td>54(31.8%)</td>
<td></td>
</tr>
<tr>
<td>Duration after RT(yr)</td>
<td>9.56 ± 5.92</td>
<td>9.56 ± 5.92</td>
<td>−1.096</td>
<td>0.274</td>
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<tr>
<td>Duration of dialysis before RT(month)</td>
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<td>9.00</td>
<td>−1.486</td>
<td>0.137</td>
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<td>Dialysis style</td>
<td>Hemodialysis</td>
<td>112(95.7%)</td>
<td>153(90.0%)</td>
<td>4.441</td>
</tr>
<tr>
<td></td>
<td>Peritoneal dialysis</td>
<td>4(3.4%)</td>
<td>8(4.7%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neither</td>
<td>1(0.9%)</td>
<td>9(5.3%)</td>
<td></td>
</tr>
<tr>
<td>Donor</td>
<td>Deceased</td>
<td>86(73.5%)</td>
<td>121(71.2%)</td>
<td>0.187</td>
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<td>Living</td>
<td>31(26.5%)</td>
<td>49(28.8%)</td>
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</tr>
<tr>
<td>Complication</td>
<td>No</td>
<td>92(78.6%)</td>
<td>123(72.4%)</td>
<td>1.454</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>25(21.4%)</td>
<td>47(27.6%)</td>
<td></td>
</tr>
<tr>
<td>MSPSS</td>
<td>Family</td>
<td>6.18 ± 0.99</td>
<td>5.64 ± 1.11</td>
<td>4.189</td>
</tr>
<tr>
<td></td>
<td>Friend</td>
<td>5.64 ± 1.22</td>
<td>4.89 ± 1.25</td>
<td>4.979</td>
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<tr>
<td></td>
<td>Significant other</td>
<td>5.61 ± 1.14</td>
<td>4.97 ± 1.15</td>
<td>4.641</td>
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<tr>
<td></td>
<td>Total</td>
<td>5.81 ± 0.99</td>
<td>5.17 ± 1.00</td>
<td>5.336</td>
</tr>
</tbody>
</table>

$P < 0.05$.
in Italy, although no signifi-


cation of depression severity (P < 0.05). The F value was 8.540

(P < 0.05), indicating that the linear regression equation was sta-

Table 4
Regression analysis of predictors of depression in RT recipients.

<table>
<thead>
<tr>
<th>B</th>
<th>SE</th>
<th>β</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
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<td>Constant</td>
<td>46.318</td>
<td>3.246</td>
<td>–</td>
<td>14.268</td>
</tr>
<tr>
<td>Employment status 1</td>
<td>2.470</td>
<td>1.083</td>
<td>0.149</td>
<td>2.280</td>
</tr>
<tr>
<td>Employment status 2</td>
<td>2.405</td>
<td>1.252</td>
<td>0.123</td>
<td>1.921</td>
</tr>
<tr>
<td>Employment status 3</td>
<td>–3.740</td>
<td>3.506</td>
<td>–0.059</td>
<td>–1.067</td>
</tr>
<tr>
<td>Economic burden 1</td>
<td>2.597</td>
<td>1.418</td>
<td>0.142</td>
<td>1.831</td>
</tr>
<tr>
<td>Economic burden 2</td>
<td>3.659</td>
<td>1.435</td>
<td>0.203</td>
<td>2.550</td>
</tr>
<tr>
<td>Economic burden 3</td>
<td>5.293</td>
<td>1.488</td>
<td>0.284</td>
<td>3.558</td>
</tr>
<tr>
<td>MSPSS total score</td>
<td>–2.408</td>
<td>0.437</td>
<td>–0.304</td>
<td>–5.512</td>
</tr>
<tr>
<td>Inhabitation area</td>
<td>2.689</td>
<td>2.126</td>
<td>0.130</td>
<td>2.212</td>
</tr>
</tbody>
</table>

*P < 0.05; Employment status 1: retired = 1, other = 0; Employment status 2: unemployed = 1, other = 0; Employment status 3: student = 1, other = 0; Economic burden 1: mild economic burden = 1, other = 0; Economic burden 2: moderate economic burden = 1, other = 0; Economic burden 3: severe economic burden = 1, other = 0.

income, and dialysis style, were dummy coded before analysis (e.g.,
mild economic burden [dummy 1] = 1, other = 0; moderate eco-
nomic burden [dummy 2] = 1, other = 0; severe economic burden
[dummy 3] = 1, other = 0). Stepwise method revealed that the best
predictors of depressive symptoms among RT recipients were
employment status, economic burden, inhabitation area, and total
MSPSS, which accounted for 19.8% (R² = 0.445, R² = 0.198) of
the total variance. Each variable signifi-cantly contributed to the pre-
diction of depression severity (P < 0.05). The F value was 8.540
(P < 0.05), indicating that the linear regression equation was sta-

tistically significant.

4. Discussion

In this study, 59.2% of the participants were categorized under
the depression group on the basis of their SDS index scores,
suggesting that depression was common among RT recipients in China;
this finding was comparable with the obtained result of 50.34% in
Tang’s study [10]. Moderate to severe depression was observed for
24.0%, which was in agreement with previously published studies
(27.0%, 18.75%) [18,21]. However, the depression prevalence of
11.8%, 75%, and 22% among RT recipients in Panama, Iran, and
Canada contradict the fi ndings of the present study [6,11,12]. The
differing results may be due to the different measurement tools
used. The present study used the SDS, whereas the studies con-
ducted in Panama, Iran, and Canada utilized the Hospital Anxiety
and Depression Scale, the BDI, and the Center for Epidemiological
Studies-Depression, respectively.

Moreover, compared with the SDS raw scores of the Norm, those
of the RT recipients in the different post-transplantation duration
groups were statistically insignificant. This result coincides with
previous reports on RT recipients in China [9,10]. For RT recipients
in Italy, although no signifi cant diff erence was found in the depression
scores of RT recipients and healthy people, RT recipients achieved signifi-cantly lows scores in general negative emotions [5].

The experience of RT recipients from renal failure loss, fol-


dowed by dialysis, to renal transplantation may take a long period and thus infl uence their emotion and psychology. Prior to RT, pa-

ents have high expectations of the operation. However, after the
transplant surgery, they became disappointed about having to
overcome many new challenges, such as fear of rejection and
infection, family economic burden, complex regimens of immu-
nosuppressive therapy, and side effects. A number of recipients
ultimately fail to return to work after RT because of their poor
health, and recipients with weakened immune systems must avoid
exposure to crowded areas to prevent cross-infection. Conse-
quence, their social activities are greatly reduced, leading to

various trends of depression.

Depressed individuals typically feel frustrated and self-pity. They think slowly and speak sluggishly. A number of depressed individuals even resort to committing suicide attempts, which harm their health and induce suffering to their family [27]. The high prevalence and severity of depression in our study suggests that psychiatric evaluation should be implemented as a routine exam-

ination for RT recipients in China. Healthcare providers should give more attention to RT recipients, communicate with them, encourage them to express their thoughts and feelings, and teach them how to adjust psychologically. Antidepressant drugs and psychological expert’s intervention are effective treatment for depression when necessary.

In the present study, we found no significant diff erence in the
SDS raw scores for different durations after RT (≤5 yr, 5–10 yr,
10–15 yr, >15yr). Perez-San-Gregorio measured and compared the depression of kidney transplant recipients in two phases (in the transplantation ward after being discharged from the ICU and 12 months after being discharged from hospital) and found no sig-
nificant diff erences [28]. The severity of depression of recipients
lasts a long time after RT because of various reasons. After RT, re-
cipients face many new problems, such as acquiring new self-care
skills, living with fear of rejection and infection, recognizing the
signifi cance of symptoms of rejection and infection, and complying with
a complex regimen of immunosuppressive drugs. These challenges
make the recipients feel stressed and disappointed at the early stages after transplantation. Over time, immunosuppressive drugs
gradually induce side effects, such as changes in appearance and
size, diabetes, high blood pressure, and so on, which may make recipients feel depressed [18]. Long-term use or overdose of
immunosuppressive drugs weakens their immune function, whereas inadequate dosing may lead to chronic rejection; both scenarios threaten their health [6]. In addition, many studies found that immunosuppressive drugs, such as tacrolimus and

cyclosporine-A, increase the risk of mood/depressive disorders
[29,30]. Periodic follow-up examinations after RT disrupt the re-
cipients’ daily life, further increasing their psychological distress.
Other possible reasons for the persistence of depressive symptoms
among RT recipients are their underlying diseases and comorbidi-
ties [11]. Recipients may feel threatened or depressed if their un-
nerlying disease or comorbidity is not completely cured or it
relapses over time. Such troubles and preexisting conditions may
cause depressive symptoms among recipients even after a long
time after RT.

In our study, we found that employment status was a major
factor infl uencing the depression of RT recipients. Retired or un-
employed recipients had higher SDS scores than those who had a
full- or part-time jobs. Many studies reported low rates of return
to work after transplantation [31]. However, working recipients
exhibited better renal function and QOL, and they experienced
slight limitations in physical functioning, unlike their non-working
counterparts [32,33]. Adequate labor promotes organ coordination
and body rehabilitation. In addition, working encourage recipients
to communicate more, and earning a salary reduces the fi nancial
burden of the family. Consequently, patients gain self-esteem and
satisfaction in their work, reducing their negative emotions and
promoting their physical, psychological, and social functions.
Therefore, RT recipients should be encouraged to participate in
appropriate social work after transplantation. However, the body
resistance of RT recipients is lower than that of the normal popu-
lation for long-term use of immunosuppressive drugs, indicating
the need for regular follow-up examinations. Thus, occupations
with low labor intensity and flexible working time are ideal for RT
recipients.

Our results showed that economic burden was a major factor

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X. Lin et al. / International Journal of Nursing Sciences xxx (2016) 1–7

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influencing depression among RT recipients, indicating that recipients with heavier economic burden have greater risks of acquiring depressive disorder and severe depressive symptoms. Several studies found that a good socioeconomic status, such as having a high family income [9], having low economic burden [11], and having the expense shouldered by public service or medical insurance [21] may be beneficial to the physical and mental health of an individual. The reason is that adequate financial support ensures regular follow-up examinations and medications can be sustained, both of which are beneficial for the function and survival of the graft. Meanwhile, sufficient financial support alleviates the recipients’ psychological pressure and guilt to their family, thereby reducing their depressive symptoms and other negative emotions. However, medical payment, which was another socioeconomic factor identified in our study, showed no correlation with depression severity, presumably because the number of recipients who paid their own medical costs was insignificant (5.6%). Economic burden induced depressive symptoms to a great extent. Doctors in follow-up clinics should prescribe the appropriate medicine according to the recipients’ financial situation, suggest that they purchase suitable medical insurance, and help them apply for free medicine to reduce their economic burden and mental pressure.

The results revealed that the inhabitation area of RT recipients was related to their depression. Recipients living in rural areas had higher SDS scores than those living in urban areas. ESRD is a severe illness with a long course. It requires tremendous expenses, including pre-operative treatment, renal transplantation, and post-operative medication treatment. Compared with urban residents, rural residents had lower and more unstable family income, causing them to feel a heavier economic burden. In addition, the majority of renal transplant follow-up clinics is located in capital cities or highly developed urban areas, making it inconvenient for rural residents to travel to the city for follow-up examinations and medical treatment. In addition, information on rehabilitation and treatment is more accessible to urban than rural residents. In other words, rural residents face greater economic burden, spend more time and money during follow-up examinations, and lack information sources; these factors may intensify their psychological burden and negative emotions.

In our study, another significant predictor of depression was perceived social support, which has consistently been reported to be strongly correlated with depression among RT recipients [12,19,21]. Recipients who perceived positive social support experienced few moments of loneliness and helplessness, whereas recipients who perceived negative social support usually felt disrespected and misunderstood by others. The latter cannot effectively utilize the social support system and are therefore more prone to feeling depressed. Our results are in agreement with those obtained by previous studies. After transplantation, recipients must still endure tremendous and sustained economic burden and psychological stress. Family members, friends, and colleagues should show their care and support to RT recipients. A RT recipient who feels loved and cared for can feel secure, ameliorating his/her stress and depressive symptoms. Healthcare providers should provide regular follow-up examinations, medical therapies, and social adaptation strategies to help recipients overcome their various problems. Enterprises and companies should provide appropriate jobs with flexible work hours and corresponding compensation to help recipients return to work and reduce their economic burden.

Our study has certain limitations. First, a single-center cross-sectional design was utilized. We did not compare the recipients’ depressive symptoms after transplantation with that before transplantation. Second, our study did not explore other possible factors contributing to depressive symptoms, such as anxiety, self-efficacy, coping mechanism, and comorbidities. These factors should be considered in future studies. Third, we only used self-reported instruments, which may not accurately reflect the prevalence and severity of depressive symptoms. We recommend that future should utilize a multi-center, longitudinal design and examine the other factors contributing to depression.

5. Conclusions

Our results revealed that depression was common among RT recipients. Employment status, economic burden, inhabitation area, and social support were determined to be major factors affecting depression among RT recipients. Thus, periodic psychological evaluations of depression should be implemented as a routine examination during check-ups in RT follow-up clinics. More attention should be given to recipients who have moderate or severe economic burden, live in rural areas, or are unemployed. Perceived social support of recipients is another key factor among RT recipients. Information on the recipients’ depressive symptoms, employment status, economic burden, inhabitation area, and perceived social support can be used to develop individualized intervention protocols for depressed recipients.

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Authors’ contributions

X. Lin drafted the manuscript and collected data. J. Lin provided important data and information for the study. H. Liu designed the study and revised the manuscript. S. Teng and W. Zhang executed the scheme and collected data. J. Lin is the equal contributors as X. Lin. All authors read and approved the final manuscript.

Declaration of interests

The authors report no conflict of interest. The authors are responsible for the content and writing of the paper.

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